INTERNATIONAL AGENCY FOR RESEARCH ON CANCER
WORLD HEALTH ORGANIZATION
AND
INTERNATIONAL ASSOCIATION OF CANCER REGISTRIES

Manual for Cancer Registry Personnel

Edited by
D. Esteban, S. Whelan, A. Laudico and D.M. Parkin

IARC Technical Report No. 10

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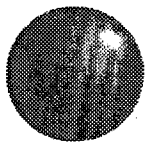

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Introduction

The need for data on cancer

It has been estimated that in 1985 there were 7.6 million new cancer cases in the world, 52% of which occurred in the developing countries (Parkin *et al.*, 1993). The burden of cancer will increase very rapidly in the next few years, largely due to an increasing proportion of elderly people in most countries. In the year 2000, there will be some 10.5 million new cases, and nearly six million of these will occur in the developing world. Cancer, which has long been a major problem in the more developed countries, is now a major public health problem in all countries.

In order to undertake any programme of cancer control, it is necessary to understand the burden of cancer in a community. Cancer is not a single disease, it is a term which describes many different diseases. It is not sufficient to know the total number of cancers in a population, because patterns of occurrence vary widely between geographical areas, between ethnic groups, by socio-economic categories, by occupation and by a wide variety of cultural factors. So data on cancer have to show the distribution of the different types of cancer in a population.

Once the baseline data are established it is possible to search for the aetiological or causative agents, and establish appropriate interventions to prevent the cancers from developing. Examples of activities to prevent cancer are screening programmes, notably for cancer of the cervix (this is called secondary prevention, because it prevents cancer from developing by removing it at an early stage), and education about the ill-effects of tobacco or the benefits of healthy eating (primary prevention to stop the cancer occurring at all).

The role of the population-based cancer registry is to collect the data which will give an accurate picture of cancer in a population, in order to understand and so control the impact of cancer in that population. Analysis of the data collected will show how many cancers there are, and which types are the most frequent. This will permit studies to identify the causes of cancer, and at the same time the registry data can be used to evaluate the effect of screening programmes or other activities designed to reduce cancer incidence in the population, as well as to study the effect of early diagnosis and of treatment. The cancer registry data can also be used to plan requirements for the personnel, medical facilities and equipment needed for the diagnosis and treatment of the cancer patient.

The cancer registry

A registry is simply a place where registers or records of, for example, births, marriages and deaths are kept. There are many different types of registry or register, there are registries which record information on illnesses other than cancer, and there are several types of cancer registry.

The hospital cancer registry is concerned with cancer patients from the hospital in which it operates, or the group of hospitals for which it has responsibility. It has a primarily clinical function, and the data produced are used to assess the medical care given to the cancer patient, to improve treatment regimes, and to follow the patient to ensure that check-up visits are made regularly. The data recorded will include extensive clinical information which would not normally be collected by a population-based cancer registry, for example on diagnostic procedures and courses of therapy. The hospital registry does not distinguish between residents and non-residents in an area, but collects information on all patients in the hospital irrespective of where they come from.

The pathology registry collects all pathological or histological diagnoses made in a laboratory, and data from such registries have been used to calculate minimum incidence data for areas where no other information has been available. Again, no distinction is made between residents of the area and those who come from elsewhere. This type of registry will not have complete information, because all cases diagnosed clinically or by a technique other than pathology will not come to the attention of the registry, but the quality of the data will be very good.

The population-based cancer registry (also called a tumour registry) aims to collect information on every case of cancer occurring in a defined population. In order to accomplish this task, a clearly delimited geographical area must be decided and accurate data on the population living in this area acquired. Every effort must be made to exclude patients who do not live in the designated area from the incidence data. It is essential to cover every potential source of data for residents of the area.

The manual

This manual has been prepared to help people working in population-based cancer registries. The different chapters follow the order of the tasks which have to be performed by the registry personnel, starting, in Chapter 2, with learning how to recognise the medical vocabulary used to describe the symptoms, the diagnosis and the treatment of cancer. Chapter 3 introduces the different sources from which information may be found, concentrating on the various hospital departments where it is likely that cancer patients may have been diagnosed or treated, and presents the type of data which you should be looking for and how to record it.

Once the information has been located and collected, the data have to be put into a coded format. The items which are used to produce statistics on cancer incidence are the site and the type of cancer, and Chapter 4 gives instructions on how to code the medical diagnosis. Chapter 5 follows the steps involved in the management of the data in the cancer registry. The quality of the data, with some indicators to show how it can be monitored, is discussed in Chapter 6. Once the data have been collected, coded and put together it is important to use all this information. Chapter 7 gives a description of how data can be analysed and presented in the form of tables and graphs. Chapter 8 stresses the need for confidentiality in the cancer registry and suggests methods of ensuring that the data are kept secure.

The manual has been designed for anybody who comes to work in a registry. You may have medical training, in which case it will not be necessary to study the section at the end entitled Medical Terminology Course. We know that many of the people working in cancer registries do not have medical training, and we hope that this section will be of help. It is designed to help you understand human physiology and the terms which you will come across in the medical records.

The emphasis throughout is on active registration. This manual is primarily designed to help people operating cancer registries in developing countries, where it is not possible to rely on routine notifications and it is necessary to go out and actively search for information on cases in the hospitals.

The format is loose-leaf, so that additional material can be added by you and so that separate chapters can be replaced and updated from time to time.

The Manual is intended as a complement to the book Cancer Registration: Principles and Methods (Jensen *et al.*, 1991), which describes the steps involved in planning and operating a population-based registry. You should be familiar with the contents of this book, and you can also use it as a resource if you wish to have additional information on how to report the results of the registry and statistical methods.

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2
The Diagnosis and Treatment of Cancer

In the day-to-day operations of the registry, the cancer registry personnel deal mostly with cases of cancer. They will encounter various terms that refer to symptoms or signs of the illness, describe the tumour and refer to the site of origin, as well as the methods and results of diagnosis and treatment. It is not necessary to know the exact definition of all these terms, but the worker should be able to decide whether they relate to the diagnosis or treatment of cancer, or whether they are used to describe the site or type of the tumour. This chapter provides general information on symptoms of cancer, methods of detection and forms of treatment. Common medical terms are presented and defined. The Medical Terminology Course at the end of this manual should also be studied.

2.1
Medical terminology

2.1.1 Word roots, suffixes and prefixes

In the process of cancer registration, particularly during collection of information on cases, personnel will meet medical terms which may refer to symptoms, to diagnostic procedures or to treatments. Registry workers do not have to memorize all these different terminologies. However, it is important that they learn the meaning of the more common word roots (or origins), prefixes (beginnings) and suffixes (endings) (the parts of words which are combined to make up medical terms) to help in understanding difficult terms. This is especially useful as most medical records are handwritten with varying degrees of legibility. A simple medical dictionary is very helpful. Examples of suitable dictionaries on the market are given in the list of suggested further reading at the end of the Manual.

Most medical terms are derived from languages such as Latin, Greek, French or German. As an example, let us take the word arthralgia which is based on the Greek word arthron (joint) as a root, and the suffix (ending) -algia which is derived from the Greek word algo (pain). Thus arthralgia means pain in the joint.

The root, also known as stem, of a medical term is usually the main part of the word and refers to the organ or place where the illness originated. It is generally derived from a Greek or Latin noun or verb. The root may be found:

- at the beginning, as in: osteoma, lingual, leukaemia
- in the middle: intercostal, hyperchromatic, prognosis
- at the end: anuria, neoplasm, hypogastric, mesoderm

The meaning of a medical term is modified by the addition of a prefix (at the beginning) or a suffix (at the end).

The prefix is often a preposition or an adverb and it consists of one or two syllables added in front of the root of the word which alters its meaning. Examples are given below:

Medical term	*Prefix*	*Definition of prefix*
submandibular	sub-	below
hypogastric	hypo-	beneath, under, deficient
aphonia	a-	without
anencephalic	an-	without
endocardium	endo-	inside
bilateral	bi-	two
contralateral	contra-	against, opposite

A suffix refers to a syllable or group of syllables attached to the end of the root to modify its meaning. Suffixes, as prefixes, modify the meaning of a root element. Examples are:

Medical term	*Suffix*	*Definition of suffix*
Appendicitis	-itis	inflammation
Histology	-ology	study of
Leukopenia	-penia	deficiency
Carcinoid	-oid	form, resembling
Ovoid	-oid	form, like, resembling
Hepatomegaly	-megaly	enlargement

Hepatic	–ic	condition of
Erythrocytosis	–osis	abnormal increase, disease, morbid status
Nephropathy	–pathy	morbid condition (non-inflammatory)

Often, a root will be combined with a suffix and put after another root, so forming the word ending, for example:

- Leukaemia – Root (aem = blood) + suffix (–ia = condition), added to another root (leuk– = white), to form the word leukaemia.
- Carcinogenic – Genic is composed of a root (gen = forming, producing) + a suffix (–ic = condition of).

In summary, the basic forms of medical terms are:

Root plus suffix:

- Hepatoma: (hepa = liver) + (–oma = tumour).
- Leukorrhea: (leuko = white) + (–rrhea = flow).

Prefix plus root:

- Neoplasm: (neo– = new) + (plasm = fluid substance of cells).
- Biology: (bio– = life, living) + (logy = study of).
- Pathology: (patho– = relating to disease) + (logy = study of).

Prefix plus root plus suffix:

- Epigastric: (epi– = on or upon) + (gastr = stomach) + (–ic = condition of), relates to the epigastrium at the upper middle region of the abdomen.
- Dyspneic: (dys– = difficult) + (pne = breathing) + (–ic = condition of), describes difficulty in breathing.
- Tachycardic: (tachy– = rapid) + (card = heart) + (–ic = condition of), describes rapid heart rate.

Two roots:

- Carcinogen: (carcin(o) = cancer, crab) + (gen = forming).
- Scleroderma: (scler(o) = hard) + (derma = skin).

The vowel is in brackets because it has been introduced to combine the two root words.

EXERCISES

The answers to the exercises are given at the end of this chapter.

Question 2(a):

In the list below different word roots are used to describe the origin of the tumour or primary site. These word roots are usually, although not always, derived from Greek or Latin. Look them up in your dictionary and match the word roots with the sites.

___ a. Gastr–	1. Skin
___ b. Nephr–	2. Breast
___ c. Hepat–	3. Spleen
___ d. Rhin–	4. Lung
___ e. Cerebr–	5. Kidney
___ f. Bronch–	6. Brain
___ g. Mamm–	7. Nose
___ h. Card–	8. Liver
___ i. Derm–	9. Heart
___ j. Lieno–	10. Stomach

Question 2(b):

In the list below word roots are used to describe the different body tissues. These are combined with other word elements to describe the histological type of the neoplasm. Look up these word roots in your dictionary and match them with the correct definition.

___ a. Angi–	1. Gland
___ b. Fibr–	2. Threadlike
___ c. Oste–	3. Marrow
___ d. Lei–	4. Fat
___ e. Aden–	5. Slime
___ f. Cyst–	6. Membrane
___ g. Lip–	7. Sac, Cyst
___ h. Myel–	8. Smooth
___ i. Mening–	9. Vessel
___ j. Rhabdo–	10. Rod
___ k. Hem–	11. Cartilage
___ l. Chondr–	12. Bone
___ m.Myx–	13. Skin
___ n. Derm–	14. Blood

Question 2(c):

In the list below are prefixes commonly used with medical terms. Match the prefix with the correct definition:

___ a. Poly–	1. Half
___ b. Infra–	2. After
___ c. Hemi–	3. New
___ d. Ect–	4. Back
___ e. Hyper–	5. One
___ f. Ad–	6. To, toward
___ g. Peri–	7. Outside
___ h. Oligo–	8. Abnormal enlargement
___ i. Dys–	9. Bad
___ j. Pre–	10. Above
___ k. Inter–	11. Difficult
___ l. Supra–	12. Below, beneath
___ m.Post–	13. Before
___ n. Mono–	14. Around
___ o. Ex–	15. Between
___ p. Ne(o)–	16. Many
___ q. Megal–	17. Excessive
___ r. Micr–	18. Small
___ s. Mal–	19. To take away from
___ t. Dors–	20. Scanty

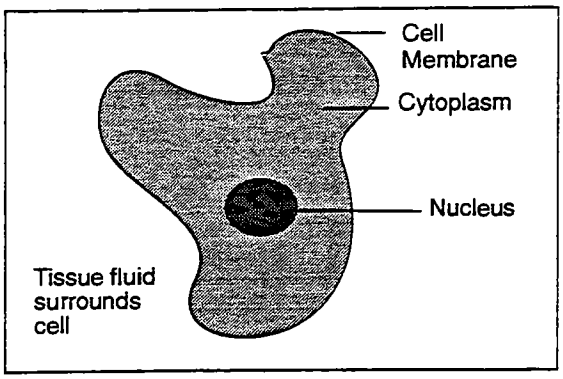
2.1.2 Tumour formation and pathology

The human body is composed of millions of microscopic units called cells. These are of different types and are arranged in different ways. A typical cell is enclosed in a cell membrane and contains a nucleus and cytoplasm. Groups of cells performing the same function form *tissues*. The epithelial tissue or epithelium lines the body cavities and provides protection and lubrication; connective tissue supports and holds other tissues together; muscle tissue is for movement and nervous tissue carries messages between the brain and spinal cord and the rest of the body.

Several tissues operating together form *organs*, such as the heart, lungs, liver, stomach, colon and kidneys. Different organs work together in a unit called an *organ system* each of which has a particular function in sustaining life. For example, the digestive system or alimentary tract is composed of the mouth, pharynx, oesophagus, stomach, small intestine, colon and anus. Together, these organs allow an individual to ingest, digest and absorb food and to excrete waste products. Other organ systems are the nervous system, the respiratory system, the genito–urinary system and the circulatory system.

Since the cell is the basic structural unit of the human body, any abnormality in the cell can result in abnormalities being carried throughout the tissues, organs and organ systems and

Figure 2.1 Cell Structure



may ultimately result in the malfunction of any or all of these. Tumour formation begins at the cellular level.

The study of the functional changes in tissues and organs of the body which cause or are caused by disease is known as pathology.

Most cells are able to reproduce themselves in order to grow and to replace worn-out or injured cells: the exception is the cells of the brain. Tissues normally grow by increasing the number of cells through a process of cell division or mitosis. Certain normal tissues replace their cells at regular intervals, for example the intestinal epithelium is replaced every 2–6 days. Other tissues have the capacity to undergo mitosis but rarely do so unless there is a stimulus. Yet other tissues, such as the muscle tissue, do not undergo mitosis once adult life has been reached.

The process of tissue growth is normally controlled by the body. In some persons, however, this normal life process gets out of control and the cells proliferate rapidly and uncontrollably, in a haphazard way, forming a 'neoplasm', 'new growth' or 'tumour' which serves no useful purpose for the body.

In the strict sense, 'tumour' can mean any swelling of body tissues. However, this term is frequently used to denote abnormal tissue growth or neoplasia characterized by abnormal and excessive division of cells, which usually results in distortion or destruction of the normal anatomy (anatomy is the structure of the body and the inter–relation of its parts). Neoplasm is derived from the word root "plasm" which means fluid substance of cells plus the prefix "neo–" meaning new. Thus neoplasm is a 'new growth'.

The terms 'tumour' and 'neoplasm' are often used inter–changeably. There are two general types of tumours or neoplasms: benign (non-

cancerous) and malignant (cancerous) tumours.

(1) *Benign tumours (non–cancerous)*

These are usually slow–growing tumours. They may become quite large and create pressure on neighbouring structures. The neoplasm or tumour displaces the surrounding tissue but does not invade or infiltrate it. Such tumours do not spread to other parts of the body. They do not invade parts of the body located elsewhere. They remain in the part of the body in which they originate.

An important feature of the benign tumour is 'encapsulation'. The tumour is usually very clearly separated from the surrounding tissues by a protective sheath or envelope, or a small rim of fibrous tissue.

Microscopically, the tumour cells look very similar to their tissue of origin. For example, a lipoma is a benign tumour of the fatty tissue. The tumour cells look very similar to the fat cells of origin, but they are greatly increased in number to form a tumour.

Usually, benign tumours cause no serious difficulties if properly managed. However, if left untreated, they may cause problems such as obstruction or bleeding (haemorrhage).

(2) *Malignant tumours (cancerous)*

These tumours are frequently characterized by rapid growth, and they destroy the part of the body in which they originate. They invade the surrounding tissues and may spread to other parts of the body (distant organs). Cells that break away from the original tumour may be carried by the blood stream or the lymphatic system to other areas of the body where they settle and form 'secondary' or 'metastatic' tumours. The process of spreading to different organs of the body is called metastasis. The secondary sites are known as metastatic sites.

The tumour can metastasize or spread to lymph nodes, or to other parts of the body:

Lymph nodes. These are small glands, which form part of the lymphatic system and are frequently involved in the spread of malignant tumours. They may be either regional (the lymph nodes are located close to the tumour site), or distant (the lymph nodes are located in some other part of the body).

Other parts. This refers to any organ or tissue of the body. However, malignant tumours typically spread to organs such as the bone, liver, and lung; metastasis takes place more frequently to these organs than to others.

Microscopically, malignant tumours are characterized by cells with nuclei showing numerous mitoses (cell divisions) and varying degrees of anaplasia (loss of normal differentiation) or lack of differentiation when compared to the tissue from which they originated.

Malignant tumours begin in the same way as benign tumours, i.e. as a local growth. At this stage, they can be eradicated from the body by surgery or destroyed by radiotherapy. If left untreated, the tumour grows and infiltrates the surrounding tissues, or metastasizes to distant organs, and may eventually kill the host.

A tumour has two basic characteristics:

- it is a mass of new cells
- it has no known purpose in the normal function of the body

Malignant tumours or cancer possess these two characteristics plus a third, the capacity of the uncontrolled dividing cells to invade and spread to distant parts of the body by way of the blood stream or lymphatic system.

EXERCISE

Question 2(d):

Which of the following three statements best describes the difference between a malignant and a benign tumour–

i Malignant tumours grow more rapidly than benign tumours

ii Malignant tumours attain a much larger size than benign tumours.

iii Malignant tumours can metastasize to other organs while benign tumours

remain at their site of origin and do not spread to other parts of the body.

When describing a malignant tumour, three important elements must be identified: the site of origin of the tumour, the type of cells involved in the malignancy, and the extent of the disease.

Identification of the site of origin of the tumour (primary site) is important because tumours in different organs or tissues behave differently to those in others. In the same way, different histological types have different behaviours (histology is the study of the minute structure of cells, tissues and organs in relation to their functions). The histological type or morphology of the tumour is determined by microscopic examination of a piece of tissue which has been excised (ex– = out, cise = cut) by a biopsy or during surgery. Biopsy is the removal of tissue from the living body for purposes of diagnosis by microscopic examination.

There are three significant events in the life history of a malignant tumour:

- tumour growth
- spread to the lymph nodes
- spread to distant organs (distant metastasis)

All these events are taken into consideration in the determination of the extent of the disease or 'stage' of the disease. This serves as a guide in the selection of the appropriate form of treatment to be used. Generally, treatment is more successful for small tumours, or those which have not spread, so that stage (extent) of disease is also used as a means of predicting the possible outcome of the disease (prognosis). These will be discussed in more detail in the chapter on coding (Chapter 4).

Generally, malignant tumours are either carcinomas or sarcomas:

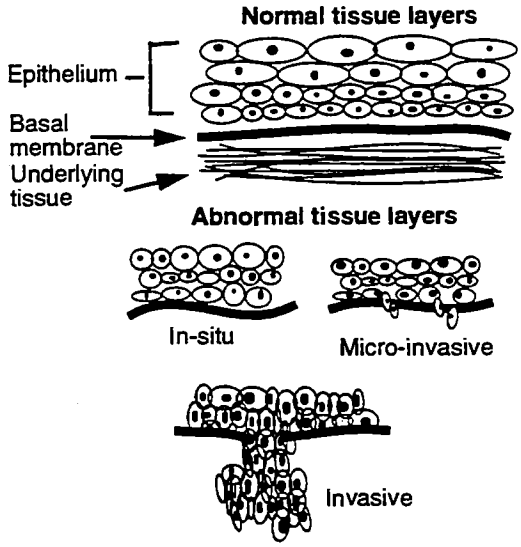
(a) **Carcinomas** are malignant tumours composed of epithelial cells which tend to invade surrounding tissues and give rise to metastases. Malignancies originating from the skin and the cells that line the walls of hollow organs (such as the intestinal tract) are carcinomas. Carcinoma is derived from the word root "carcin" meaning crab plus a suffix "–oma" meaning tumour. Examples are:

- bronchogenic carcinoma = lung cancer: (broncho– = windpipe) + (gen = producing) + (–ic = condition of).
- breast carcinoma = breast cancer.
- gastric carcinoma = stomach cancer.
- hepatocellular carcinoma = cancer of liver: (hepato– = liver) cells.

Carcinoma–*in–situ* refers to a malignant tumour which is confined to the epithelium (lining) and has not infiltrated into the tissues beneath it.

Sometimes a malignant tumour is described by the type of cells involved, for example, adenocarcinoma (adeno– = gland) + (carcinoma = malignant tumour of epithelial origin) is a malignant tumour arising from glandular tissue.

Figure 2.2.
Histological Aspect



(b) **Sarcomas** are malignant tumours arising from connective tissues. The word is derived from the root "sarco" meaning flesh plus the suffix "–oma" meaning tumour. Malignant tumours arising from the muscle tissue, fatty tissue, fibrous tissue, vascular tissue, bone, cartilage and nervous tissue are sarcomas. They tend to metastasize to distant organs. Examples are:

- Fibrosarcoma = a malignant tumour arising from fibrous connective tissues such as tendons: (fibr– = threadlike, fibre) + (sarcoma = malignant connective tissue tumour).
- Chondrosarcoma = a malignant tumour arising from cartilage: (chondro– = cartilage) + (sarcoma = malignant connective tissue tumour).

- Leiomyosarcoma = malignant tumour of smooth muscle: (leio– = smooth) + (myo– = muscle) + (sarcoma = malignant connective tissue tumour).
- Osteosarcoma = malignant tumour of the bone: (osteo– = bone) + (sarcoma = malignant connective tissue tumour).

2.1.3 Symptoms

A patient consults a physician or seeks hospitalization because of certain complaints felt by the patient (symptoms) or abnormalities which can be appreciated by an observer (signs). Among cancer patients, the presenting signs and symptoms vary with the different organs involved. The most pressing complaints which prompted the patient to seek medical attention are recorded in the patient's history (record of the patient's illness) under the heading Chief Complaints. The development of these symptoms, as well as other associated complaints, are recorded under the heading of History of Present Illness. In the process of taking a medical history, these signs and symptoms may be recorded using medical terminology. To facilitate abstracting of the medical record, the Registry personnel should learn some medical terms describing symptomatology, the word elements comprising these terms and their definitions.

In the list below are some symptoms which may be indicative of malignancy:

(1) Unusual bleeding

This may occur in the digestive tract, respiratory system, genitourinary tract or elsewhere. In the digestive or alimentary tract, unusual bleeding may occur as:

Haematemesis: (haema– = blood) + (emesis = to vomit) = vomiting of blood.

Melena: derived from the Greek word "melas", a root meaning black; this is defined as the passage of black, tarry stools, one of the signs of bleeding from the upper alimentary tract.

In the respiratory system, bleeding may occur as:

Epistaxis: (epi– = upon, over, in addition) + (staxis = haemorrhage), which is nose bleeding or haemorrhage from the nose.

Haemoptysis: (haemo– = blood) + (pty = saliva) + (–sis = condition of), a condition characterized by spitting up or coughing up of blood.

In the genito–urinary tract, unusual-bleeding may occur as:

Haematuria: (haemat– = blood) + (ur = urine) + (–ia = condition of) = a condition characterized by blood in the urine.

Menorrhagia: (meno = menstruation) + (–rrhagia = excessive flow), an excessive menstrual flow.

Metrorrhagia: (metro = uterus) + (–rrhagia = excessive flow) = uterine bleeding.

Unusual bleeding may also occur in the form of:

Haematoma: (haema = blood) + (–oma = tumour), a localized collection or pooling of blood outside the blood vessel in an organ, space or tissue (a bruise is a simple example of a haematoma).

Haemoperitoneum: (hemo = blood) + (peritoneum = the membrane lining the walls of the abdominal and pelvic cavities), a collection of blood in the peritoneal cavity.

Haemothorax: (hemo = blood) + (thorax = chest), a collection of blood in the pleural cavity, which is located in the chest (pleura is the membrane surrounding the lungs and lining the thoracic cavity).

(2) Unusual discharge

The suffix used to indicate dicharge is "–rrhea". This is attached to different word roots to indicate the site where this occurs, or the type of discharge.

Galactorrhea: (galact(o) = milk) + (–rrhea = flow, discharge), an excessive or spontaneous milk flow:

Rhinorrhea: (rhino = nose) + (–rrhea = flow, discharge), a watery nasal discharge.

Bronchorrhea: (broncho = windpipe) + (–rrhea = flow, discharge),

a discharge of mucus from the bronchi.

Leukorrhea: (leuko = white) + (–rrhea = flow, discharge), the whitish discharge from the vagina or the uterine cavity.

(3) *Change in bowel habits*

This usually indicates disease in the gastrointestinal tract, particularly the colon and rectum, and may occur in the form of:

Diarrhea: (dia = across, through) + (–rrhea = flow, discharge), abnormal frequency and looseness of bowel movements.

Constipation: infrequent or difficult evacuation of faeces.

(4) *Change in urinary habits*

This usually indicates disease in the genito–urinary system. It may occur in the form of:

Dysuria: (dys– = difficult, painful) + (ur = urine) + (–ia = condition of), a condition characterized by painful or difficult urination.

Polyuria: (poly– = many) + (ur = urine) + (–ia = condition of), an excessive secretion of urine or increased frequency in urination. Another term for this is 'frequent urination'.

Urgency: a compelling desire to urinate.

Oliguria: (olig– = scant) + (ur = urine) + (–ia = condition of), a condition characterized by diminished urine secretion.

Anuria: (an– = without) + (ur = urine) + (–ia = condition of), a condition characterized by no urine formation.

Nocturia: (noct– = night) + (ur = urine) + (–ia = condition of), increased frequency of urination during the night.

(5) *Indigestion or difficulty in swallowing*

This may indicate disease in the upper digestive tract, and may occur in the form of:

Dysphagia: (dys– = difficult, painful) + (phag = eat) + (–ia = condition of), difficulty or pain in swallowing.

Nausea: a sensation referred to the epigastrium or abdomen, with tendency to vomit.

Vomiting or emesis: the forcible ejection of contents of the stomach through the mouth ('throwing up').

Hyperemesis: (hyper– = excessive) + (emesis = vomiting), intractable or excessive vomiting.

Dyspepsia: (dys– = difficult) + (peps = digest) + (–ia = condition of), epigastric discomfort after meals, more commonly referred to as 'wind' or 'indigestion'.

Anorexia: (an– = without) + (orexia = appetite), lack of appetite.

(6) *Cough or hoarseness of voice*

This may indicate disease in the larynx or the respiratory system. A change in voice or difficulty in speaking is a condition also termed dysphonia: (dys– = difficult) + (phon = sound) + (–ia = condition of).

Aphonia: (a– = without) + (phon = sound) + (–ia = condition of), the inability to produce vocal sounds.

Dyspnea: (dys– = difficult) + (pne = breath) + (–a = condition of), a condition characterized by difficulty in breathing.

Orthopnea: (ortho– = upright) + (pne = breath) + (–a = condition of), a condition characterized by difficulty in breathing except in the upright position.

Tachypnea: (tachy– = rapid) + (pne = breath) + (a– = condition of), very rapid respiration.

Apnea: (a– = absent) + (pne = breath) + (–a = condition of), cessation of breathing.

(7) *Change in a mole or a wart*

Moles or warts which increase in size rapidly or change in colour or become ulcerated or bleed may be evolving into skin cancer.

(8) *A sore that does not heal*

In the skin or mucosa, this may be a sign of malignancy.

(9) *A mass, lump or thickening*

In the breast or elsewhere, this may be a tumour beginning in that organ or it may be a metastatic focus from another organ.

The patient may complain of abdominal enlargement which may be due to enlargement of organs such as the liver, spleen, kidney, ovaries or other organs.

(10) *Unexplained anaemia*

Anaemia: (a– = without) + (aem = blood) + (–ia = condition of) is a deficiency in the number of the red blood cells or the quantity of haemoglobin in the blood, which may result from decreased formation of red blood cells, or increased destruction of these cells, or bleeding.

Patients with anaemia complain of pallor or paleness of the skin. They also complain of dizziness, fainting spells, fatigue and breathlessness.

The formation or production of red blood cells or erythrocytes: (erythro– = red) + (cytes = cells), is known as erythropoiesis: (erythro– = red) + (poie = make, produce) + (–sis = condition of).

The destruction of red blood cells can result from the process of haemolysis being more marked than is usual.

Haemolysis: (haemo = blood) + (–lysis = dissolution or destruction of), refers to the breaking down of red blood cells.

(11) *Unexplained loss of weight*

Cancer is often associated with loss of weight. This has been attributed to the effects of the tumour itself resulting in decreased nutrient intake. Prolonged periods of malnutrition may result in a generalized physical wasting of the body known as cachexia.

Hence, in the absence of other symptoms, a patient with unexplained weight loss may be suspected of having cancer.

Occasionally, cancer may be diagnosed in patients who have no complaints (asymptomatic) – for example, in patients who undergo routine physical examination or who participate in screening programmes.

EXERCISES

Question 2(e):

R.S.T., 76 years old, male, noted that for the past four months he had an increased frequency of urination, especially at night. He also noted increasing difficulty in urination. Since the start of his illness, he had lost about 7 kilos in spite of good appetite.

Based on the above history, what symptoms will be recorded in the patient's medical record?

Question 2(f):

A.S., 47 years old, male, noted rapidly growing mass at the front of the neck (anterior neck mass) for the past six months, not associated with pain or tenderness. As the mass increased in size, he noted hoarsening of the voice. About two months ago, he began complaining of difficulty in swallowing. A week ago, he also noted increasing difficulty of breathing.

Indicate whether the following statements are TRUE or FALSE by encircling the correct answer:

T F a. Patient had dysphagia.
T F b. Patient had dyspnea.
T F c. Patient had a neck mass.
T F d. Patient had dysphonia.
T F e. Patient had all the above signs and symptoms.
T F f. Patient did not have any of the above symptoms.

Question 2(g):

L.C., 59 years old, female, had been having epigastric pain on and off for years. Initially there were no accompanying signs or symptoms. However, a few months ago, she noted progressive weight loss associated with anorexia. A week ago, she had several episodes of passing black, tarry stools. A few hours ago, she had an episode of haematemesis.

T F a. Patient vomited blood.
T F b. Patient had signs of bleeding from the upper gastro-intestinal tract.
T F c. Patient had melena and haematemesis.
T F d. Patient had anorexia (lack of appetite).
T F e. Patient had weight loss.
T F f. Patient had hyperemesis.

Question 2(h):

Match the symptoms with the correct definition. Some of the symptoms have been discussed previously but you may need to look up the definition of a few items in your medical dictionary.

___ a. Aphonia	1. Difficulty in breathing
___ b. Dysuria	2. Increased frequency of urination at night
___ c. Dyspnea	3. Passing of bloody urine
___ d. Nocturia	4. Vomiting of blood
___ e. Haemate-mesis	5. Whitish vaginal discharge
___ f. Melena	6. Painful or difficult urination
___ g. Polyuria	7. Loss of voice
___ h. Paresthesia	8. Passing of black, tarry stools
___ i. Leukorrhea	9. Increased frequency of urination
___ j. Diarrhea	10. Frequent, loose, watery stools
___ k. Dysphagia	11. Abnormal sensation, usually tingling, or like small insects crawling on skin
___ l. Urgency	12. Difficulty in swallowing
___ m. Orthopnea	13. Compelling desire to urinate
___ n. Anorexia	14. Lack of appetite
___ o. Haematuria	15. Difficulty in breathing except in the upright position

2.1.4 Physical signs

These are the findings of the doctor during physical examination. The physical findings begin with a general description of the patient's condition, for example, his nutritional status or development, whether he is able to walk (ambulatory) or is confined to bed.

The physical examination often proceeds from the head, eyes, ears, nose, throat (HEENT), down to the neck, the breast, chest, lungs, heart, abdomen, genitalia, rectum, extremities, skin and lymph nodes as well as assessment of the musculo-skeletal system and the nervous system.

In the course of physical examination, the physician notes for example the presence of any masses or swelling; the presence of asymmetry (a dissimilarity in corresponding parts or organs on opposite sides of the body which are normally alike); the presence of sores or non-healing wounds; any abnormal discoloration of skin and mucous membranes; as well as impairment in motor (muscular function) or sensory functions (sensation).

In the list below are some of the physical findings which a tumour registrar may encounter while reviewing the medical records:

(1) *Changes in the colour of the skin and mucous membranes*

Pallor: paleness of the skin or mucous membrane. This is noted in the presence of anaemia especially following blood loss or haemorrhage: (haemo = blood) + (-rrhagia = excessive flow).

Icterus or jaundice: yellowish discoloration of skin and mucous membranes. This is seen in the presence of liver diseases or those of the biliary tract, e.g., in blockage of the bile ducts that drain the bile from the liver to the intestine.

Cyanosis: bluish discoloration of the skin and mucous membrane due to insufficient oxygen or high concentration of reduced haemoglobin in the blood. Cyanosis is derived from: (cyano = blue) + (-sis = condition of).

(2) *Presence of non-healing wound or ulceration in the skin or mucosal lining of an organ*

An ulceration in the skin or other organs of the body is often not due to malignancy. It may be inflammatory in nature or it may be due to impairment of circulation or poor nutrition. However, it can be secondary to a

malignant process in the skin or to deeper organs with extension to the skin. The ulceration may be associated with a foul-smelling discharge which may be purulent, sanguinous (bloody) or mixed (sanguino-purulent).

(3) *Presence of masses*

Masses can occur in the skin, in the subcutaneous tissue, in the muscle, or in the bone or other organs of the body. Masses may be benign as in cysts or benign tumours; they can also be malignant.

A small lump or thickening in the breast may be one of the early signs of breast cancer.

A mass in the neck, for example, may be a thyroid tumour or it may be an enlarged lymph node secondary to a primary nasopharyngeal malignancy or a stomach cancer.

A mass in the abdomen may be due to enlarged organs such as the liver, the spleen, the ovaries, or uterus.

> *Hepatomegaly*: (hepat- = liver) + (megal = abnormal enlargement) + (-y = characterized by), enlargement of the liver.
>
> *Splenomegaly:* (splen- = spleen) + (megal = abnormal enlargement) + (-y = characterized by), enlargement of the spleen.

The mass may be enlarged lymph nodes or groups of lymph nodes. This is also known as lymphadenopathy (lympho- referring to the lymphatic system) + (adeno = gland) + (-pathy = disease), disease of the lymph node.

Lymph node enlargements due to cancer are usually secondary as in re-gional lymph node involvement or distant lymph node metastasis, with the primary site of the tumour occurring elsewhere (see section 2.1.2). Malignancy, however, may originate in lymph nodes, as in lymphomas like Hodgkin's disease and non-Hodgkin lymphoma.

An abdominal mass may also be secondary to dilatation of the stomach or the colon, as a result of obstruction to the digestive tract. It may also be due to a distended bladder. The physician may be able to indicate which is most likely.

(4) *Accumulation of fluid in some portions of the body*

Ascites: accumulation of fluid in the abdominal or peritoneal cavity. If the fluid in the peritoneal cavity is bloody, this is known as haemoperitoneum (peritoneum is the membrane lining the abdominal cavity).

*Pleural effusion: a*ccumulation of fluid in the pleural cavity, also known as hydrothorax. If the fluid in the pleural cavity is bloody, this is known as haemothorax.

Oedema: abnormal accumulation of fluid in connective tissue or serous cavity.

(5) *Obstruction in the circulatory system*

Venous obstruction: signs of venous obstruction include dilated or distended veins or swelling of the face or the extremities. For example, if there is an obstruction in the superior vena cava (the main vein returning blood from the upper body to the heart) this is manifested by dilated veins over the neck and chest associated with puffiness or oedema of the face and arms.

Arterial obstruction: Obstruction of an arterial blood supply results in a diminished or absent blood supply from the heart to the tissues or cells supplied by the blocked artery. The affected cells die from lack of oxygen and food, resulting in a condition known as necrosis: derived from the Greek word root "necro-" meaning death and the suffix "-sis" meaning a condition of. Necrosis refers to death or decay of cells or tissues in a part of the body.

(6) *Assessment of motor function, the ability of the patient to move his/her limbs or other parts of the body*

Paralysis: refers to the loss or impairment of motor function in a part of the body due to neural (nerve) or muscular mechanisms. Another term for paralysis is palsy. Example: paralysis of one side of the face due to a lesion in the facial nerve is known as Bell's palsy.

The suffix "–plegia" is used to indicate paralysis as in:

Hemiplegia: (hemi– = half) + (plegia = paralysis), paralysis of one half or one side of the body.

Quadriplegia: (quadr(i)– = four) + (plegia = paralysis), paralysis of all four limbs.

Paraplegia: (para– = beside, beyond) + (plegia = paralysis), paralysis of the lower part of the body, including the legs.

Paresis: derived from the Greek word 'paresis', meaning relaxation, refers to slight or incomplete paralysis.

Hemiparesis: (hemi– = half) + (paresis = incomplete paralysis), muscular weakness affecting one half of the body.

Paraparesis: (para– = beside, beyond) + (paresis = incomplete paralysis), muscular weakness or partial paralysis of the lower extremities.

(7) *Assessment of sensory function or the ability of the patient to see, hear, smell, taste and feel (touch, pain, temperature)*

The word root "aesth(a)esi(o)", which means feeling, is used as in:

Anaesthesia: (an– = without) + (aesthesi = feeling) + (–ia = condition of), loss of feeling or sensation, especially to pain.

Hypoaesthesia: (hypo– = deficient) + (aesthesi = feeling + (–ia = condition of), decreased sensitivity to stimulation or decreased sensation.

Hyperaesthesia: (hyper– = increased) + (aesthesi = feeling) + (–ia = condition of), increased sensitivity to stimulation or sensation.

Paraesthesia: an abnormal sensation like tingling, burning or prickling.

Dysaesthesia: an abnormal sensation resulting from a normal stimulus.

EXERCISE ON PHYSICAL FINDINGS

Question 2(i):

In the list below are different physical findings which may be encountered by the tumour registry personnel while reviewing the medical records. Match the physical findings with the correct definition. You may consult your medical dictionary for some items.

___ a. Ascites	1. Paleness or absence of skin coloration
___ b. Icteresia	2. Enlargement of the liver
___ c. Necrosis	3. Generalized physical wasting and malnutrition
___ d. Orthopnea	4. Accumulation of fluid in the pleural cavity
___ e. Lymph-adenopathy	5. Accumulation of interstitial fluid in the tissues secondary to obstruction of lymphatic vessels
___ f. Ulceration	6. Enlargement of the spleen
___ g. Pallor	7. Yellowish discoloration of skin and mucous membrane
___ h. Cyanosis	8. Bluish discoloration of skin and mucous membrane
___ i. Hepato-megaly	9. Paralysis of one side of the body
___ j. Pleural effusion	10. Loss of sensation or feeling especially from pain
___ k. Paraplegia	11. Non–healing wound
___ l. Anaesthesia	12. Accumulation of fluid in the abdominal cavity
___ m. Spleno-megaly	13. Death or decay of cells due to lack of oxygen or food
___ n. Lymph-edema	14. Disease of the lymph nodes
___ o. Cachexia	15. Difficulty in breathing except in the upright position
___ p. Haematoma	16. Paralysis of the lower portion of the body including the legs
___ q. Venous obstruction	17. Localized collection of extravasated blood in the tissues
___ r. Asymmetry	18. Blockage of veins
___ s. Hemiplegia	19. Dissimilarity in corresponding parts on opposite side of the face
___ t. Oedema	20. Abnormal accumulation of fluid in connective tissue

2.2 Diagnostic Methods

In order to arrive at a diagnosis, a physician employs several methods. In the cancer registry, these are grouped into several categories, and the registrar is expected to be able to decide which were used. A common grouping is:

A. **Non-microscopic methods**

(1) *Clinical only*

(2) *Clinical investigations*

- (a) Laboratory examinations
- (b) Radiological examinations or X- rays
- (c) Ultrasound
- (d) Nuclear medicine
- (e) CT scan
- (f) Magnetic resonance imaging
- (g) Endoscopy

(3) *Exploratory surgery/autopsy*

(4) *Specific biochemical and/or immunological tests*

B. **Microscopic methods**

(5) *Cytology or haematology*

(6) *Histology of metastasis*

(7) *Histology of primary tumour*

(8) *Autopsy*

2.2.1 Non-microscopic methods

Non-microscopic methods of diagnosis, as the name implies, do not confirm the diagnosis by examining cells or tissues under the microscope. Diagnosis is arrived at through the following methods:

(1) *Clinical only*

The diagnosis is based on the clinical history and physical examination. Example:

- A fungating mass almost involving the whole breast, associated with enlarged lymph nodes in both axillary regions and at the supraclavicular region may be diagnosed as breast cancer based on this method.

(2) *Clinical investigations*

The diagnosis is based on clinical history and physical examination, with the aid of ancillary procedures such as laboratory examinations, diagnostic radiology, scans, ultrasound and other imaging techniques.

(a) Laboratory examinations:

These include liver function tests, serum calcium, and other blood chemistries. T and B cell marker studies and chromosome studies may also fall under this category. Example:

- A clinical impression of breast cancer, with bone metastases, is supported by the finding of an abnormal or elevated alkaline phosphatase in a blood test.

(b) Diagnostic radiology:

Cancer is detected by means of X-rays. Example:

- A clinical impression of breast cancer with lung metastasis is supported by the finding of multiple nodular densities representing metastasis of the cancer in both lungs on a chest X-ray.

An X-ray examination, however, may require the taking of several pictures, the results of which are summarized in one report. Examples:

- A metastatic series which involves taking X-rays of various parts of the body to determine whether or not cancer has spread to any of these parts.
- A skeletal survey which involves taking a number of X-ray pictures of various parts of the body to rule out the presence of bone metastases.

There are different types of radiological examinations:

Body section radiography: this involves a series of x-rays taken at different depths in order to obtain defined images of specific areas. The image required is brought sharply into focus while the other areas are blurred out. These types of x-rays are used to locate lesions accurately in solid organs like the lungs and bones. They

are also known as tomograms, laminograms or planograms.

Radiological examinations using contrast media: a contrast medium is a radiopaque substance which can be injected into the veins, arteries, lymphatic vessels or hollow cavities to obtain contrast with the surrounding tissues. The contrast medium does not permit X-rays to pass through it so that the structures containing it appear white on the X-ray film, thus delineating abnormal masses or growths and defining the contour of the body structures on X-ray. Some of the X-ray studies using contrast media are:

Angiography: (angio = vessel) + (-graphy = method of recording), the radiological study of the blood vessels (vascular system) or lymphatic vessels. Examples:

- Cerebral angiogram: X-rays of the blood vessels of the brain
- Cardiac angiogram: X-ray showing the blood vessels of the heart and the large blood vessels
- Lymphangiogram: X-ray studies of the lymphatic vessels

Bronchography: (broncho = windpipe) + (-graphy = method of recording), the radiological study of the airways (bronchi) of the lung.

- *Bronchogram*: x-ray of the bronchial system

Cholecystography: (chole- = bile) + (cyst(o) = sac) + (-graphy = method of recording), the radiological study of the functions of the gallbladder and bile ducts after introduction of an opaque contrast medium.

- *Cholecystogram*: X-ray of the gallbladder

Cholangiography: (chol(e)- = bile) + (angi(o) = vessel) + (-graphy = method of recording), the radiological study of the bile ducts.

- *T-tube cholangiography*: medium injected through a tube inserted during operation.
- *Percutaneous transhepatic cholangiography (PTC)*: direct introduction of contrast medium through the liver into a bile duct usually carried out under television monitor. This procedure demonstrates the presence of obstruction either by a stone or by a mass as in a tumour.
- *Endoscopic retrograde cholangiopancreatography (ERCP)*: cannula into the opening of the bile duct, by using a flexible (fiberoptic) duodenoscope. Contrast medium is introduced into the cannulated duct system and X-ray pictures are taken. As the cannula is withdrawn, more X-ray films are taken in various projections.
- *Operative cholangiography*: surgical procedure of the gallbladder.
- *Upper GI Series (UGIS or barium swallow)*: the patient is asked to take barium (a contrast medium) orally, then a series of X-ray pictures is taken as the barium goes down from the pharynx to the oesophagus, stomach and small intestines.
- *Lower GI series (Barium Enema)*: radiological studies of the rectum and colon following introduction of barium through the rectum.
- *Myelography*: (myel(o) = spinal cord) + (-graphy = method of recording), radiological study of the spinal cord.
- *Sialography*: (sial(o) = salivary gland) + (-graphy = method of recording), radiological study of the salivary ducts.
- *Urography*: (uro = urine, urinary tract) + (-graphy = method of recording), radiological study of the urinary tract.
- *Cystography*: X-ray of the urinary bladder
- *Pyelography*: X-ray of the kidneys, ureter with emphasis on the pelvis of the kidney and ureters.
- *Intravenous pyelography (IVP)*: contrast medium is injected intravenously and a series of X-rays is taken as the contrast medium quickly passes into the urine.
- *Retrograde pyelography*: a series of X-rays done after introduction of

contrast medium through a catheter inserted into the ureter.

Other radiological procedures include:

Fluoroscopy: a technique for producing a temporary image on a screen. The radiologist moves the screen up and down the patient's body and observes what is happening within selected parts of the body. This is especially useful for identifying restricted or blocked passages in the hollow organs, especially with use of contrast material.

Mammography: (mamm(o) = breast) + (–graphy = method of recording), a technique for detection of breast cancer. Several X–ray views are taken of one or both breasts and the X–ray films are later examined for the presence of a lesion. Very small, early cancers of the breast can be diagnosed using this technique, before they can be felt by physical examination.

Xeroradiography: (xero– = dryness) + (radio = radiation) + (–graphy = method of recording), a technique using the same image producing process as the Xerox copier machines. The xeroradiography machine can produce either a positive or negative picture on specially coated white paper that can be read in any light. Today, this is used for X–rays of the skull, limbs and breast as well as the cervical spine.

Thermography: (thermo = heat) + (–graphy = method of recording), a technique for detecting cancer by differentiating regions of hot and cold temperature in the body. The surface temperature (its infrared radiation) is photographically recorded. The thermogram is a mosaic of many thousand bits of temperature information displayed photographically in shades of gray. The lighter tones indicate hot spots (increased emission of heat); the darker tones indicate cool areas. Since cancer cells usually divide more rapidly than normal cells, they often give off more heat than normal surrounding cells.

(c) Ultrasound:

Diagnostic ultrasound is a relatively new technique for visualizing internal structures of the body by recording the reflection of ultrasonic waves (high frequency sound waves) or echoes as they interact with various tissues of the body. Different densities in tissues can be distinguished from cystic masses and solid masses. The record produced is called an ultrasonogram or an echogram. Examples are:

- Pelvic ultrasound – to visualize the uterus, fallopian tubes, ovaries and other pelvic organs.
- Ultrasound of the liver, gallbladder and pancreas.
- Ultrasound of the kidneys.
- Ultrasound of the breasts.

(d) Diagnostic nuclear medicine:

This is an imaging technique whereby a radioactive substance known as a radioisotope is administered to a patient to diagnose disease. As the radioisotope disintegrates, it emits gamma rays from within the body and these are photographically recorded by a scanner. The photographic record is referred to as a scan. This differs from X–ray procedures where the X–rays are passed through the body from an external source.

Sometimes non–radioactive compounds are labelled or tagged with a radioactive isotope and sometimes radioactive tracers (radioactive pharmaceuticals) are given by mouth or by vein. Some of the isotopes are selectively absorbed by tumours or by specific organs in the body. The concentrated radioisotopes outline the tumour or organ, making it visible on the scanner by emission of radioactive energy.

The more common scans are: bone, kidney, thyroid, heart, lung, liver, spleen, brain, and total body scan.

(e) Computerized tomography scan (CT scan):

In this method, a picture is produced of all the structures in one plane (or slice) of the body. It is done by passing X-rays through the body in this plane and, from the readings, a computer constructs an image which is displayed on a television screen where it can be photographed for a permanent record. The precision of the scanner permits a more accurate diagnosis of the extent of the disease than most other means. It can discover tumours at an early stage and pinpoint their exact location. CT scans can be used with or without the use of contrast media. Examples are:

- CT scan, head
- CT scan, lung
- CT scan, upper abdomen

(f) Magnetic resonance imaging:

This is a non-invasive imaging technique which does not expose the patient to ionizing radiation and permits delineation of tissues without the use of contrast enhancing agents. The MRI scans do not visualize bone. Hence, the soft tissue adjacent to bone is easily viewed.

(g) Endoscopy:

This a diagnostic procedure involving the use of specific instruments (scopes) which enable one to view the interior of the body. Endoscopes may be either rigid metal or flexible fibre-optic tubes. Diagnoses arrived at through endoscopy without microscopic confirmation will be included in the category of exploratory surgery, although not all such examinations require a surgical incision. If a lesion is noted, it is possible to remove tissue by biopsy (via the endoscope) for histological study.

Typical endoscopy procedures include:

Bronchoscopy: examination of the bronchi with a scope

Colonoscopy: examination of the colon and rectum by means of an elongated, flexible fibrescope

Colposcopy: examination of the cervix and vagina under magnification

Cystoscopy: direct visual examination of the interior of the urinary bladder

Oesophagoscopy: direct visualization of the interior of the oesophagus

Gastroscopy: direct visual examination of the interior of the stomach

Laryngoscopy: examination of the interior wall of the larynx

Otoscopy: inspection of the inner ear

Proctoscopy: inspection of the rectum, with the aid of a tubular endoscope with appropriate illumination

Rhinoscopy: direct examination of the nasal passages either through the nostrils (anterior rhinoscopy) or through the nasopharynx (posterior rhinoscopy)

Sigmoidoscopy: direct visual examination of the sigmoid colon by means of an instrument which can visualize up to 25 cm from the anal verge

Urethroscopy: visual inspection of the interior of the urethra

In all of the "-oscopies" described so far, the scope has been inserted through a natural opening in the body. However, in the following endoscopic examinations, an actual incision is made through which the instrument is inserted into the body space to be examined.

Mediastinoscopy: examination of the mediastinum by means of a tubular instrument permitting direct inspection of the area between the lungs.

Peritoneoscopy: examination of the peritoneal cavity by an instrument inserted through the abdominal wall.

Thoracoscopy: direct examination of the pleural cavity by means of an endoscope which is inserted into the cavity through an intercostal space.

(3) *Exploratory surgery/autopsy*

The diagnosis is based on findings during surgical exploration, by direct visual examination or palpation, or on the results of a post-mortem examination (autopsy), without microscopic

confirmation (also called provisional anatomical diagnosis of malignancy or PAD).

When a suspected cancer of an internal organ has been located, exploratory surgery may be performed to determine the exact nature of the cancerous condition and the extent of the disease or the degree to which other organs or structures within the observed area are affected. In most instances, biopsies will be done and specimens examined microscopically, in which case the diagnostic method falls into group B, 'Microscopic methods' (see section 2.2.2).

(4) *Specific biochemical and/or immunological tests*

There are some substances which can be measured in blood (or other body fluids) which may be helpful in the diagnosis of cancer.

(a) *Serum alpha–foeto protein (AFP)* is a substance normally present in the tissues of the foetus and which disappears or is greatly reduced in amount after birth. High levels of AFP in the patient's blood suggest the presence of hepatocellular carcinoma or teratocarcinoma. AFP is synthesized by the tumour cells themselves and secreted by them in the blood. A drop in the AFP level indicates regression of the tumour. Hence, AFP is valuable for diagnosis as well as for monitoring response to treatment or the development of recurrence.

(b) *Beta–subunit of the human chorionic gonadotropin (Beta–HCG)* is a placental antigen which is present in the serum of all patients with tumours arising in cells of the placenta (especially choriocarcinoma), in a majority of patients with germ cell tumours of the testis and ovary, and to some extent in patients with other cancers.

Serial measurement of Beta–hCG is of importance in the diagnosis and follow–up of cases of choriocarcinoma. For example, a very high level of Beta–HCG in a patient points strongly to the presence of choriocarcinoma; if after chemotherapy the level of Beta–HCG goes down to normal, one can say that the patient responded to the treatment, and a later increase in the level of Beta–HCG is indicative of reactivation of the tumour.

The normal value of Beta–HCG is 0–5 units/ml.

(c) *Serum acid phosphatase:* elevated levels of acid phosphatase in the serum are noted in 85% of patients with cancer of the prostate with metastases to the bones, but in only about 20% of cases which remain localized in the prostate gland. Acid phosphatase determination can be used to determine whether prostate cancers are suitable for surgery.

The normal value in the serum depends on the method used in determining the acid phosphatase level, as in:

Bodansky:	0.5–2.0 units
King-Armstrong	1 – 5 units
Bessey-Lowry:	0.1 – 0.63 units
International units:	0.2 – 1.8 units/l

(NOTE: The normal values are given as a guide. Registry clerks need not memorize these values but should be aware of the normal values in the hospital where they are working).

Other tumour markers or serum studies which may be used to study the spread of cancer are:

(d) *Serum alkaline phosphatase:* the levels of this enzyme in the blood increase when there is destruction of cells. It is produced in the liver and bones, and an elevated alkaline phosphatase is indicative of bone and liver abnormalities.

The normal value depends on the method used in determining the

alkaline phosphatase level such as:

Bodansky	adults:	2–4.5 units:	chil-dren:	5-14 units
King-Arm-strong	adults:	4–13 units,	chil-dren:	15–20 units
Interna-tional units:	21–91 u/l			

(e) *Lactic acid dehydrogenase (LDH)*: this is an enzyme which occurs in many body cells. An elevated LDH indicates increased cell destruction, possibly following metastasis.

Normal values are: 60 – 100 u/l

(f) *Carcinoembryonic antigen (CEA)*: this is a protein which is normally present in endodermal tissues (the innermost of the primary germ layers of the embryo) during the first six months of foetal life. It was first noted to be present in colorectal cancer and was initially thought to be specific to cancers of the gastrointestinal tract. However, studies have shown that CEA is elevated not only in GI tract malignancies but in other malignancies and in non–malignant conditions. At present, its most useful application is in predicting the outcome of disease (prognosis) and in the follow–up of response to treatment, and checking for development of recurrence.

(g) *Foetal sulfoglycoprotein antigen (FSA)*: this antigen is associated with gastric cancer. It is observed in a majority of patients with gastric cancer and in 3 to 7% of individuals aged 45 to 70 without gastric neoplasm.

(h) *Pancreatic oncofoetal antigen (POA)*: this is an antigen associated with pancreatic cancer.

(i) *Human placental lactogen (HPL)*: this is a polypeptide synthesized by cells of the human placenta.

HPL is demonstrable in the sera of the majority of patients with choriocarcinomas and in certain patients with germ cell tumours of the ovary and testis.

(j) *Tissue or organ–associated antigens*:

(i) cervical cancer antigens: associated with cancer of the cervix uteri;

(ii) ovarian cancer antigen (CA 125): associated with carcinoma of the ovary;

(iii) breast cyst fluid protein: associated with breast cancer;

(iv) lung tumour antigen: associated with lung cancer;

(v) leukaemia–associated antigens: associated with acute leukaemia;

(vi) prostatic–specific antigen: associated with carcinoma of prostate.

(k) *Ectopic hormones:*

(i) calcitonin: associated with medullary carcinoma of thyroid gland;

(ii) parathormone: associated with small cell lung cancer;

(iii) 'big' ACTH: associated with small cell lung cancer.

(l) *Antigens of oncogenic viruses*:

(i) Human Papilloma Virus (HPV): certain types are associated with carcinoma of the cervix uteri;

(ii) Epstein–Barr virus: associated with Burkitt's lymphoma and nasopharyngeal carcinoma;

(iii) mouse mammary tumour virus: associated with breast cancer.

(m) *Normal antigens or their variants:*

(i) ferritin: associated with breast cancer;

(ii) casein: associated with breast cancer;

(iii) ceruloplasmin: associated with a variety of cancers;

(iv) immunoglobulins: associated with multiple myeloma, Waldenstrom's macroglobulinaemia;

(v) blood group substances: associated with a variety of cancers;

(vi) lactoferrin: associated with lung cancer;

(vii) tissue polypeptide antigen (TPA): associated with a variety of cancers.

2.2.2 Microscopic methods

The microscopic methods of diagnosis include:

Cytology: the microscopic examination of cells, usually contained in fluid which bathes a suspected cancer; and

Histology: the microscopic examination of tissues removed from the suspected cancer itself or from its spread (metastasis).

The purpose of microscopic examination is to determine the characteristics of the tissues and cells, to see whether they are indicative of a malignancy.

(5) Cytology or haematology

(a) Cytology: (cyto = cells) + (–logy = study of), the study of cell structure, function and pathology. Cells are continuously being shed (exfoliated) from tissues that line body cavities and hollow organs of the body. These exfoliated cells may float in the fluid or mucous material which bathes or passes through these cavities. The microscopic examination of these cells to determine whether they are malignant or not and to determine their tissue of origin is known as exfoliative cytology.

There are some body cavities which can be checked for fluid, such as the pleural cavity, and the peritoneal cavity. Normally, the fluid in these cavities is limited to an insignificant lubricating layer that cannot be aspirated. Therefore fluid in these cavities which can be aspirated indicates a pathological process such as malignancy or infection.

Listed below are some of the sources of specimens for cytological examination:

- sputum
- bronchial washing or bronchial-brushing
- tracheal washing
- pleural fluid
- gastric fluid
- spinal fluid
- breast secretion
- prostatic secretion
- urine sediment
- cervical and vaginal smears
- bone marrow aspiration
- peritoneal fluid

There are several procedures employed to obtain material for cytological examination, including the following:

(i) swabs: use of a swab or similar device to obtain fluid and secretions which can be used to make a smear. Example: cervical smear

(ii) brushings: the lining of an organ is brushed for the purpose of obtaining cells. Example: gastric brushing; bronchial brushings

(iii) washings: instillation of fluid into a hollow organ or structure and removal of the fluid for the purpose of collecting any cells which have been exfoliated in the fluid. Example: gastric washing

(iv) scrapings: the lining of a structure or organ is scraped with an instrument for the purpose of obtaining cells. Example: cervical smear, using an Ayre's spatula or cerviscraper

(v) punctures: insertion of a needle into a cavity or organ for the purpose of removing some portions of the contents(fluid, bone marrow, tissue). Examples:

- paracentesis: surgical puncture of a cavity for aspiration of fluid
- paracentesis abdomini: puncture of the peritoneal cavity
- thoracocentesis: puncture of the pleural cavity

The Papanicolaou classification of cells for detection of malignancy is as follows:

Class	*Interpretation*
I	No evidence of a malignant neoplasm, no atypical cells
II	Atypical cells present but no evidence of malignant neoplasm

III Cells present causing suspicion of malignant neoplasm

IV Fairly conclusive evidence of malignant neoplasm

V Conclusive evidence of malignant neoplasm

(b) *Haematology:* (haema– = blood) + (–logy = study of), the microscopic examination of the cells of the blood or blood-forming tissues (especially bone marrow), looking for changes in these structures and/or number of various types of blood cells, including immature cells.

There are three main types of blood cells:

- erythrocytes: (erythro = red) + (–cyte = cell), or red blood cells;
- leukocytes: (leuko = white) + (–cyte = cell), or white blood cells;
- thrombocytes: (thrombo = thrombus or clot) + (–cyte = cell), or platelets, the cells concerned with clotting of the blood.

(i) *Red blood cells (RBC):*

These contain haemoglobin, a blood protein responsible for the transport of oxygen from the lungs to the tissues and the transport of carbon dioxide from the tissues to the lungs.

There is only one type of mature red blood cell, or erythrocyte.

There are several forms of immature or very young erythrocytes, namely:

- pronormoblast: the earliest precursor of red blood cells
- normoblast: nucleated red blood cell
- reticulocyte: a young erythrocyte (one– to two–day old red blood cell)

The reticulocyte count is a useful measure to determine whether anaemia is due to decreased production of red cells or due to increased destruction of these cells. A significant increase in the number of reticulocytes in the blood reflects the release of an increased number of young red blood cells from the bone marrow, usually suggestive of increased cell destruction or haemolysis: (haemo = blood) + (–lysis = destruction). In contrast, a failure to produce red blood cells is reflected in a very low reticulocyte count.

Anaemia: (an– = without) + (–aemia = blood), a deficiency in the number of red blood cells or a deficiency in the haemoglobin content of the red cells. This is characterized by pallor of the skin and mucous membranes and may be associated with becoming tired easily, dizziness or fainting spells.

(ii) *White blood cells:*

There are five types of circulating white blood cells:

- neutrophil
- eosinophil
- basophil

} granular leukocytes

- lymphocytes
- monocytes

} agranular leukocytes

Neutrophils: these white blood cells contain very small purplish granules in their cytoplasm. The mature form has segmented nuclei. Hence, this cell is also known as: polymorphonuclear leukocyte ('polymorph'). The immature forms of a neutrophil are:

- stem cell
- myeloblast
- promyelocyte
- myelocyte
- metamyelocyte
- band or stab cells

Normally, neutrophils are not released to the peripheral blood until they have matured beyond the metamyelocyte or 'band' stage. Neutrophils usually comprise about 40–60% of leukocytes in the peripheral blood.

Eosinophils: these are granular leukocytes with large reddish granules in the cytoplasm. They develop in the bone marrow just like neutrophils. Eosinophils comprise about 1–3% of leukocytes.

Basophils: these granular leukocytes have large bluish granules in their cytoplasm. They mature in a similar fashion to the neutrophils. Basophils are the least common of leukocytes, comprising only about 0–1%.

Lymphocytes: these are agranular leukocytes with a small amount of bluish cytoplasm. They comprise about 20–40% of leukocytes. Analysis of these

cells have shown that there are two types, the T and the B cells.

Monocytes: these are agranular leukocytes with phagocytic and bactericidal capacities. They comprise about 4–8% of all white blood cells.

(iii) *Platelets (thrombocytes)*

These are tiny cells or discs whose primary function is haemostasis (clotting of blood).

Peripheral blood is circulating blood obtained from blood vessels or the extremities. This may be obtained through a finger prick or through a venipuncture (specimen taken directly from a peripheral vein). The common examinations for peripheral blood include: complete blood count (CBC), platelet count, reticulocyte count and peripheral smear.

In examination of the peripheral blood, the peripheral smear is the most important. Examination of the peripheral smear shows the size and colour of the red blood cells, their variations in size known as anisocytosis: (an– = without) + (iso = equal–) + (cyto = cell) + (–osis = increase), or variation in shape referred to as poikilocytosis: (poikilo– = irregular) + (cyto = cell) + (–osis = increased number), which are helpful in the diagnosis of specific anaemias. Normally, immature forms of leukocytes are not found in the peripheral blood. Hence, a markedly increased leukocyte count with a number of immature forms, especially 'blasts', alerts one to the possibility of leukaemia.

Certain types of conditions associated with abnormality of the blood cells are:

Anaemia: deficiency in erythrocytes or haemoglobin

Aplastic anaemia: a form of anaemia in which there is lack of formation of blood cells in the bone marrow

Leukaemia: a malignant disease of the blood and blood-forming organs characterized by uncontrolled proliferation of leukocytes which is diagnosed by microscopic detection of abnormal cells

Leukocytosis: increase in the number of leukocytes in the blood

Leukopaenia: reduction in the number of leukocytes in the blood

Polycythaemia: excessive number of erythrocytes

Thrombocytopaenia: decrease in the number of platelets

A table of normal values for blood examinations is given below. The registry personnel are not expected to memorize these values. They are given as a guide for abstracting haematological reports. The diagnosis of haematological malignancies by peripheral blood examinations is often based on an abnormal cell count (usually a markedly elevated white blood cell count (WBC)) and the presence of immature cells in the smear. Registry personnel should have a basic knowledge of what is normally expected in complete blood count examinations and peripheral smears in order to be able to recognize values which are abnormal.

Bone marrow studies are essential in the diagnosis of a wide variety of haematological disorders, especially leukaemias. The circulating blood cells are actively produced in the bone marrow. A bone marrow sample can be obtained by needle aspiration or by biopsy of bone marrow, and is considered as a histological examination (see 6/7 below).

Haematocrit	Men	42-52%
	Women	37-47%
Haemoglobin	Men	140-180 Gms/litre
	Women	120-160 Gms/litre
Erythrocytes (RBC):	Men	4.5-6.3 x 10^{12}/litre
	Women	4.2-5.4 x 10^{12}/litre
Reticulocyte count:		0.5-2% of red blood cells
Leukocytes (WBC):		0.5–2% of red blood cells 5 x 10^{9} – 10 x 10^{9}/litre
Neutrophils:		40–60%
Band (stabs):		0–5%
Juveniles:		0–1%
Myelocytes:		0%
Eosinophils:		1–3%

Basophils:		0–1%
Lymphocytes:		20-40%
Monocytes:		4–8%
Platelet count:		200–500 x 10^9/ litre

(6) Histology of metastasis

Histology: (histo = tissues) + (–logy = study of), the microscopic examination of tissues removed from a site of spread (metastasis) of cancer.

The examination may be made using tissue obtained from a biopsy (the removal and examination – both gross and microscopic – of tissues from a living body for the purpose of diagnosis), or from an operative or surgical procedure.

If the source of the specimen is from a suspected metastatic site, it is known as histology of the metastasis.

(7) Histology of primary tumour

If the source of the specimen is from the suspected origin of the malignancy, it is known as histology of the primary.

(8) Autopsy

This refers to the examination of the body after death, and involves the removal and examination (gross and microscopic) of organs and tissues from the body, to establish the diagnosis or to determine the cause of death. It is also known as necropsy or post–mortem examination.

There are usually two types of reports made following autopsy:

(a) the Provisional Anatomical Diagnosis (PAD), is arrived at through the gross (= macroscopic) examination findings at autopsy, not confirmed microscopically; and

(b) the Final Anatomical Diagnosis (FAD) is arrived at through microscopic examinations of tissues removed at autopsy. This is the most important portion of the autopsy report. It could confirm the diagnosis of cancer made clinically. It can determine the origin of the cancer (primary site) and its histological type. It can also give an accurate assessment of the extent of spread of the malignancy.

EXERCISES ON DIAGNOSTIC METHODS

Question 2(j):

How are materials for cytological examination obtained?

Question 2(k):

Match the diagnostic method with the correct definition (you may need to look up some of the terms in your medical dictionary).

___ a. Papanicolaou smear
___ b. Mammography
___ c. Alpha–foeto protein
___ d. CT scan
___ e. Ultrasonography
___ f. Bronchoscopy
___ g. Symptoms
___ h. Beta–HCG
___ i. Urography
___ j. Histology
___ k. Physical examination
___ l. Haematology
___ m. Autopsy
___ n. Liver scan

1. Specific tumour marker for hepatocellular carcinoma and germinal teratocarcinoma
2. An imaging technique which records the reflection of echoes as they interact with various body tissues
3. Complaints felt by a patient
4. Exfoliative cytology
5. An imaging method which makes use of a computerized reconstruction of the cross-sectional image of the structures in a body plane
6. Radiographic technique to detect early breast cancer
7. Study of tissues
8. A tumour marker for gestational trophoblastic tumours
9. Endoscopic examination of the bronchi
10. Study of cells of the blood and blood-forming tissues
11. An imaging technique which makes use of radioactive substances known as radioisotopes
12. Radiological study of the urinary tract
13. A diagnostic method consisting of inspection palpation, percussion and auscultation
14. Post–mortem examination

2.3 Treatment

Treatment for patients with cancer may either be cancer-directed or non-cancer directed.

(1) Cancer–directed treatment

Definitive cancer–directed treatment is a specific therapy which modifies, controls, removes or destroys cancer tissue. This may be directed towards a primary or towards a metastatic site. Treatment may be considered as definitive cancer–directed therapy, even if it is not considered curative for a particular patient because of the extent of disease, failure to complete treatment or lack of response. Definitive cancer–directed therapy may be either curative, adjuvant or palliative.

(a) Curative treatment is aimed at completely eradicating an existing disease. Examples are:
- Total hysterectomy for early endometrial cancer:
  (hystero = uterus) + (–ectomy = surgical removal).
- Modified radical mastectomy for early breast cancer:
  (mast = breast) + (–ectomy = surgical removal).
- Total thyroidectomy for papillary cancer of thyroid:
  surgical removal of whole thyroid gland.
- Abdomino–perineal resection for rectal cancer:
  surgical removal of anus and rectum and creation of a permanent colostomy.

(b) Adjuvant treatment is given to enhance the effectiveness of another form (modality) of treatment.
- Adjuvant chemotherapy for breast cancer after mastectomy.
- Adjuvant radiotherapy for cervical cancer after hysterectomy.

(c) Palliative treatment may modify, control, remove or destroy cancer tissue but does not attempt to cure.
- Palliative resection of colorectal cancer.
- Palliative radiotherapy for advanced breast cancer.
- Palliative chemotherapy for advanced lung cancer.

(2) Non–cancer directed treatment

Non–cancer directed therapy may also be given to cancer patients to relieve symptoms and alleviate pain and distress but such therapy does not treat the cancer.

This includes palliative (non–cancer–directed) treatment, to relieve symptoms such as obstruction without attempting to cure. Examples are:
- 'By–pass' operations to relieve obstruction by forming a connection (anastomosis) between two normally separate organs. Examples of this are gastro–jejunostomy (anastomosis of stomach and jeju-num) to relieve obstruction of the duodenum, and colostomy to short–circuit the gastro–intestinal tract when there is obstruction in the colon.

Surgical procedures to relieve pain are also included in this category:
- Rhizotomy: (rhizo = root) + (–tomy = cut), interruption of the roots of the spinal nerves within the spinal canal to relieve intractable pain.

Supportive treatment is directed to sustaining the strength of the patient.
- Blood transfusion.
- Parenteral nutrition: nutrition not through the alimentary canal but through intravenous injection.

The different modalities of cancer–directed treatment are:
- surgery
- radiotherapy
- chemotherapy
- hormone therapy
- immunotherapy

2.3.1 Surgery

This involves the total or partial removal of a primary tumour or its secondary site. It does not include incisional biopsy where a part of the tumour is removed for examination in order to establish the diagnosis.

The suffix "–ectomy" is often used with word roots to indicate surgical removal of organs. Examples are:
- Cholecystectomy: (chole– = bile) + (cyst = sac) + (–ectomy = surgical

removal), surgical removal of gall-bladder.
- Gastrectomy: (gastr = stomach) + (–ectomy = surgical removal).
- Hysterectomy: (hyster(o) = uterus) + (–ectomy = surgical removal).
- Mastectomy: (mast = breast) + (–ectomy = surgical removal).
- Nephrectomy: (nephr(o) = kidney) + (–ectomy = surgical removal).
- Oophorectomy: (oophor(o) = ovary) + (–ectomy = surgical removal).
- Orchiectomy: (orchi = testis) + (–ectomy = surgical removal).
- Pneumonectomy: (pneumo = lung) + (–ectomy = surgical removal).

Surgical treatment relevant to the cancer registry includes the following:
- most "–ectomies"
- excision biopsy or extirpation
- biopsy, NOS, if there is no residual on further surgery
- electrocautery
- cryosurgery
- laser surgery
- conisation of cervical carcinoma–in–situ
- fulguration (destruction of tissue with the aid of electro-cautery) of bladder, rectum or skin tumours (this is derived from the Latin word 'fulgur' meaning lightning)
- transurethral resection (TUR) of bladder or prostatic tumour

Surgical treatment can be definitive or not definitive. Surgical procedures done mainly to establish diagnosis or to determine extent of disease are considered not definitive, and definitive surgery does not include the following:
- bypass surgery
- conisation of the cervix for micro-invasive cancer of the cervix
- exploratory laparotomy or thoracotomy with or without biopsy
- excision of lymph nodes for diagnosis or staging
- total removal of non–cancerous endocrine glands
- paracentesis abdominis or thoracentesis
- surgery to relieve pain
- TUR without removal of tumour tissue

2.3.2 Radiotherapy

Ionizing radiation is delivered clinically in the following ways:

(1) External beam irradiation from sources at a distance from the body:
- X–rays
- cobalt
- linear accelerator
- betatron
- neutron
- electron

(2) Brachytherapy: (brachy = short) + (–therapy = treatment), refers to local irradiation from sources in contact with or near target tissue:
- intracavitary (e.g. radium insertion for cervical cancer)
- interstitial (as in radon seed implants in breast cancer)
- surface placement of radioactive isotopes in closed containers may be given *via* implants, moulds, seeds, needles, or applicators

(3) Internal or systemic irradiation from radioactive sources (131I or 32P) administered intravenously or parenterally.

The radioisotopes used for radiotherapy are:
- Gold (Au198)
- Cobalt (Co60)
- Radium (Ra226)
- Radon (Rn 222)
- Caesium (Cs137)
- Iodine (I131)
- Iridium (Ir192)
- Phosphorus (P32)

2.3.3 Chemotherapy

This involves the use of any chemical or cytotoxic drug in the treatment of cancer. The cytotoxic effect is exerted directly on the tumour and does not result from a change in the hormonal balance (hormone therapy) nor a change in the host's immune response (immunotherapy).

Chemotherapy may be:

- curative: aims to achieve a cure
- palliative: aims to reduce the bulk of disease to relieve symptoms and to prolong life
- adjuvant: aims to control microscopic spread of cancer following other forms of treatment such as surgery or radiotherapy

Some of the chemotherapeutic agents used are:

Actinomycin D	L-asparaginase
Bleomycin	Lomustine(CCNU)
Carboplatin	Melphalan
Carmustine (BCNU)	6-Mercaptopurine (6-MP)
Chlorambucil	Methotrexate
Cisplatin	Mitomycin C
Cyclophosphamide (endoxan)	Mitoxantrone
Cytarabine	Nitrogen mustard
Daunorubicine	Procarbazine
Doxorubicin (adriamycine)	Semustine (Methyl – CCNU)
Etoposide (VP 16)	Thiotxepa
5-Fluorouracil (5FU)	Vinblastine
Hexamethylmelamine	Vincristine (oncovin)
Hydroxyurea	Vindesine
Ifosfamide	

(See Appendix 2.3 for a more complete list of chemotherapeutic agents commonly used.)

Notes:

The registry personnel are not required to memorize these chemotherapeutic agents. However, they should at least be acquainted with the drugs in order to recognize them as chemotherapeutic agents if they are encountered in the process of reviewing the medical records.

There are also some non-malignant conditions which are treated with chemotherapeutic agents, e.g., psoriasis with methotrexate, systemic lupus erythematosus (SLE) with cyclophosphamide.

2.3.4 Hormone therapy

This is defined as the use of any type of therapy which achieves its effect on cancer tissue through a change in the hormonal balance of the patient.

Hormone therapy may be either ablative or additive.

(1) Ablative

removal of an endocrine organ in order to achieve a change in the hormonal balance of the patient. This may be done by surgical removal of the endocrine organ as in:

- Oophorectomy: (oophor = ovary) + (–ectomy = surgical removal).
- Adrenalectomy: (adrenal) + (–ectomy = surgical removal).
- Hypophysectomy: (hypophysis) + (–ectomy = surgical removal).
- Orchiectomy: (orchi = testis) + (–ectomy = surgical removal).

The first three procedures may be employed in the treatment of breast cancer.

Radiation ablation of the ovaries for breast cancer is also considered as ablative therapy.

(2) Additive

exemplified by the use of hormones, anti-hormones or steroids for hormonal effect on cancer tissues. Examples:

- Hormones: oestrogen, progesterone, testosterone
- Anti–hormones: tamoxifen (anti-oestrogen)
- Steroid: prednisone

The administration of steroids in the presence of cerebral oedema or superior vena cava syndrome to reduce the oedema is not considered as hormone therapy.

2.3.5 Immunotherapy

This refers to the use of any type of therapy which exercises its effect on cancer tissue through a change in the host's immune response. Examples:

- Interferon
- Interleukines
- vitamin therapy
- vaccine therapy (e.g. BCG)

EXERCISES ON TREATMENT

Question 2(l):

Indicate whether the following statements are TRUE or FALSE by encircling the correct answer:

T F a. Treatment which cannot be considered curative for a particular patient due to the extent of the disease, the lack of apparent response or incompleteness of treatment, is not considered definitive treatment.

T F b. Conisation of the cervix uteri is a definitive treatment for microinvasive or invasive cancer of the cervix.

T F c. Biopsy, NOS is considered definitive if on further surgery, no residual tumour is found.

T F d. Radioisotopes used for radiation therapy may either be given orally, intracavitarily, interstitially or parenterally by intravenous injection.

T F e. Chemotherapy can be curative, adjuvant or palliative.

Question 2(m):

What forms of treatment are a.–j. (Column A). Choose appropriate response(s) from Column B.

Column A	*Column B*
___ a. Cobalt	1. Surgery
___ b. BCG	2. Radiotherapy
___ c. Methotrexate	3. Chemotherapy
___ d. Mastectomy	4. Hormone therapy
___ e. Orchiectomy for prostatic carcinoma	5. Immunotherapy
___ f. Transurethral resection, prostate	
___ g. Linear accelerator	
___ h. Radiation ablation, ovaries for advanced breast cancer	
___ i. Radium insertion for cervical cancer	
___ j. Interferon	

GROUPED ANSWERS TO QUESTIONS 2(a)–(m)

Answers (2a)	Answers (2b)	Answers (2c)
10 a.	9 a.	16 a.
5 b.	2 b.	12 b.
8 c.	12 c.	1 c.
7 d.	8 d.	7 d.
6 e.	1 e.	17 e.
4 f.	7 f.	6 f.
2 g.	4 g.	14 g.
9 h.	3 h.	20 h.
1 i.	6 i.	11 i.
3 j.	10 j.	13 j.
	14 k.	15 k.
	11 l.	10 l.
	5 m.	2 m.
	13 n.	5 n.
		19 o.
		3 p.
		8 q.
		18 r.
		9 s.
		4 t.

Answer 2(d):

(iii) Malignant tumours can metastasize to other organs while benign tumours remain at their site of origin and do not spread to other parts of the body.

Answer 2(e):

The following symptoms will be recorded in the patient's medical record:

- nocturia: (Noct– = night) + (ur = urine) + (–ia = condition of)
- dysuria: (dys– = difficult) + (ur = urine) + (–ia = condition of)
- sudden weight loss

Answers 2(f)

a. T c. T e. T

b.T d.T f. F

Answers 2(g):

a.T c. T e. T

b.T d. T f. F

Answers 2(h):

7 a.	Aphonia	8 f.	Melena	12 k.	Dysphagia
6 b.	Dysuria	9 g.	Polyuria	13 l.	Urgency
1 c.	Dyspnea	11 h.	Paresthesia	15 m.	Orthopnea
2 d.	Nocturia	5 i.	Leukorrhea	14 n.	Anorexia
4 e.	Haematemesis	10 j.	Diarrhea	3 o.	Haematuria

Answers 2(i):

12 a.	Ascites	8 h.	Cyanosis	3 o.	Cachexia
7 b.	Icteresia	2 i.	Hepato megaly	17 p.	Haematoma
13 c.	Necrosis	4 j.	Pleural effusion	18 q.	Venous obstruction
15 d.	Orthopnea	16 k.	Paraplegia	19 r.	Asymmetry
14e.	Lymphadenopathy	10 l.	Anaesthesia	9 s.	Hemiplegia
11 f.	Ulceration	6 m.	Splenomegaly	20 t.	Oedema
1 g.	Pallor	5 n.	Lymphedema		

Answer 2(j):

There are several procedures employed to obtain material for cytological examination, including the following:

(i) swabs: use of a swab or similar device to obtain fluid and secretions which can be used to make a smear;

Example: – cervical smear

(ii) brushings: the lining of an organ is brushed for the purpose of obtaining cells;

Example: – gastric brushing; bronchial brushings

(iii) washings: instillation of fluid into a hollow organ or structure and removal of the fluid for the purpose of collecting any cells which have been exfoliated in the fluid;

Example: – bronchial washing

(iv) scrapings: the lining of a structure or organ is scraped with an instrument for the purpose of obtaining cells;

Example: – cervical smear, using an Ayre's spatula or cerviscraper

(v) punctures: insertion of a needle into a cavity or organ for the purpose of removing some portions of the contents(fluid, bone marrow, tissue);

Examples:– paracentesis: surgical puncture of a cavity for aspiration of fluid

- paracentesis abdominis: puncture of the peritoneal cavity
- thoracocentesis: puncture of the pleural cavity

Answers 2(k):

4	a. Papanicolaou smear
6	b. Mammography
1	c. Alpha–foeto protein
5	d. CT Scan
2	e. Ultrasonography
9	f. Bronchoscopy
3	g. Symptoms
8	h. Beta–HCG
12	i. Urography
7	j. Histology
13	k. Physical examination
10	l. Haematology
4	m. Autopsy
11	n. Liver scan

Answers 2(l):

a. F: Treatment which modifies, controls, removes or destroys cancer tissue is considered definitive treatment even if it cannot be considered curative for a particular patient due to the extent of the disease, lack of apparent response or incompleteness of treatment.

b. F: Conisation of the cervix is a definitive or curative treatment for carcinoma–in–situ, cervix but not for microinvasive or invasive carcinoma of the cervix.

c. T

d. T

e. T

Answers 2(m):

2 a. Cobalt
5 b. BCG
3 c. Methotrexate
1 d. Mastectomy
4 e. Orchiectomy for prostatic cancer
1 f. Trans-urethral resection, prostate
2 g. Linear accelerator
4 h. Radiation ablation, ovaries for advanced breast cancer
2 i. Radium insertion for cervical cancer
5 j. Interferon

Appendix 2.1

Acronyms and Abbreviations

Abbreviation..	Meaning
AB, Ab, ab....	abortion; antibody
abd.....	abdomen
ABG	arterial blood gases
AC, ac.....	anterior chamber; ante cibum (before meals)
Acid phos. / p'tase	acid phosphatase
ACTH	adrenocorticotropic hormone
AD, ad	auris dextra (right ear)
AdenoCA	adenocarcinoma
ADH	antidiuretic hormone (vasopressin)
Adj.....	adjunct; adjuvant; adjustment
ad lib	ad libitum (as desired)
adm, admin ...	admit; admitted; admission; administer; administration
aetiol	aetiology
AFB.....	acid fast bacillus
aff.....	afferent; affirmative
AFP.....	alpha-foetoprotein
A/G.....	albumin globulin ratio
Ag.....	argentum (chemical symbol for silver); antigen
AI, ai.....	aortic insufficiency; ad interim (in the meantime)
AIDS.....	acquired immuno-deficiency syndrome
AKA	above the knee amputation; also known as
alb.....	albumin
alk phos / p'tase	alkaline phosphatase
ALL.....	acute lymphocytic leukaemia
AM, a.m.....	ante meridiem (before noon)
AMA.....	against medical advice
amb	ambulatory; ambulate
AMI.....	acute myocardial infarction
AML	acute myeloblastic (myelocytic) leukemia
amp	ampule; amputation; ampere
amt.....	amount
AN	acoustic neuroma
ANA	antinuclear antibody
Anes(th)	anaesthesia(tic)

ant . . . . . anterior
ante . . . . . before
AO . . . . . aorta; acridine–orange technique (two–colour fluorescence test for
. . . . . cancer cells)
AP . . . . . antero–posterior; appendectomy
A & P . . . . . ausculatation and percussion
APR . . . . . abdomino–perineal resection;anterior pituitary resection
aq. . . . . aqua (water); aqueous
AR . . . . . aortic regurgitation
ARC . . . . . AIDS-related complex
ARD, ARDS . . . . . acute respiratory disease (syndrome)
ARF . . . . . acute renal failure
Art, art . . . . . artery(ial)
AS. . . . . aortic stenosis; auris sinistra (left ear)
ASCVD. . . . . arteriosclerotic cardiovascular disease
ASHD . . . . . arteriosclerotic heart disease
ATP . . . . . adenosine triphosphate
ATR . . . . . Achilles' tendon reflex
AU, Au . . . . . angstrom unit; aurum (chem. symbol for gold); both ears
198AU . . . . . radioactive gold
AUT, aut. . . . . autopsy
AV, av . . . . . arterio–venous; aortic valve
A & W . . . . . alive and well
AX . . . . . axilla; axis

Ba . . . . . barium
bas . . . . . basal
baso . . . . . basophil(e)
BBB . . . . . bundle branch block; blood–brain barrier
BBT . . . . . basal body temperature
BCC . . . . . basal cell carcinoma
B–cells . . . . . special lymphocytes formed in bone marrow
BCG . . . . . bacillus Calmette–Guérin
BE. . . . . barium enema; below elbow
BID, bid . . . . . bis in die (twice a day)
bil, bilat. . . . . bilateral
bil, bili, bilirub . . . . . bilirubin
BKA . . . . . below the knee amputation
BM . . . . . bowel movement; basal metabolism; bone marrow
BMR. . . . . basal metabolic rate
BP, bp . . . . . blood pressure; boiling point
BPH . . . . . benign prostatic hypertrophy
BS. . . . . bowel sound; breath sound
BSA . . . . . body surface area
BSE, bse . . . . . breast self–examination
BSO . . . . . bilateral salpingo–oophorectomy
bsp . . . . . bromsuphalein

BT, bt ..... bleeding time; brain tumour; blood transfusion
BUE ..... both upper extremities
BUN ..... blood urea nitrogen
Bx, bx ..... biopsy

C ..... centrigrade; cubic; cervical (vertebra)
c ..... with (cum)
CA ..... carcinoma; cancer
ca++ ..... calcium
cad ..... coronary artery disease
cal ..... calorie; caliber
CAP, cap ..... capillary; capsule
CAT ..... computerized axial tomography
cath ..... catheter(ize); cathartic
caud ..... caudal
CBC ..... complete blood count
CBD ..... common bile duct
CC ..... chief complaint(s)
cc ..... cubic centimetre(s); with correction
CCU ..... coronary care unit
CEA ..... carcinoembryonic antigen
cerv ..... cervical
cf ..... confer (compare)
chemo ..... chemotherapy
CHF ..... congestive heart failure
CHOP ..... chemotherapy regimen using cyclophosphamide-doxorubicin, oncovin (vincristine) and prednisone (for lymphomas)
CIN ..... cervical intraepithelial neoplasia (dysplasia)
CIS ..... carcinoma-in-situ
Cl ..... chloride
clin ..... clinical
CLL ..... chronic lymphocytic leukaemia
CM, cm ..... centimetre
CML ..... chronic myelogenous leukaemia
CMV ..... cytomegalovirus
CNS ..... central nervous system
CO ..... cardiac output
CO- ..... carbon dioxide
Co 60 ..... cobalt 60
COLD ..... chronic obstructive lung disease
compd. cpd ..... compound
con ..... contra (against)
conc ..... concentration, concentrated
cond ..... condition; condensed; conductivity;
contra ..... contra-indicated (against)
COPD ..... chronic obstructive pulmonary disease
CPAP ..... continuous positive airway pressure

cpm, CPM ..... counts per minute (pertains to particles emitted after administration of radioactive material)
CPR ..... cardiopulmonary resuscitation

CR, cr ..... clot retraction; cranial
CS, Cs, csc ..... Caesarean section; cesium (chemical symbol for); corticosteroid
C & S ..... culture and sensitivity
CSF ..... cerebrospinal fluid
CSR ..... central supply room
CT ..... computerized tomography
CVA, Cva ..... cardiovascular accident; costo–vertebral angle
CVP ..... central venous pressure
cu ..... cubic
cu. mm ..... cubic millimetre
CVD ..... cardiovascular disease
CVS ..... cardiovascular system
c/w ..... consistent with; compatible with
Cx, cx ..... cervix; convex
CXR, CxR ..... chest X–ray
Cys, cysto– ..... cystoscopy
cytol– ..... cytology

D, d ..... deviation; dexter (right); dorsal (thoracic vertebra 1st, 2nd, etc.)
DBP ..... diastolic blood pressure
DC, dc ..... discontinue; discharge
D & C ..... dilatation and curettage
DD ..... differential diagnosis
dec, decr ..... decreased
deg, degen ..... degeneration; degree
Derm ..... dermatology
DES ..... diethylstilbestrol
DH ..... dehydrogenase; delayed hypersensitivity
DHL ..... diffuse histiocytic lymphoma
DI ..... diabetes insipidus; diagnostic imaging; deterioration index
Dia, diath ..... diathermy; diametre
diag ..... diagnosis; diagnostic; diagram
DIC ..... disseminated intravascular coagulopathy
Diff Ct ..... differential count
DISCH ..... discharge
DL ..... direct laryngoscopy
DLCL ..... diffuse large cell lymphoma (diffuse histiocytic)
DLL ..... diffuse lymphoblastic lymphoma (diffuse lymphoblastic convoluted/non-convoluted)
DM, dm ..... diabetes mellitus; decimetre
DML ..... diffuse mixed cell lymphoma (diffuse mixed lymphocytic histiocytic)
DNA ..... deoxyribonucleic acid
DOA ..... dead on arrival
DOB ..... date of birth

DOD. . . . . date of death
DOE. . . . . dyspnea on exertion
dos. . . . . dosage; dosis (dose)
DR, Dr, dr. . . . . diagnostic radiology; dorsal root (with reference to spinal nerves); dram; dressing; delivery room
DSCL . . . . . diffuse, small, non-cleaved lymphoma (diffuse, undifferentiated, Burkitt's and non–Burkitt)
DT . . . . . delirium tremens
D/T. . . . . deaths total ratio
DTR . . . . . deep tendon reflexes
DU. . . . . duodenal ulcer; diagnosis undetermined
D/W. . . . . dextrose in water
Dx . . . . . diagnosis
DXR. . . . . deep X–ray therapy

EAC . . . . . external auditory canal
EBL. . . . . estimated blood loss
EBV . . . . . Epstein–Barr virus
E & C. . . . . evacuation and curettage
ECF . . . . . extracellular fluid; extended care facility
ECG. . . . . electrocardiogram
EDC. . . . . expected date of confinement
EE. . . . . eye and ear
EEG . . . . . electroencephalogram
EENT . . . . . eye, ear, nose and throat
EF. . . . . ejection fraction
e.g. . . . . exempli gratia (for example)
EKG . . . . . electrocardiograph (gram) (see also ECG)
EM, Em . . . . . electron microscope; endometrium electromyogram(phy)
EMI . . . . . computerized tomography scanner (developed by Electro Music Instruments)
Endo . . . . . endocrinology
ENT . . . . . ears, nose and throat
EOA. . . . . examination, opinion and advice
EOD. . . . . extent of disease
EOM, eom . . . . . extraocular muscles; extraocular movements
Eos. . . . . eosinophil
Ep cell, epith cell. . . . epithelial cell
ER. . . . . emergency room
ESR. . . . . erythrocyte sedimentation rate
EST. . . . . electroshock therapy
et al . . . . . et alibi (and elsewhere); et alii (and others)
etc. . . . . et cetera (and others of the like, kind, and so forth)
etiol . . . . . etiology
EUA . . . . . examination under anaesthetic
evac . . . . . evacuated; evacuation
eval . . . . . evaluate(ion)
ex, exag, exam. . . . . example; exchange; exaggerated; examined(ation)

exc . . . . . excision
Expl lap, E.L. . . . . exploratory laparotomy
EXREM. . . . . external radiation dose
ext., extd . . . . . extend (spread); extensor(ion) external; extra; extratum (extract); extremity

F . . . . . Fahrenheit (temperature scale); female
FB . . . . . fingerbreadth; foreign body
FBS . . . . . fasting blood sugar
FCC . . . . . follicular cleaved cell
FDA . . . . . Food and Drug Administration
FH FHx. . . . . foetal heart; family history
FIGO . . . . . International Federation of Gynecology and Obstetrics
Fl, fld . . . . . flexion; fluidium (fluid)
fl. oz. . . . . fluid ounce
FLCL . . . . . follicular large–cell lymphoma (nodular histiocytic)
fluor, fluores,) . . . . . fluoroscopy (escent)
fluoro
FML . . . . . follicular mixed–cell lymphoma (nodular mixed lymphocytic-
. . . . . histiocytic)
FS . . . . . frozen section
FSCL. . . . . follicular small cleaved lymphoma (nodular, poorly differentiated lymphocytic)
FSH . . . . . follicle–stimulating hormone
ft . . . . . foot; feet
F/u; FU. . . . . follow–up; fluorouracil (5–FU)
FUO . . . . . fever of undetermined origin
FVC . . . . . forced vital capacity
Fx . . . . . fracture

G, g . . . . . gravida; gas; globulin; glucose; gram(s)
GA, Ga, ga . . . . . gastric analysis; galium (chemical symbol for); gauge (of needles); general anaesthesia
GB, GBS . . . . . gallbladder (series)
Gc . . . . . gonorrhea; gonococcus
GE . . . . . gastroenterology; gastroesophageal
gen. . . . . general(ized); genus
GH . . . . . growth hormone (of anterior pituitary)
GI. . . . . gastrointestinal; growth–inhibiting
ging . . . . . gingiva
gl, gland. . . . . glandula (a gland); glandular
Gl, Glu, glu, gluc. . . . glucose
Glob. . . . . globulin; globular
GM, gm . . . . . grand mal; gram(s)
gn. . . . . gram negative
GP . . . . . general paralysis; general paresis; general practitioner; gram positive
Gr, grav, gravida . . . . gravid (pregnancies, 1, 2, 3, etc.); gravity
grp . . . . . group

GS ..... general surgery
GSW..... gunshot wound

GTH..... gonadotropic hormone
GTT ..... glucose tolerance test
gtt ..... guttae (drops)
GU ..... genitourinary; gastric ulcer
GVHR..... graft versus host reaction
GYN, gyne, gynecol.. gynaecology

H ..... hydrogen (chemical symbol for)
h..... hour; human
HA ..... headache
HAA ..... hepatitis associated antigen
HB, hb ..... heart block; haemoglobin
HBP ..... high blood pressure
HC ..... hydrocortisone; home care
HCG..... human chorionic gonadotropin
HCL ..... hydrochloric acid (formula for)
HCT, hct ..... haematocrit
HCVD ..... hypertensive cardiovascular disease
HD, hd..... Hodgkin's disease; head; hearing distance; hora decubitus (at bedtime); haemodialysis
heent ..... head, ears, eyes, nose, throat
hemat, hct, h'crit.... haematocrit
Hg ..... mercury (chemical symbol for)
Hgb ..... haemoglobin
HGH..... human growth hormone
Hgt, Ht..... height
H–ICDA ..... Hospital Adaptation of the International Classification of Diseases, Adapted
Hist, Histol, histo ... histology
HLA ..... homologous leukocytic antibodies
hm ..... hand movement (eye)
Hn– ..... nitrogen mustard
H/O ..... history of
H–O ..... water (formula for)
homolat..... homolateral
Hosp..... hospital
H & P..... history and physical examination
HPF, hpf..... high power field
HPG..... human pituitary gland
HPI..... history of the present illness
hpn ..... hypertension
HR, hr ..... heart rate; hour(s)
HS ..... hour of sleep (L. hora somni)
HT, ht..... height; hydrotherapy; high tension
HV ..... hyperventilation
HVD..... hypertensive vascular disease

Hx ..... history
Hyst, hyst ..... hysterectomy

I ..... intensity; iodine (chemical symbol for)
Iac ..... internal auditory canal
IARC ..... International Agency for Research on Cancer
ICD ..... International Classification of Diseases
ICDA ..... International Classification of Diseases, Adapted
ICD–9–CM ..... International Classification of Diseases, 9th Revision, Clinical Modification
ICD–O ..... International Classification of Diseases for Oncology
ICM ..... intercostal margin
ICP ..... intracranial pressure
ICS ..... intercostal space; impulse–conducting system
ICSH ..... interstitial cell–stimulating hormone
ICU, ICCU ..... intensive care unit, intensive critical care unit
ID, id ..... identification; idem (the same); infectious disease(s), intradermal(ly)
I & D ..... incision and drainage
i.e. ..... id est (that is)
IF ..... intermediate frequency, interstitial fluid, intrinsic factor
Ig, IgA, IgB, Igd ..... immunoglobulin (A, B, D, etc.)
IHD ..... ischaemic heart disease
IM ..... intramuscular; index medicus; internal medicine
Immun, Immunol ... immunology; immunity; immunization
IMP ..... impression
In, in ..... indium (chemical symbol for); inch (2.5 cm)
In d ..... in dies (daily)
inflam ..... inflammation(ory)
info ..... information
ing ..... inguinal
INH ..... inhalation; isoniazid (an antituberculous drug)
inj, inject ..... injectable; inject(ion); injury(ious)
In Pt, INPT ..... inpatient
INREM ..... internal radiation dose
in situ ..... in the natural or normal position (has not spread)
Insp, inspir ..... inspiration(ory)
Inst, Instn ..... institute, institution
Int ..... intermittent; intern, internal, internist
Intest ..... intestinal
Int Med ..... internal medicine
io ..... intraocular
I & O ..... intake and output
IOP ..... intraocular pressure
IPPA ..... inspection, palpation, percussion, auscultation
IPPB ..... intermittent positive pressure breathing
IQ ..... intelligence quotient; inner quadrant (breast)
IRD ..... index of roentgen
IS, is ..... immune serum; intercostal space; intraspinal

ISF ..... interstitial fluid
IT, ITh ..... intrathecal (with reference to injections)
ITP ..... idiopathic thrombocytopenic purpura

IU ..... immunizing unit; international unit; intrauterine
IUD ..... intrauterine device
IV ..... interventricular; intervertebral; intravenous(ly); intraventricular
IVC ..... inferior vena cava; intravenous cholangiogram
IVD ..... intervertebral disc
IVP ..... intravenous pyelogram(phy)
IVT ..... intravenous transfusion

J ..... Jaeger; joint; journal
jt ..... joint

K, k ..... kalium (potassium, chemical symbol for)
KCl ..... potassium chloride (formula for)
Kg, kilo ..... kilogram
KJ ..... knee jerk
KUB ..... kidney, ureter, bladder (X–ray)
kv ..... kilovolt
KVO ..... keep vein open

L, l, lt ..... Latin; left; length; (ligament); light; litre; lumbar (vertebra – 1st, ... 2nd etc.)
LA ..... left atrium; left auricle; long–acting; lanthanum (chemical symbol for)
lab ..... laboratory
LAF ..... laminar air flow
LAP, lap ..... laparotomy; leucine aminopeptidase; leukocyte alkaline phosphatase
LASER ..... light amplication by stimulated emission of radiation
Lat., lat ..... lateral
lb ..... pound
LD, LDH ..... lactate dehydrogenase; lethal dose; low density
LE ..... lower extremity; lupus erythematosus
LFT ..... liver function test
LH ..... luteinizing hormone; left hand
lig ..... ligament(s)
lin, linac ..... linear (accelerator)
LIQ ..... lower inner quadrant (breast)
LIS ..... lobular carcinoma in situ
LKS, LSK ..... liver, kidney, spleen
LLE ..... left lower extremity
LLL ..... left lower lobe (lung)
LLQ ..... left lower quadrant (abdomen or breast)
LMP ..... last menstrual period

LN, l.n., ln . . . . . lymph node
LOC . . . . . level of consciousness
LOQ . . . . . lower outer quadrant (breast or abdomen)

L.P., LP, lp . . . . . lumbar puncture; latent period; light perception; low power (with reference to microscopy field); low pressure
LS . . . . . liver scan
L–S . . . . . lumbo–sacral
LTH . . . . . luteotropic hormone (prolactin)
LUL . . . . . left upper lobe (lung)
LUQ . . . . . left upper quadrant (of abdomen and breast)
lym, lymph, lympho. lymphocyte(s)
L & W . . . . . living and well

M, m . . . . . male; married; mass; metabolite; metre; milli– (thousand); Monday; morphology; murmur; musculus (muscle)
mag, Mag, magn . . . . magnification; magnus (large)
malig . . . . . malignant
mas, masc . . . . . masculine; mass
mast . . . . . mastectomy
mc . . . . . millicurie; megacycle(s)
MCG . . . . . microgram
MCH, MCHC . . . . . mean corpuscular haemoglobin (count) or (concentration)
MCL . . . . . mid–clavicular line
MCV . . . . . mean corpuscular volume
MD, md . . . . . mano dextra (with the right hand); mean deviation; Doctor of Medicine
MDR . . . . . minimum daily requirement
ME, me . . . . . methyl (chemical symbol for); middle ear
MED, med . . . . . medial; median; medicine(al); medium (bacteriology); minimal effective dose
Med. Rec . . . . . medical record (department)
Med Tech . . . . . medical technology(ician) (see also MT)
mEq/l . . . . . milli–equivalent per litre
met, metas . . . . . metastasis; metastasize; metastatic
mev . . . . . million electron volts
Mg, mg, MG . . . . . magnesium (chemical symbol for); milligram(s); myasthenia gravis
MI, mi . . . . . mitral insufficiency; myocardial infarction
micro . . . . . microscopic
min . . . . . minute
ML, ml . . . . . malignant lymphoma; millilitre; midline
mld . . . . . minimum lethal dose
MM, mm . . . . . millimetre; mucous membranes; muscles
mod, modif . . . . . moderate(ly); modification; modified
Mono, monos . . . . . monocyte(s)
MOTNAC . . . . . Manual of Tumor Nomenclature and Coding
MR . . . . . mitral regurgitation

MRD. . . . . medical record department
MRI . . . . . magnetic resonance imaging
MS, Ms. . . . . mano sinistra (with the left hand); mitral stenosis; multiple sclerosis; morphine sulfate
MSB . . . . . main stem bronchus
MSH. . . . . melanocyte (melanophore)-stimulating hormone
MSL . . . . . midsternal line
MST . . . . . median survival time
MT . . . . . medical technologist
MTD. . . . . maximum toxic dose
MU, mu . . . . . micron; mouse unit (with reference to gonadotropins)
MV, mv . . . . . millivolt; mitral valve; mean variation
MVA. . . . . motor vehicle accident
MX, Mx . . . . . microscopic; management

N, n . . . . . nitrogen (chemical symbol for); normal number; nares (nasal, nostril); nerves (nerve); negative; natus (born)
NA, Na, N/A. . . . . natrium (sodium, chemical symbol for); not applicable
NaCl. . . . . sodium chloride (formula for)
NAD. . . . . no acute distress; no appreciable disease;
Nat. . . . . national; native; natural
NB, N.B. . . . . newborn; nota bene (note well)
NBM. . . . . nothing by mouth
NCI . . . . . National Cancer Institute
NEC . . . . . not elsewhere classified
NED . . . . . no evidence of disease
neg. . . . . negative (–)
NERD . . . . . no evidence of recurrent disease
Nerv. . . . . nervous; nerve
NES . . . . . not elsewhere specified
Neuro, neurol . . . . . neurology(ical)
NG . . . . . nasogastric; new growth
NKA . . . . . no known allergies
NL, nl, norm . . . . . non licet (is not permitted); normal (limits)
NMR. . . . . nuclear magnetic resonance
No. . . . . number
Noct, nocte, ncx, noctis). . . . . night, nocturnal
norm . . . . . normal
NOS, Nos. . . . . not otherwise specified; number(s)
nov. . . . . novum (new)
NP . . . . . nasopharynx(geal)
NPC . . . . . near point of convergence; nasopharyngeal carcinoma
NPDL . . . . . nodular, poorly differentiated lymphocytic lymphoma
NPN . . . . . non-protein nitrogen
NPO . . . . . non per os (nothing by mouth)
NR, nr . . . . . do not repeat (non repetatur) (in prescriptions);
NS, ns. . . . . nervous system; neurosurgeon;

NSR ..... normal sinus rhythm
NSS..... normal saline solution
NSSTW..... non–specific S T wave changes (ECG)
nuc, nucl, Nuc Med.. nucleated; nucleus; nuclear medicine
N & V..... nausea and vomiting
NVE..... neck vein engorgement
NW ..... non–white

O, o ..... occiput; occulus (eye); oral(ly); oxygen (chemical symbol for)
OB, ob, OBS, obstet.. obstetrics(al); observation; obsolete
OB–GYN ..... obstetrics and gynecology
Occ..... occasional; occlusion
OD, od, o/d ..... oculus dexter (right eye); omni die (once daily); on demand;
..... occupational disease
OP, op ..... outpatient; occiput posterior; operative procedure; osmotic pressure
OPD..... outpatient department
Oph, ophth ..... ophthalmology(ist); ophthalmoscope(ic)
OR ..... operating room
Ortho..... orthopaedic
OS, Os, os ..... oculus sinister (left eye); bone; mouth; opening
Osteo..... osteomyelitis; osteopath(y)
OT, ot..... occupational therapy; objective test (psychology); orotracheal;
otolaryngology(ist)
OTO, Otol ..... otology(ist)
OU..... oculi unitas (both eyes together); oculus uterque (for each eye)
oz..... ounce (28 gr)

P, p ..... parte (part); per (by); phosphorus (chemical symbol for); pulse; pupil;
plasma
PA..... posterior–anterior (back to front); paralysis agitans; pernicious
..... anaemia; pulmonary artery
P & A ..... percussion and auscultation
palp..... palpable; palpate(ion)
Para ..... formula designating p–number of pregnancies; a–number of abortions; –number of living children
PAS..... peroxidase acid stain
P'ase..... phosphatase
Path, pathol..... pathology(ical); pathologist
PBI..... protein–bound iodine
PC ..... post cibos (after meals); post cibum (after food)
pCO–..... carbon dioxide content of the blood
PCV ..... packed cell volume
PD ..... poorly differentiated; peritoneal dialysis
PDA..... Patent Ductus Arteriosus
PE, pe..... physical examination; pulmonary embolism
PED, Pedia..... paediatric(s)
PEEP..... positive end–expiratory pressure

PEG ..... pneumoencephalogram
PERLA ..... pupils equal, reactive to light and accomodation
PERRLA ..... pupils equal, round, reactive to light and accomodation
PF..... platelet factor; pulmonary factor; permeability factor
PH, PHx..... past history; public health
pH ..... symbol for expression of hydrogen ion concentration (acidity and alkalinity)
phys..... physiology
Phys Med..... physical medicine

Phys Ther..... physical therapy
PI ..... present illness
PID..... pelvic inflammatory disease
PM, pm ..... petit mal; physical medicine; postmeridian (afternoon);
..... postmortem (after death)
PMB ..... polymorphonuclear basophilic leukocyte
PME ..... polymorphonuclear eosoinophilic leukocyte
PMH..... past medical history
PMN..... polymorphonuclear (neutrophilic) leukocyte
PND ..... paroxysmal night dyspnea; postnasal drip
PO, POp, post–op ... postoperative
PO– ..... oxygen content of blood
POS, pos..... positive (+); position
PP..... postpartum
PPD ..... purified protein derivative (tuberculin skin test)
ppm ..... part per million
ppp..... platelet poor plasma
ppt..... precipitate
PRBC ..... packed RBC (red blood cells)
preg, pregn, pg ..... pregnant
preop, pre–op ..... preoperative
prep ..... preparation; prepare
prn..... pro re nata (as needed)
Proct, procto ..... proctology(ist)
prog, progn ..... prognosis
pros, prost..... prostate
prosth ..... prosthesis
prothrom, PT) ..... time
pro–time
prox..... proximal
PS..... pulmonary stenosis
PSI ..... posterior sagittal index
Psy, psychiat ..... psychiatry(ic)
psych, psychol..... psychology(ist)
PT, pt ..... part; patient; physical therapy; pint; point; prothrombin time
PTA..... prior to admission
PTC ..... prior to consultation
PTH ..... parathormone (parathyroid hormone)
PTT..... partial thromboplastin time

PUD ..... peptic ulcer disease
pul, pul em ..... pulmonary embolism
PV ..... paraventricular (nucleus); plasma volume
PVC ..... premature ventricular contraction
PVD ..... peripheral vascular disease
Px, PX ..... past history; physical examination; pneumothorax; prognosis

Q ..... quadrant; quantity; quart; quotient
q ..... quaque (each, every)
qd ..... quaque die (every day)
qh ..... quaque hora (every hour)
qhs ..... at bedtime
qid ..... quater in die (four times a day)
qm ..... quaque mane (every morning)
qn ..... quaque nocte (every night); quaque nox (every night)
QNS ..... quantity not sufficient
qt ..... quart; quantity; quiet
qtty ..... quantity
quad ..... quadrant(s)
qual ..... quality(ative)
q.v. ..... quod vide (which see)

R, r ..... radioactive mineral; radiology(ist); radius; range; rectal; resistance with reference to disease); right; respiration; roentgen (symbol for); roentgenology(ist)
RA, Ra ..... radium (chemical symbol for); repeat action; right atrium; right auricle; rheumatoid arthritis
Rad; rad ..... rad (radiation absorbed dose); radical; radiotherapy(ist); radius
RAEB ..... refractory anaemia with excess blasts
RAIU ..... radioactive iodine uptake
RaRx, RxTx, Rt, RT .. radiation therapy; radiotherapy
RBBB ..... right bundle branch block
RBC ..... red blood cells; red cell count
RCM ..... right costal margin; reinforced clostridial medium
RCS ..... reticulum cell sarcoma
RDS ..... respiratory distress syndrome
Readm ..... readmission
rec ..... recens (fresh); record; recreation; recurrent
ref phys ..... referring physician
REG, reg ..... radioencephalogram; region; register(ed); regular
rehab ..... rehabilitation
REM, rem ..... rapid eye movement (sleep); roentgen–equivalent–man
REP, rep, rept ..... repair; repetatur (let it be repeated); report; retrograde pyelogram; roentgen equivalent physical
RES ..... reticuloendothelial system
resp ..... respiration; rspiratory; respectively; responsible

retic ..... reticulocyte(s)
Retic ct ..... reticulocyte count
RF ..... renal failure; rheumatoid factor
RH, Rh ..... relative humidity; releasing hormone; rhesus (with reference to blood factors); rhonchi (rales); right hand
RHD ..... rheumatic heart disease
RI ..... refractive index

RIA ..... radioimmunoassay
RICM ..... right intercostal margin
RIQ ..... right inner quadrant (of breast)
RLE ..... right lower extremity
RLL ..... right lower lobe (of the lung)
RLQ ..... right lower quadrant (of the abdomen or breast)
RM ..... respiratory movement
RML ..... right middle lobe
RNA ..... ribonucleic acid
RO, R/O ..... routine order; rule out
Roent ..... roentgenology(ist)
ROM ..... range of motion
ROQ ..... right outer quadrant of the breast or abdomen
ROS ..... review of systems; review of slides
rout ..... route
RR ..... respiratory rate; recovery room; response rate
R & R ..... rate and rhythm (of pulse)
RS, R–S ..... Reed–Sternberg cells (for diagnosing Hodgkin's disease)
RT, rt ..... radiotherapy; right; reaction time; recreational therapy
RTC ..... return to clinic
RUE ..... right upper extremity
RUL ..... right upper lobe
RUQ ..... right upper quadrant
RV ..... right ventricle
R–V ..... recto–vaginal
Rx, RX ..... recipe (take, used in prescription); therapy; treatment

S, s ..... sacral (in vertebra); semis (half); single (marital status); sinister (left); sulphur (chemical symbol for)
s ..... without (L. sine)
SA, Sa, sarc ..... sarcoma; sino–atrial node
sat, satd, satn ..... saturated; saturation
SB ..... small bowel
SBE ..... subacute bacterial endocarditis
SBP ..... systolic blood pressure
sé, sc ..... without correction; small cleaved
sci ..... science(tific)
SD ..... standard deviation
SE ..... saline enema; standard error selinium (chemical symbol for)
Sed rate ..... sedimentation rate

SEER. . . . . Surveillance, Epidemiology and End Results
seg . . . . . segmented; segmenters (neutrophils)
SEM . . . . . standard error of mean
sep . . . . . separated (marital status)
SF . . . . . spinal fluid
SG . . . . . specific gravity
SGOT . . . . . serum glutamic oxaloacetic–acid transaminase
SGPT . . . . . serum glutamic pyruvic transaminase

SH . . . . . social history
SIADH . . . . . syndrome of inappropriate antidiuretic hormone secretion
sib . . . . . sibling
SIDS . . . . . sudden infant death syndrome
Sig, sig . . . . . sigmoidoscopy; signa, signetur (write, let it be written)
SL. . . . . sublingual
SLE. . . . . systemic lupus erythematosus
SLL. . . . . small lymphocytic lymphoma (diffuse lymphocytic well differentiated)
SM, sm. . . . . small; streptomycin; sustained medication; systolic murmur
SMA . . . . . (SMA–6; SMA–12); sequential multiple analysis measures body levels of albumin, alkaline phosphatase, bilirubin, BUN, calcium, carbon dioxide, cholesterol, creatinine, glucose, LDH, potassium chloride, sodium, total protein, etc.
SNODO . . . . . Standard Nomenclature of Diseases and Operations
SNOMED . . . . . Systemized Nomenclature of Medicine
SNOP . . . . . Systemized Nomenclature of Pathology
SNS. . . . . sympathetic nervous system
SOB . . . . . shortness of breath
SOL . . . . . space occupying lesion
sol, soln, solut . . . . . solution, soluble
SOP . . . . . standard operating procedure
SP, Sp, sp . . . . . specific; specimen; spine(al)
S/P, s/p . . . . . status post
sp gr, spec gr . . . . . specific gravity
SQ . . . . . subcutaneous
Sq. cell ca, SCC . . . . . squamous cell carcinoma
S & S . . . . . signs and symptoms
SSE. . . . . soap suds enema
Stabs . . . . . banded (neutrophils)
Staph . . . . . staphylococcus
stat. . . . . statim (at once, immdiately); statistics
STD, std . . . . . sexually transmitted disease; standard
STH . . . . . somatotropic hormone (growth hormone)
Strep, Str, Strepcoc. . . streptococcus
Sub–Q, subq, subcut . subcutaneous(ly)
sup. . . . . superior
Surg . . . . . surgery(ical); surgeon
Susp . . . . . suspension
SVC . . . . . superior vena cava (syndrome)

Sx, sym, sympt ..... symptoms and signs
sys, syst ..... system(ic); systolic
Sz ..... seizure

T, t ..... temperature; thoracic (vertebra, 1st, 2nd, 3rd, etc.); topography; time; toxocity; type; transverse
T4 ..... thyroxine
T & A ..... tonsillectomy and adenoidectomy
TA, TAT ..... toxin–antitoxin; tetanus antitoxin

tab ..... tabella (a tablet)
TAH ..... total abdominal hysterectomy
TB, tbc ..... tuberculosis; tubercle bacillus
TBI ..... total body irradiation
Tc–99m ..... isotope (technitium)
TCC ..... transitional cell carcinoma
T–cells ..... lymphocytes that mature in the thymus and are involved in cell mediated immunity
TD, td, tid ..... ter die (three times a day); thoracic duct; tumour dose treating distance
TEMP ..... temporary; temporal; tempore (in the time of); temperature
term ..... terminal
tet ..... tetanus
TH, th ..... tetrahydrocortisol; thoracic; thorax; thyroid hormone (thyroxine)
TIA ..... transient ischemic attack
TIBC ..... total iron binding capacity
TID, tid ..... ter in die (three times a day)
tinc ..... tincture
TL ..... tubal ligation
TM ..... tympanic membrane
TNI ..... total nodal irradiation
TNM ..... tumour, node, metastasis (staging classification)
TOMS ..... tomograms
topo, topog ..... topography
tox ..... toxic(ity)
TP ..... total protein; testosterone propionate
TPN ..... total parenteral nutrition
TPR ..... temperature, pulse, respiration; total peripheral resistance
trach ..... trachea(otomy)
trans cell ca, TCC ... transitional cell carcinoma
transpl ..... transplant(ation)
TRH ..... thyrotropin releasing hormone
TRT, Tx ..... treatment
TS ..... tumor size; thoracic surgery
TSH, TTH ..... thyroid stimulating hormone (thyrotropic hormone)
tsp ..... teaspoon
TUR, TUR(B), TUR(P). transurethral resection of (bladder, prostate)

tus ..... tussis (cough)
Tx ..... treatment

U ..... unit; urology(ist); upper
UA ..... urinalysis
UE ..... upper extremity
UGI, UGIS ..... upper gastrointestinal series
UH ..... upper half
UICC ..... International Union Against Cancer
UIQ ..... upper inner quadrant

umb ..... umbilicus (navel)
undiff ..... undifferentiated
unilat ..... unilateral
unk ..... unknown
U/O ..... urine output
UOQ ..... upper outer quadrant (breast)
UQ ..... upper quadrant
ureth ..... urethra(l)
URI ..... upper respiratory infection
urol ..... urology(ic); urologist
US, U/S ..... ultrasound
UTI ..... urinary tract infection
UV ..... ultraviolet

V, v ..... variation; coefficient of variation; vena (vein); vide (see); virus
VA ..... visual acuity
vag ..... vaginal
vasc ..... vascular
VC ..... vocal cord(s); vital capacity
VD ..... venereal disease
VDRL ..... Venereal Disease Research Laboratory
ventr ..... ventral
ventric ..... ventricle(ular)
viz ..... namely
VM ..... vasomotor
VP ..... venous pressure
VPC ..... ventricular premature beats; volume packed cells
Vs, vs ..... vital signs; vesicular sound (auscultation, chest)

W, w ..... water; width; white
w/ ..... with
WB ..... whole blood
WBC ..... white blood cell; white blood count
W/D, WD ..... well developed
W–E ..... wide excision

WHO ..... World Health Organization
Wid ..... widow(er)
wk ..... week
W/N ..... well nourished
WNL ..... within normal limits
w/o ..... without

wt ..... weight
W/U ..... work-up

X, x ..... axis (of a cylindrical lens); experimental; unknown quantity
(symbol for) X-chromosome; chromosome in male (paired with Y-chromosome)
X-matching ..... cross matching
X-rays ..... roentgen ray
XX ..... normal female chromosome type
XY ..... normal male chromosome type

Y-chromosome .... chromosome in male paired with X-chromosome
y/o ..... years old
yr, yrs ..... years

Zn ..... zinc (symbol for)

Appendix 2.2

Symbols

1° ..... first degree
2° ..... secondary; second degree
♀ ..... female
♂ ..... male
↑ ..... increased
↓ ..... decreased
− ..... negative; subtract
+ ..... positive; add
µ ..... micron
µmg, µg ..... microgram
< ..... less than
> ..... more than; greater than
≤ ..... less than or equal to
≥ ..... more than or equal to
* ..... birth
† ..... death
Θ ..... diametre
= ..... equal to
≠ ..... is not equal to
~ ..... approximate
' ..... foot; feet
" ..... seconds; inch(es)
° ..... degree; hour
..... number (before a figure e.g. # 2)
% ..... percent; percentage
/ ..... per or divided by
× ..... multiplied by
: ..... ratio to

Appendix 2.3

Cancer Chemotherapeutic Agents

ACTINOMYCIN D	Cosmegen; dactinomycin
AMSACRINE	M–AMSA; 4'–(9 acridinyl aminomethane–sulfon-m–anisodide)
ASPARAGINASE	
5 AZACYTIDINE	
BLEOMYCIN	Blenoxane
BUSULFAN	Myleran
CARBOPLATIN	Paraplatin
CARMUSTINE	BCNU; bichlorethylnitrosourea
CHLORAMBUCIL	Leukeran
CISPLATIN	Cis–diammine dichloroplatinum DDP; platinol; platamine
CYCLOPHOSPHAMIDE	Cytoxan; cyclophar; endoxan
CYTARABINE	Cytosine arabinoside; arabinosyl cytosine; cytosar–U; ara–C
DACARBAZINE	DTIC; dimethyltriazine imidazole carboxamide
DAUNORUBICIN	Daunomycin; cerubidin
DOXORUBICIN	Adriamycin; hydroxyl daunorubicin
5 FLUOROURACIL	Adrucil; fluoroblastin; 5 FU
HEXAMETHYL-MELAMINE	HMM
HYDROXYUREA	Hydrea
IFOSFAMIDE	Holoxan
LOMUSTINE	CCNU; cyclohexylchlorethyl nitrosourea; CeeNU
MELPHALAN	Alkeran; phenylalanine mustard; L–PAM; L–sarcolysin
MERCAPTOPURINE	6–MP; purinethol
METHOTREXATE	Amethopterin; MTX, maxtrex; mexate; emthexate
MITHRAMYCIN	Mithracin
MITOMYCIN C	Mutamycin
MITOTANE	op'–DDP; lysodren
MITOXANTRONE	Novantrone; DHAD
PROCARBAZINE	Matulane; methylhydrazine
SEMUSTINE	Methyl–CCNU; MeCCNU; chloroethyl methylcyclohexyl nitrosourea
STREPTOZOCIN	Streptozotocin
TAXOL	
THIOGUANINE	6–TG; lanvis
THIOTEPA	Thio–TEPA; triethylenethiophosphoramide
VINBLASTINE	Velban
VINCRISTINE	Oncovin
VINDESINE	Eldisine
VP–16	Etoposide; VP–16–213 epipodophyllotoxin; vepesid

3
Data Collection

3.1
Case-finding

Case-finding is the system used for locating every new case of cancer that comes from the area covered by the registry, and which is diagnosed and/or treated on or after the registry's reference date (the date the registry began collecting data on cancer).

Question:

What diagnoses should be reported to the registry (reportable diagnoses) ?

Answer:

All cases considered as malignant in the Morphology section of the International Classification of Diseases for Oncology (ICD-O) should be reported to the registry. A written list of the diagnoses to be reported (reportable list) includes:

(a) all cases of carcinoma and sarcoma and all cases considered as malignant in the Morphology section of ICD-O;

(b) selected in-situ and benign tumours as well as selected tumours of uncertain behaviour which are of interest to the registry staff and/or the cancer committee. Registries may differ as to which neoplasms from this group are to be included in the registry.

An example of a reportable list is given in Appendix 3.1.

Question:

What is the responsibility of the tumour registrar in this regard ?

Answer:

It is the responsibility of the tumour registrar to obtain a clear agreement with his supervisor or the cancer committee on the list of tumours to include in the registry. The basic criterion in determining whether a tumour is reportable or not is a diagnosis of cancer by a physician or dentist, whether clinically diagnosed or histologically proven. A positive pathology report takes precedence over other reports or statements in a patient's chart.

3.1.1 Methods of case-finding and tracking systems

Case-finding and abstracting may or may not be done at the same time. In many registries case-finding is done first (see Figure 1).

A case-finding list is prepared for each of the data sources in a hospital. This list should indicate the patient's name, age, sex, hospital case number, address (if available), date of diagnosis and result of examination. The list is arranged alphabetically for easier matching prior to abstracting. An example of a case-finding list is given in Figure 2.

The next step is to abstract the medical records and combine the information gathered from the different data sources in a hospital.

It is recommended that each registry have a written log or tracking system so that registry or supervisory personnel can see at any time which potential sources of cases have been covered and when. An example is given in the general case-finding form (Figure 3) which indicates the hospital and year, and the date case-finding was started and finished for each of the different data sources in a given hospital.

3.1.2 Sources of cases

The main sources of information on cancer cases are hospital and pathology laboratory records and, where available, death certificates. However, a population-based registry may cover private clinics, general practitioners, coroners, hospices, health insurance systems, screening programmes to ensure completeness of data collection.

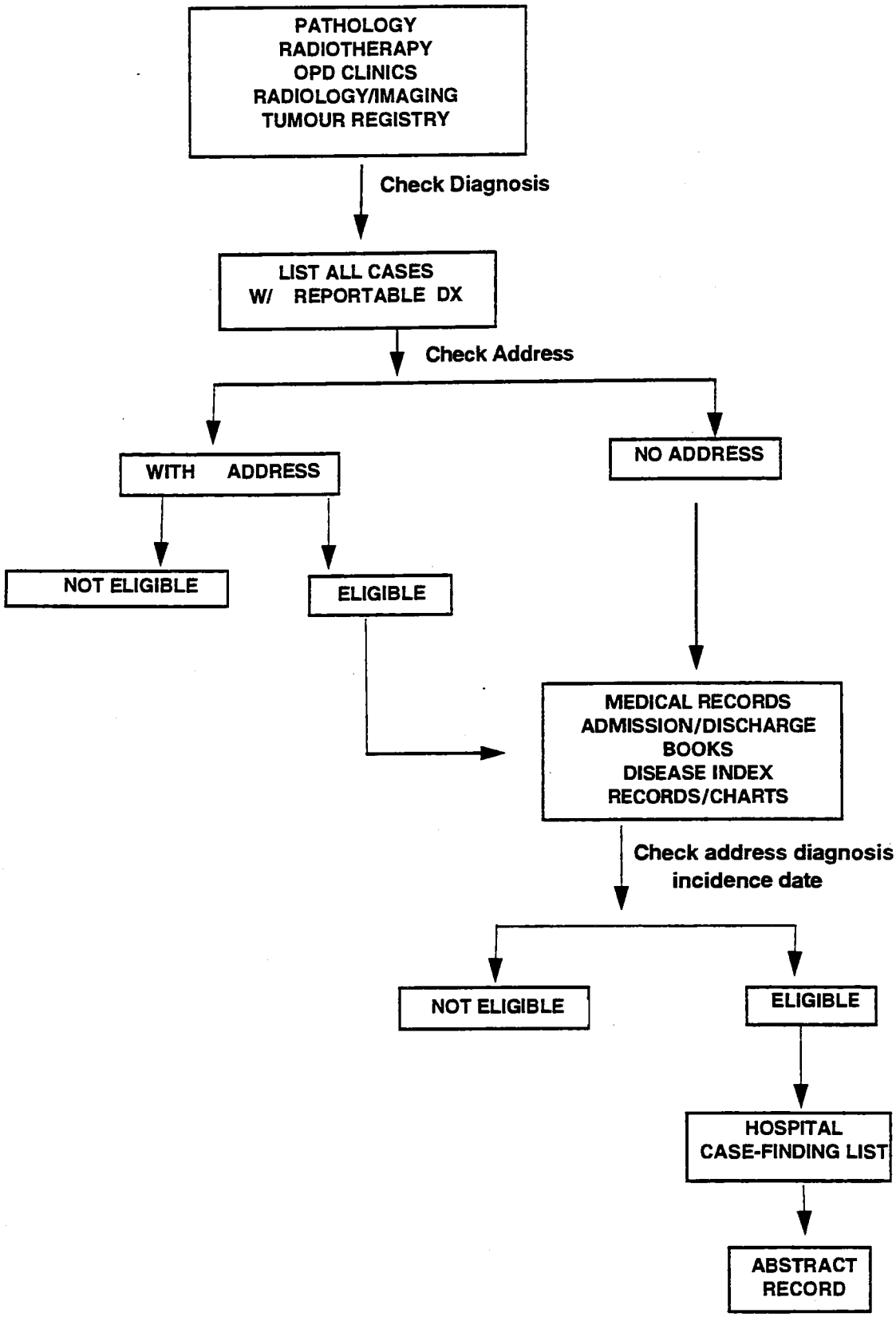


Figure 1. Flow chart for casefinding in hospitals

Department of Health – Rizal Cancer Registry, Rizal Medical Center
Pasig, Metro Manila
Hospital: **Source:**

Year:

CASE-FINDING LIST					
Hospital case no.	**Name Last First**	**Age/sex**	**Address**	**Date admiss. or dx**	**Diagnosis/ Result**

Prepared by: **Date**

Figure 2. Example of a case-finding list

In the hospital, case-finding involves a careful monitoring of the records kept by the different services and departments which deal with cancer patients. These include the medical records department; outpatient clinics; pathology and haematology laboratories; radiotherapy units, radiology, ultrasonography, nuclear medicine, computerized tomography and magnetic resonance imaging, and any hospital tumour registry. Record keeping may vary from hospital to hospital,and it is important that cancer registry personnel looking for cases be acquainted with the system of record keeping used in the different hospitals.

If death certificates are available, these are an important source of cases. Whenever possible, the original death certificates should be consulted. Malignant cancers mentioned anywhere in the death certificate should be identified and abstracted (see Section 3.3.10).

Question:

What are the data sources in a hospital?

Answer:

The data sources in a hospital are:

(a) *Medical records:*

- inpatient records:
  - admission and discharge books/ records
  - medical record disease index
- outpatient records:
  - general outpatient records
  - special clinics

Examples of specialized outpatient clinics are:

medical oncology, gynaecological oncology, haematology, urology, eye, ear, nose, throat, breast, dermatology, endoscopy

(b) *Pathology records:*

- surgical pathology and haematology reports/logbooks
- autopsy reports/logbooks
- cytology reports/logbooks

(c) *Radiotherapy records/logs*

(d) *Radiology, ultrasonography, nuclear medicine, computerized tomography and magnetic resonance imaging logs/reports*

(e) *Hospital tumour registry*

Each registry should have written procedures and instructions for carrying out complete case-finding.

3.1.3 Steps in case-finding in the different hospital data sources

(1) *Medical records*

The inpatient medical records may or may not be kept separately from those of outpatients. The cancer registry personnel should be acquainted with the system used in a given hospital.

(a) Inpatient medical records

Case-finding in the inpatient medical records is carried out mainly by reviewing the admission and discharge records as well as the medical record disease index or any index which might exist.

(i) *Admission and discharge records*: The list of patients admitted and discharged in each hospital covered by the registry should be reviewed. The cases with reportable diagnoses **who are residents of the catchment area of the registry** should be identified.

In some hospitals, the lists of admissions and discharges are kept together in a single logbook. This list gives the patient's name, age, sex, case number, dates of admission and discharge, diagnosis on admission and final diagnosis. The address may or may not be included. In some hospitals, these may be in card files or nowadays in a computer file. If the address is not given, list all cases with reportable diagnoses.

In some hospitals, the list of admissions and that of the daily discharges are kept separately. Be sure to review both lists.

Looking at the admissions and discharges in a given hospital will ensure the collection of most cases, including those which were clinically diagnosed (no histopathological or cytological examinations) and those which were diagnosed histologically elsewhere, and for which there is no record in the pathology department. If there is a

discrepancy between the diagnosis on admission and that on discharge, the discharge diagnosis is preferred.

Vague or ambiguous terms may sometimes be used by physicians to describe a tumour when its behaviour is uncertain, especially when there is no histological diagnosis. The terms subject to doubt will vary from country to country, and each registry should define its own rules.

For example, the following terms used in one country indicate that the tumour is reportable:

- apparently (malignant)
- presumed (malignant)
- compatible with (malignancy)
- probable (malignancy)
- consistent with (malignancy)
- suspect or suspected (malignancy)
- favour (a malignancy)
- suspicious (of malignancy)
- most likely (malignant)
- typical (of/for malignancy)

The terms below would indicate that the tumour is **not reportable**:

- "approaching"
- "rule out"
- "equivocal"
- "suggests"
- "possible"
- "very close to"
- "questionable"
- "worrisome"

In cases where the diagnosis remains doubtful, the details of the case should be abstracted but kept in a holding file (see Chapter 5).

(ii) *Review of the medical record disease index*: The cancer registry personnel should be acquainted with the system used by the medical records department in keeping its disease index. In most hospitals the disease index is arranged according to the International Classification of Diseases (ICD) code numbers. For some smaller hospitals these may not be available. The case-finder should have a list of the codes which are reportable to the registry. For the sake of simplicity, this manual refers to the ICD. If a different system is used in a given hospital, the abstractor should be familiar with that system.

The cancer registry personnel should also be acquainted with the system used by the medical records in a given hospital to assign hospital case numbers. Some hospitals assign a case number each time a patient is admitted (**serial numbering system**). Others assign the patient a number which stays with that patient for all admissions (**unit numbering system**).

The numbering system can influence case-finding procedures, especially if matching of patients is being attempted by matching medical record numbers instead of names.

The medical record disease index gives the patient's name, age, sex, hospital case number, and diagnosis (usually in ICD codes). Usually the address is not given. All reportable cases encountered in the index should be listed. The main aim of reviewing the medical record disease index is to ensure completeness of case-finding.

IN SOME HOSPITALS, HOWEVER, THE DISEASE INDEX MAY BE INCOMPLETE AND NEED UPDATING, SO IT IS IMPORTANT TO COVER ALL AVAILABLE DATA SOURCES IN THE HOSPITAL IN ORDER TO ACHIEVE COMPLETE REGISTRATION.

(b) Outpatient medical records

The cancer registry personnel doing case-finding should know the different areas where cancer patients are seen in an outpatient setting. The outpatient clinic personnel can show the case-finder new logbooks or patient appointment listings which identify new patients.

In the general outpatient medical records, the outpatient logbooks should be reviewed. These give information on the name, age, sex, case number, date of consultation, and

diagnosis. Because of the bulk of patients seen in the outpatient department, identification of new patients may pose some problems. As a solution, one may ask the outpatient clinic personnel to flag new cases for easier identification. However, since many hospitals can be covered by the population-based registry, this is not always possible.

In some hospitals, especially in tertiary hospitals and medical centres, cancer patients may be seen under some specialized clinics on an outpatient basis. These specialized clinics include the following: medical oncology, gynaecological oncology, haematology, urology, ENT, dermatology, breast and endoscopy clinics. The cancer registry personnel in charge of case-finding should know where these specialized clinics are and how the records are kept to ensure complete coverage.

(2) Pathology records

These include histology, cytology, haematology, bone marrow examination and autopsy findings. Since such examinations are done for the majority of suspected cancer cases, a high percentage of reportable cases will be found by reviewing those from the pathology department with a diagnosis of cancer.

(a) Surgical pathology reports and logs

The pathology reports and logbooks (records) in the pathology department are usually filed numerically by accession number and the year of examination is usually indicated. All pathology reports should be reviewed, making sure that all accession numbers are accounted for. This is the preferred method of case-finding.

Pathology results may be sent by the pathology secretaries to the cancer registry office. If this method is used for case-finding, there should be a system which will allow for checking of completeness. This may be done, for example, by random checking of the pathology reports and logbooks in the hospital, to determine if there are any reportable cases for which pathology reports were not sent to the registry office. Quality control procedures in cancer reporting systems have demonstrated that pathology reports do not always reach the registry, for various reasons, hence the need for checking for completeness.

(b) Autopsy reports and logbooks

Autopsy reports, just like surgical pathology reports, are filed numerically by accession number. In reviewing the reports as well as the autopsy logbooks, make sure that all accession numbers are accounted for.

Review all the diagnoses recorded, not only those which caused death. Malignancies not suspected during life (occult) may be found on autopsy.

Two types of report are usually made following autopsy:

(i) the provisional anatomical diagnosis (PAD), based on the gross autopsy findings; and

(ii) the final anatomical diagnosis (FAD), based on microscopic examinations; this takes precedence over the provisional anatomical diagnosis.

(c) Haematology reports and logbooks

Haematology reports include peripheral smears and bone marrow aspiration and/or biopsy results. The peripheral smears and the bone marrow aspiration reports and logbooks are kept separately.

In most hospitals, the haematology reports are filed separately from the surgical pathology reports. In some hospitals, however, these may be interfiled with the pathology reports. Make sure that they are all included in the case-finding.

Review of the peripheral smears will ensure collection of leukaemia and lymphoma cases which have not undergone bone marrow aspiration and/or biopsy.

We would like to stress that the registry personnel are not expected to review all complete blood count reports in each hospital since this is a

routine procedure done for many conditions other than cancer. Only the reports for patients who are suspected of or diagnosed with leukaemia and other haematological malignancies should be reviewed. There must be a mechanism for the laboratory to identify such cases. The laboratory may be requested to flag them for easier identification.

(d) Cytology reports

Review all cytology reports. All cases with a diagnosis of suspicious or fairly conclusive or positive for malignancy should be identified and included in the Case-finding List from cytology. A class III or 'suspicious' cytology report, however, is not diagnostic of cancer. Unless supported by a positive biopsy (as reported on a pathology report) or by a clinical impression of cancer these need not be included.

Classification systems for cytology vary between areas. The case-finder should familiarize himself/herself with the classification system used.

Some pathologists keep a written log in which they briefly record whether each specimen turned out to be positive or negative for malignant cells. If this is available, case collection will be easier since it will not then be necessary to review all the cytology reports.

(3) Radiotherapy records

Any written list of new patients undergoing radiotherapy should be reviewed and used as a case identification source. Almost all cases are cancer. This is the preferred method of case-finding in the radiotherapy department.

Radiotherapy personnel may send a radiation therapy summary to the registry. If this method is used for case identification, there should be a quality control mechanism to allow for checking of completeness as the summaries may not reach the registry for various reasons.

(4) Nuclear medicine records

Patients who are treated with radioisotope by the nuclear medicine personnel should be identified and listed since they are not seen in the radiotherapy department.

The nuclear medicine section also maintains a log of patients who underwent radioisotopic scans. This should be reviewed and used as a source for finding possible cases.

(5) Radiology, ultrasonography and computerized tomography records

The radiology department maintains a log of patients who underwent radiological examinations. This is chronologically arranged, based on the date of the examination. This logbook as well as the radiology reports should be reviewed to identify reportable cases.

The ultrasonography section as well as the computerized tomography section maintain their own logs of patients, similarly arranged. These should all be reviewed and used as a case identification source.

(6) Hospital tumour registry

A hospital tumour registry (HTR) is primarily oriented towards administrative concerns and patient treatment and as such collects data which are different from those of a population-based registry. It also collects data items which are of use to the population-based registry, and when available the hospital tumour registry is a very important source of information. To complete case-finding, the hospital tumour registry cases should be reviewed, matching them with the cases gathered from other data sources within the hospital and paying special attention to patient identification data items (name, age, sex, address, hospital case number), as well as diagnosis and basis of diagnosis. Reportable cases occurring among residents of the population-based cancer registry's catchment area (as well as those for cross referral to other registries) should be identified. Cases missed in the previous data sources should be included in the Case-finding List.

THE HOSPITAL TUMOUR REGISTRY SHOULD NOT BE USED AS THE ONLY SOURCE OF CASE IDENTIFICATION, as not all cases will be included. Cases not included in a hospital tumour registry are:

(a) "Pathology only" cases

These are cases in which the surgical or cytological specimens are sent in from an outside source (government or private physician, clinic, or hospital) to a given hospital's pathology

department for processing and interpretation. Since the cases are not seen in the given hospital and no medical record exists there, they will not be included in the hospital tumour registry. They should, however, be included in the population-based registry, if the patients' addresses are within the catchment area of the population-based registry. Patients with no address must also be included in the Case-finding List, so that they can be linked later with Case-finding Lists from other data sources.

(b) "Consult only" cases

These are of three types, namely:

(i) patients seen as out- or inpatients who are seeking a second opinion as to their condition or treatment;

(ii) a pathologist from one hospital may send slides to a pathologist in another hospital for opinion or consultation;

(iii) patients who are travelling or vacationing in an area away from home, are taken ill and seen in a given hospital briefly, may not be entered into the registry.

(c) "Tumour board only" cases

A case may be discussed by a multidisciplinary committee (tumour board) in a hospital while not being diagnosed or treated at that hospital and therefore the case may not be entered in that hospital's tumour registry. However, if the patient is a resident of the catchment area of the population-based registry, the case should be included in the Case-finding List.

3.1.4 Cases from other sources

(1) The death certificate

The quality of the certification of cause of death varies from one country to another, especially in developing countries. However, if death certification exists, a review of the death certificates within the catchment area of the registry must be carried out to ensure complete data collection. Death certificates may be reviewed, for example, at the office of the local civil registrar of the municipalities or cities covered by the registry. Photocopies or duplicates of the death certificates may be furnished by the registrars to the registry. Ideally the original death certificates should be reviewed whenever possible. Copies sent to the registry may sometimes get lost along the way. Cases where cancer is mentioned anywhere on the death certificate, either as an immediate, antecedent, underlying or contributory cause of death, should be identified and included in the registry.

(2) Other sources

The registry personnel should be aware of administrative structures, such as social security health coverage, or special programmes, e.g. screening, which could be used as a potential source of cases in the area. It is important that all possible sources of information are examined regularly.

3.2 Finding the information on the cases

After identifying all the cases with a reportable diagnosis in a given hospital, the cancer registry personnel are ready to abstract details from the medical records. This means reviewing the medical record, checking items such as address and diagnosis, and noting pertinent information. These details are recorded on a Registry Abstract Form (Figure 4), either at the back of the form or, if there is not enough space, on an extra sheet stapled to the Registry Abstract Form.

To be able to find the relevant information, the cancer registry personnel must be acquainted with the composition of a medical record and how it is organized. Some medical records or charts are very simple, with only a few pages; others may be extremely complex, with many reports or notes, often handwritten with varying degrees of legibility. Because of the difficulty in deciphering a physician's handwriting, it is imperative to master medical terminology to the best of one's ability, keeping in mind root words and the use of the medical dictionary. If necessary, the medical consultant of the registry should be approached for assistance. Although medical records in different hospitals may not be organized in the same manner, medical records have certain characteristics in common. Be familiar with these characteristics.

Department of Health – Rizal Cancer Registry, Rizal Medical Center
Pasig, Metro Manila

GENERAL CASE-FINDING

Hospital:

Date started	Sources of case-finding	Date finished	Remarks
	Autopsy		
	Cytology		
	Surgical pathology		
	Haematology: Bone marrow		
	Peripheral smear		
	Oncology		
	Radiotherapy		
	Radiology		
	Ultrasonography		
	Computerized tomography		
	Nuclear medicine		
	Medical records: Inpatient		
	Outpatient		
	Hospital Tumour Registry		

Prepared by: **Date**

Figure 3. Example log/tracking system

Department of Health – Rizal Cancer Registry, Rizal Medical Center

Pasig, Metro Manila

Hospital: **Source:**

Year:

Prepared by: **Date**

POPULATION-BASED REGISTRY FORM 1				
(2)	PATIENT REGISTRY NO.			☐☐☐☐☐☐
(20)	MULTIPLE PRIMARIES			☐
	1 First primary			
	2 2nd primary			
	3 3rd primary etc.			
(79)	NAME OF HOSPITAL			☐☐
(14)	HOSPITAL CASE NO.			☐☐☐☐☐☐
(4)	NAME OF PATIENT	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐		
	Last name	First name	Middle name	
	FOR MARRIED WOMEN:	Maiden name		
		Husband		
(5)	Sex 1 Male	2 Female	9 Not stated	
(9)	MARITAL STATUS			
	1 Never married			
	2 Married			
	3 Widowed			
	4 Separated/divorced			
	9 NS			☐☐
(11)	AGE (at incidence date)			☐☐
(8)	PERMANENT ADDRESS (See separate code)*			
	YEARS (Actual number)			
	00 Less than 1 year			
	99 Not stated			
	CITY ADDRESS:			
(6)	DATE OF BIRTH			☐☐☐☐☐☐ Day Mo. Yr.
(11)	PLACE OF BIRTH (see separate code)*			☐☐
(54)	RACIAL GROUP (see separate code)* 0 Not stated 1 Stated		Information specifically stated	☐

* These data items are listed in the form of a 'dictionary' and assigned codes by the registry

Figure 4. Example of a registry abstract form

(54.2)	DIALECT GROUP	☐☐
(13)	INCIDENCE DATE	☐☐☐☐☐☐ Day Mo. Yr.
	MOST VALID BASIS OF DIAGNOSIS	☐
	NON-MICROSCOPIC	MICROSCOPIC
	1 Clinical only	5 Cytology
	2 Clinical investigations	6 Histology of metastasis
	3 Exploratory surgery/autopsy	7 Histology of primary
	4 Specific biochemical and/or immunological tests	8 Autopsy with concurrent or previous histology
(18)	PRIMARY SITE (TOPOGRAPHY)	☐☐☐☐
(19)	HISTOLOGICAL TYPE (MORPHOLOGY)	☐☐☐☐☐☐
(23)	FINAL DESCRIPTION OF EXTENT OF DISEASE (AFTER SURGERY/AUTOPSY)	
	1 In Situ 2 Localized 3 Direct extension 4 Regional lymph node involvement 5 3 + 4	6 Distant metastasis 8 Not applicable (for sites other than breast, lung & cervix & for cases diagnosed clinically) 9 Unknown ☐
(24)	PRESENT STATUS	☐
	1 Alive	
	2 Dead	
(26)	CAUSE OF DEATH	☐☐☐☐
	a.	
	b. or c	☐☐☐☐
(25)	DATE OF DEATH	Day Mo. Yr.
		☐☐☐☐☐☐
(27)	RESULT OF AUTOPSY	
	0 Unknown if autopsy done	6 Case found at autopsy ☐
	1 No autopsy	7 Diagnosis not confirmed
	2 No residual tumour	8 Autopsy done, result unknown
	3 Primary site revised	9 Not applicable
	4 Morphology revised	
	5 Diagnosis confirmed	
(83)	PLACE OF DEATH	
	Hospital	
	Home	
	SOURCE OF DATA	
	1 Hospital	☐☐
	2 Death certificate (LCR)	☐

Reported by ---------- Date of reporting

Figure 4 (contd)

3.2.1 The medical record: organization and composition

Each hospital has its own procedures for organizing a medical record. Most of the time, this is done by the medical records department. Usually, the record is organized by temporal sequence of events, the latest admission being located at the front. After the patient is discharged from the hospital, the attending physician prepares a narrative discharge summary of the diagnosis and treatment of the patient and this is inserted at the front of the medical record. This summary should be used as a guide to ensure that no reports have been overlooked. However, the cancer registry personnel should abstract directly from the actual reports in the patient's record and not from the discharge summary. Usually the medical record has a face or cover sheet (normally the first page) which contains the diagnosis on admission and the final diagnosis.

(1) Composition of a medical record

The following is a list of specific types of information contained in most medical records. The information will not necessarily appear in this order.

(a) Patient identification:

Full name

Hospital case number

Address and identification number (if any, e.g. social security number)

(b) Referral information:

Name

Address of referring physician/department of hospital where patient was previously seen

(c) Biographical information:

Sex

Age at diagnosis

Birthdate

Place of birth

Race/nationality/ethnic group

Dialect

Marital status

Occupation

(d) Medical history:

Chief complaint

History of the present illness:

Date of onset

Description of symptoms

Duration of symptoms

Previous medical history:

Previous illnesses and hospitalization (including date and place)

Previous diagnosis of this neoplasm

Previous treatment of this neoplasm

Family history: history of cancer in the family

Personal and social history: include medically relevant social history such as smoking, drinking, drug habits, exposures to carcinogens

(e) Physical examination (PE):

General survey (general description of patient by physician)

Head, eyes, ears, nose and sinuses, mouth and throat, neck

Chest and lungs

Heart and cardiovascular system

Breast

Abdomen

Lymph nodes

Pelvic examination

Rectal examination

Extremities

Neurological examination

(f) Provisional diagnosis (admitting impression)

(g) Special examinations:

Radiological examinations (diagnostic X-rays)

Electrocardiogram

Ultrasonography

Diagnostic nuclear examination (scans)

Computerized tomography (CT scans)

Laboratory examinations:

Haematological examinations

Blood chemistry examinations

Serology

Bacterial cultures

Urinalysis

Faecal examination

Tumour markers

(h) *Consultation/referral reports*

(i) *Endoscopic examinations*

(j) *Operative record:*

Procedure

Findings (location, size, extent of spread)

(k) *Pathology reports:*

Cytology and haematology

Tissue examinations:

Gross (description based on visual examination)

Microscopic (description based on histological examination)

Pathological diagnosis (determining the disease)

(l) *Final diagnosis*

The diagnosis made after all routine and special studies have been completed.

(m) *Treatment reports:*

Medication record (drugs and medications)

Radiation therapy

Chemotherapy

Hormone therapy

Immunotherapy

Physical therapy (physiotherapy)

(n) *Progress notes*

Day-to-day notes on the progress of the patient made by the attending physician.

(o) *Doctors' orders and notes*

(p) *Nurses' notes*

(q) *Discharge summary or case summary*

(r) *Follow–up reports:*

Progress notes added after the patient has been discharged from hospital:

(i) based on patient's return visits to the outpatient department,

(ii) based on replies to correspondence with the patient's physician, other tumour registrars, other medical facilities, the patient or his family.

(s) *Autopsy report:*

Provisional anatomical diagnosis (gross)

Final anatomical diagnosis (microscopic)

This information can be of particular value in indicating the primary site which may have been incorrectly diagnosed or unknown prior to autopsy.

(t) *Death certificate (when the patient dies in hospital or when the death certificate is obtained through follow–up)*

This may be the civil death certificate or the certificate completed by the hospital.

(2) *Forms used to record information in a medical record*

The following is a list of most forms, records, notes and summary sheets which may be found in a hospital's medical record. Their names are self–explanatory.

(a) ***List of forms with relevant information for completing the abstract:***

- Admission sheet
- Autopsy
  (necropsy or post-mortem report)
- Chemotherapy report
- Consultation report
  (request for opinion or aid from other physicians or departments)
- Cytology report
- Death certificate
- Diagnostic radiology (X–ray reports)
- Discharge (narrative) summary
- Doctor's order sheet/prescription sheet
- Doctor's progress notes
- Endoscopy report
- Haematology reports
- Laboratory reports
- Medical record data sheet (face or cover sheet)
- Medication record

- Nuclear medicine (diagnostic imaging/scans)
- Nuclear medicine report (radioisotope treatment report)
- Outpatient clinic record (Protocol study report)
- Pathology (histology) report
- Radiation therapy summary
- Referral letters (from local physicians and other institutions)

(b) ***List of forms not likely to contain relevant information for completing abstract:***

- Anaesthesia record
- Electrocardiogram report
- Electroencephalogram (ECG) report
- Emergency (accident) room report
- Graphic reports (temperature, pulse, respiration, blood pressure)
- Informed consent to treatment
- Intake–output chart (measured liquids)
- Nurses' notes
- Physical therapy report
- Recovery (post–anaesthesia room report)
- Request to blood bank
- Serology report

3.2.2 Abstracting the medical record

(1) What cases to abstract

(a) The reportable list: Each registry or registry system, in cooperation with the cancer committee, must develop a list of diagnoses to be included in the registry (for the reportable diagnoses which may be included in the list, see Section 3.1 and example list in Appendix 3.1).

Before abstracting a case of cancer, the clerk should check:

- Is the diagnosis reportable?
- When was the incidence date?
- Did the incidence date occur on or after the reference date of the registry (the date the registry began collecting data on cancer)?

If the case qualifies for registration, the patient's medical record should be abstracted.

Cases diagnosed as cancer by a physician, surgeon or dentist, even when not histologically confirmed, should be abstracted.

In the course of abstracting, one may encounter ambiguous or vague terminology describing a tumour, when its behaviour is uncertain. Refer to Section 3.1.3 for guidance.

(b) Multiple primaries: Since cancer patients can develop other cancers in their lifetime, multiple tumours occuring in the same patient may pose a problem in cancer registration.

- Is the new lesion another cancer occurring in the same individual?
- Is the new lesion an extension of the same cancer? Is it a metastasis?
- Is this a recurrence or new manifestation of a single cancer, probably following earlier treatment

In dealing with this problem, each registry may have its own definition. A simple set of recommended definitions for deciding whether more than one tumour in an individual are multiple primaries or not is given in Section 4.2.

For most multiple primary tumours, each unrelated cancer is abstracted on a separate form. The registry number for multiple neoplasms (see example abstract form, Figure 4) remains the same but a higher sequence number is assigned for each new primary cancer. The sequence number indicates the order in which a primary malignancy is discovered in relation to the total number of primaries for a given patient.

While it is ideal to abstract the medical record after the first course of therapy is completed and all the pertinent reports are filed, this may not be very practical for population–based registries in developing countries. Record keeping varies in different hospitals. Thus, for registries actively collecting data from several hospitals, it may be advisable to initiate abstracting as

soon as the chart (medical record) is available. However it may be necessary to review the patient's medical record at a later date to complete the abstract. All pertinent information gathered from the different data sources in the hospital should be incorporated in the abstract. While awaiting completion, the abstract may be kept in a 'suspense file' (holding or query file, see Chapter 5).

For patients who have died, it is necessary to incorporate the results of the autopsy (if there is one) to verify the diagnosis.

(2) *What information to abstract*

The items of information to be collected by a registry will depend on the function and scope of the registry, the availability of sources and the method of data collection. These items are usually incorporated in the Registry Abstract Form (see Figure 4).

(a) Personal identification: The cancer registry should have sufficient identifying information to ensure that an individual who has been registered previously will be recognized as the same person, should he or she be reported again to the registry. This is very important, and prevents multiple registration of the same case. The specific items that contribute to personal identification may vary from one country to another. Some countries use identification numbers or social security numbers while others do not. Useful items include name(s), date of birth and/or age and sex.

(b) Description of the tumour: This includes the anatomical site (topography) and the histology (morphology) including behaviour. Histological proof of diagnosis (pathology reports) is the the most valid basis for diagnosis and for the extent of the disease.

(c) Items of information which may be collected

(i) The person (see Section 3.3.1):

Identification:

Hospital case/record number
Personal identification number
Name(s)
Sex
Date of birth/age
Nationality
Ethnic group

Demographic and cultural:

Address
Place of birth
Marital status
Age at incidence date
Religion
Occupation

(ii) The tumour and its investigations:

Incidence date (see Section 3.3.2)
Most valid basis of diagnosis of cancer (see 3.3.3)
Method of first detection (see 3.3.4)
Primary site (topography) (see 3.3.5)
Histological type (morphology) (see 3.3.5)
Behaviour (see 3.3.5)
Pretreatment extent of disease (see 3.3.5)
Surgical/Pathological extent of disease (see 3.3.5)
Multiple primaries (see 3.3.5)
Site(s) of metastasis (see 3.3.6)

(iii) Treatment:

Initial treatment

(iv) Outcome/follow-up:

Date of last contact
Status at last contact
Date of death
Cause of death (ICD-9/ICD-10)
Place of death:

(v) Sources of information

Hospital	Date	Record number
Laboratory	Date	Record number
Primary care		Physician's name

3.3 Abstracting

The tumour registrar should be able to understand the events leading to the diagnosis of a malignancy, from the clinical history and physical examination to the various laboratory examinations and procedures undertaken to confirm the clinical impression and to determine the precise nature of the disease. Findings of these examinations will appear on pathology, cytology, X–ray, scan, endoscopic, operative or other laboratory reports, all of which are filed in the patient's medical record. Learn to recognize these relevant reports and how to abstract the diagnostic findings which form the basis of diagnosis of cancer. These are also important in determining the extent of disease.

Actual recording should be done directly onto the Registry Abstract Form, particularly the 'basis of diagnosis' and 'methods of detection'.

Definitions of the items of patient information to be collected by the cancer registry are given below, including their relevance, the problems that may be encountered and how to solve them. Although coding is an in–put procedure, the coding schemes as well as the recommended codes for these items are given in this section. Coding of neoplasms is a more complex matter and will be discussed further in the section on Coding (Chapter 4).

3.3.1 Patient identification

As a first step, a unique number must be assigned by the registry to the patient to permit subsequent identification of the case.

(1) Patient registry number (PRN)

A unique number assigned by the registry to each patient. This number is written on all documents and items of information relating to the patient. The first two digits of the PRN are usually those of the year the patient was registered. Example:

– 95 – 0001 is the PRN assigned to the first patient registered in 1995.

(2) Name

Whenever possible, give the full name of the patient, written down as follows: last name, first name, middle name or maiden name (name at birth). Very often, the middle or maiden name may be given only as an initial and should be so recorded. If the names of the parents are important and are given, include these in the abstract.

For male patients who are Sr., Jr., III, etc. indicate so following the last name. If it is known that the patient has a graduate professional degree (MD, DDS, etc.) indicate so after the last name. Example:

– de la Cruz, Jr., MD; Juan S.

Certain problems will be specific to differing local conditions. For example, in a Catholic country where monks and nuns may change their names and are called Father, Mother, Sister or Brother. In this example, the family name should be used if known, indicating the title Sister, Brother, Father, Mother and name given in religion after the last name. A cross-reference on the master patient index file is necessary to facilitate matching and to avoid duplication. Each registry should produce its own guidelines.

For married women who have taken the name of their husband, the family name of the husband should be used. As a check for this, the patient's maiden name (unmarried name or name at birth) should be indicated under the heading "Maiden name" and the husband's name under the heading "Husband". Cross–reference on the master patient index file whenever there are two names for a married woman.

(3) Identification number

Some countries use a personal identification number which is unique to an individual, e.g. the social security number in the USA, the national identity number in Malaysia and Singapore. If a unique personal identification number exists, this should be included in the patient's files. Abstract in detail the complete number, including any check digits when they exist.

(4) Hospital case number

Record the number assigned to the patient by the hospital admitting office. If the hospital has a unit numbering system, all patient records will carry this number. If the hospital has a serial numbering system, a new number is assigned on each admission to the hospital. If a patient has had several admissions, record the hospital number assigned to the patient at the time the malignancy was first diagnosed.

(5) Permanent address at time of diagnosis

Record the number, street, city or municipality, province and country of the patient's usual residence. This should be distinguished from the patient's temporary address at the time of admission, for example a patient from the country may come to the city for medical treatment and stay temporarily with friends or relatives. His/her address in the country is the permanent address and the address in the city is the temporary or city address. For example, in the Philippines, the permanent address is defined as the place where the patient has been residing for at least a year. The length of time used to define "usual residence" may vary from registry to registry and should be agreed upon in advance.If available, the time the patient has been living at said address should be indicated. Transient residents should not be included in studies of incidence and survival.

(6) Sex

Record whether male, female or not stated. If the sex is not recorded, this may be inferred from the given name and from the wording of the hospital summary. In very rare instances, the sex cannot be determined or there may have been a sex change. This information should be recorded.

(7) Age at incidence date

This refers to the age in years at the incidence date (the date of the first admission or consultation for the cancer in question – see Section 3.3.2 below). Record the patient's age on his/her last birthday; do not round off to the next birthday. If the birthdate is known, check whether the given age is correct or not.

(8) Birthdate

Record the day, month and year of the patient's birth. If the information is not known, record as unknown or not specified.

(9) Place of birth

Record the town and province or country where the patient was born. Place of birth may assist in personal identification. Codes used should conform with those used in local or national statistics institutions.

(10) Racial group

Indicate to which racial group the patient belongs, for example Caucasian, Mongolian, Filipino, Chinese, Japanese.

There may be some problems in classifying individuals of mixed heritage. Record all the details. When abbreviations are used in the medical record, be sure to know exactly what the abbreviations mean. For example:

- Fil. = Filipino.

(11) Dialect group or ethnic group

Record the regional dialect that the patient usually speaks or the ethnic group to which the patient belongs. Certain habits peculiar to specific dialect or ethnic groups may provide clues to cancer atiology. Recording this item would allow comparative studies on cancer incidence to be carried out between ethnic groups.

(12) Marital status

Record whether never married, married, widow/widower, separated/ divorced, or not specified. Do not assume that a person specified as Miss should be classified as single. Often women who have been separated or divorced use their maiden name. Patients with 'common law' marriages should be classified as married.

(13) Occupation and industry

Occupation refers to the kind of work done by an employed person, or, for persons who are retired or currently unemployed, the work carried out previously.

Industry refers to the activity of the establishment in which an economically active person works (or worked).

The Registry may use local coding schemes for occupation. This should allow for the following:

- self-employed individuals: note down their actual job and the corresponding industry
- retired persons: indicate the previous usual job and not the pre-retirement job, e.g. metal welder not night watchman
- married women (at home): note down their previous occupation if any and note down the husband's occupation
- students (full time education)
- members of the armed forces

Collecting information on occupation is frequently difficult for cancer registries. It may not be well recorded in the medical record. Death certificates may be a better source of information for this item.

Record the patient's usual or major occupation as well as industry in which the patient is currently or was previously employed. Also note a secondary occupation if one is indicated in the medical record. Data on occupation are particularly important in determining possible exposures to carcinogens.

(14) Religion

The collection of this item is optional depending on the number of religions, the feasibility of collection and relevance. Religion influences the attitudes of the patient towards acceptance or use of medical services or forms of treatment, for example Jehova's Witnesses are prohibited from receiving blood transfusions.

In a similar manner, religion may affect the patient's lifestyle and exposure to carcinogens, for example certain religions would prohibit eating meat.

3.3.2 Incidence date

Important: This date is used to define the 'anniversary' of a cancer, but unlike a birthday, is not the actual date when the cancer began. This is almost impossible to know, and it is even difficult to know when the cancer was first clearly recognized. It is better to have a reproducible date, readily recognized from the records. Usually, this is the date of first consultation at or admission to a hospital, clinic or institution for the cancer in question, which can be verified from the records. A registry may choose its own incidence date: the important thing is that it be clearly defined and consistently used. The following dates, in order of priority may be used:

(1) **Date of first consultation at, or admission to, a hospital, clinic or institution for the malignancy in question.** If the patient was admitted to a hospital, the incidence date should be the date of admission. If the patient was not admitted, the date of the first consultation for the condition should be the incidence date.

(2) **Date of first diagnosis** of the cancer made by a recognized medical practitioner or dentist. This does not refer to the date of histological confirmation.

(3) **Date of histological confirmation or date of the first pathology report** confirming the presence of cancer.

(4) **Date of death** when the cancer is first ascertained from the death certificate and follow-back attempts have not been successful ("Death Certificate Only" cases, see Section 3.3.3).

(5) **Date of death preceding an autopsy** when the cancer was first diagnosed at autopsy and was not suspected clinically.

If there is a delay between the first consultation and admission to a hospital, the date of first consultation is selected as the incidence date.

If the cancer is diagnosed while the patient is being treated for another condition, whether outpatient or inpatient, the

appropriate incidence date is this date of diagnosis.

Previously diagnosed tumours in persons who move into an area within the catchment area of a population–based registry are not included in computations of incidence.

3.3.3 The most valid basis of diagnosis

The method by which cancer in a patient is confirmed is a gauge of the reliability of the diagnosis. This information is therefore important in assessing the reliability of the data.

The most conclusive method is microscopic examination of tissues, also known as histological confirmation. This may be the initial histology of the primary site or post–mortem examination with concurrent or previous histology. The next most conclusive method of diagnosis is the microscopic analysis of cells, also known as cytological confirmation.

The basis of diagnosis distinguishes tumours which were examined microscopically from those which were not; cytological diagnoses are also distinguished from histological diagnoses, just as histology of the primary tumour is distinguished from histology of a metastatic lesion. Example:

- A biopsy of the lung on bronchoscopy is distinguished from a biopsy of a lymph node metastasis.

Although histological confirmation is the more conclusive method of diagnosis of cancer, cases diagnosed only on the basis of clinical or physical findings are also included in the registry. The medical records should be studied carefully to determine the different methods used to confirm the diagnosis of cancer. The most valid basis of diagnosis or the most conclusive method of confirmation should be noted down on the abstract. If additional information becomes available later, the most valid basis for diagnosis should be updated. Example:

- The record for a patient with an initial diagnosis of breast cancer by mammography would be updated if the diagnosis was later confirmed by histopathology.

The most valid basis of diagnosis should be updated as soon as information is available.

For coding, methods of diagnosis have been divided into two main groups, non–microscopic and microscopic, each consisting of four categories:

Non–microscopic

(1) Clinical only

This includes cases diagnosed by clinical methods such as history and physical examination, without specialized investigations;

(2) Clinical investigation

Diagnosis is arrived at with the aid of specialized examinations, but not confirmed by a positive histology or cytology, or by direct visualization. The examinations in this category include those in Section 2.2.1:

- diagnostic X–ray examinations of all types
- scans
- ultrasound
- thermography
- xeroradiography
- endoscopy

(3) Exploratory surgery/autopsy

This includes diagnoses made during surgical exploration, by direct visualization or palpation or gross autopsy, without any microscopic confirmation.

(4) Specific biochemical and/or immunological tests

Clinical diagnosis of cancer is based on laboratory tests or tumour markers which are clinically diagnostic for cancer (see Section 2.2.1). Examples are:

- Alpha foeto protein (AFP) for liver cancer.
- Beta–subunit of human chorionic gonadotropin (Beta–HCG) for choriocarcinoma.
- Abnormal electrophoretic spike for multiple myeloma.
- Acid phosphatase for prostatic cancer.
- Carcino–embryonic antigen (CEA) for gastrointestinal malignancies.

Microscopic

(5) Cytology or haematology

Cytology: microscopic diagnosis is based on examination of cells rather than tissues. Included in this category

are positive cytological examinations of sputum, cervical and vaginal smears, fine needle aspirations from the breast and other organs, bronchial brushings and washings, tracheal washings, prostatic secretions, gastric, spinal or peritoneal fluid, and urinary sediment. Diagnoses based on paraffin block specimens from concentrated spinal, pleural or peritoneal fluid are also included in this category.

Haematology: the study of cells of the blood or blood-forming tissues, especially the bone marrow, looking for changes in the structure and number of the various types of blood cells, including immature cells. This includes peripheral smears.

(Note: Bone marrow aspiration and/or biopsy findings in leukaemias are included under histology of primary.)

(6) Histology of metastasis

Microscopic diagnosis is based on a tissue specimen taken during biopsy/surgical resection from a secondary or metastatic site. For example:

- Biopsy of a cervical lymph node metastasis in the case of a nasopharyngeal carcinoma.

(7) Histology of primary

Microscopic diagnosis is based on a tissue specimen taken during biopsy/or surgical resection from the site of origin of the tumour (primary site). Examples are:

- Biopsy of the nasopharynx in nasopharyngeal carcinoma.
- Biopsy of the bone marrow in the case of acute lymphocytic leukemia.

(8) Autopsy with concurrent or previous histology

This includes autopsy findings with post-mortem histological diagnosis or cases with previous histological diagnosis confirmed at autopsy.

In the interpretation and subsequent coding of autopsy findings one must distinguish the following: (a) autopsy report with post-mortem histological diagnosis; (b) autopsy is gross only, histological examination carried out during life, and (c) the autopsy findings are not supported by any histological confirmation.

(9) Unknown

The basis for diagnosis of cancer is not specified and it is not known whether the case is microscopically confirmed or not. This includes cases undergoing radiotherapy in radiotherapy clinics, with very little or no information available on the method used to establish the diagnosis. It also includes cases diagnosed in other hospitals or institutions.

(10) Death certificate only

Cases registered for which the only available information on cancer was on a death certificate, and where follow-back attempts have been unsuccessful. This category does not include cases first coming to the registry's attention by means of a death certificate mentioning cancer (see Section 3.3.4) for which other bases of diagnosis became available.

In abstracting the most valid basis of diagnosis of cancer, always record the following basic information:

- the name of the examination or procedure,
- the date the examination or procedure was carried out, and
- the result of the examination or procedure, indicating the pertinent information; if the result is negative, this should be recorded (e.g., gastroscopy, 24 November 1986 – negative).

Record any procedure mentioned in the medical record, even if this was carried out in a previous hospitalization, if this is the basis for diagnosis. Record these at the back of the abstract. A section for notes or comments should be available for the summary of actual procedures.

3.3.4 Methods of first detection

The methods of first detection are the means by which the case has come to medical attention. The methods by which cancer

cases are detected in a population may influence incidence rates. Screening programmes, such as a cytology screening programme, may detect precancerous lesions which when treated early and adequately will no longer progress to invasive cancer. Autopsy examinations may discover that cancer was present in a patient who died of some other disease. These are called 'latent cancers', and if they are included in the statistics in the same way as cases found during the patient's lifetime, they can influence the 'incidence' of that cancer.

The percentage of cases which first comes to the attention of the registry through a death certificate mentioning cancer can be useful in assessing the adequacy of case-finding. This represents the percentage of cases which were missed during the initial case-finding and abstracting activities of the registry staff. For rapidly fatal diseases, the proportion may be quite high but for diseases with a longer duration it should be small.

The suggested codes are:

1 Screening examination
2 Incidental finding (on examination, at surgery)
3 Clinical presentation (with symptoms)
4 Autopsy (incidental finding at autopsy)
5 Death Certificates
8 Other
9 Unknown

3.3.5 Diagnosis (see also Section 3.3.9)

The most basic and most important item of medical information collected in a population-based registry is the diagnosis of cancer. As there are many types of cancer, statements used by physicians to describe a specific diagnosis will vary considerably, but will generally include two components: (1) the anatomical location of the tumour, also known as its site or topography, and (2) the appearance of the tumour when examined under microscope, also known as its histology or morphology.

The morphological terms on their own often indicate the tumour's behaviour. Examples are:

- Fibroma, which is a benign tumour.
- Sarcoma, always malignant in behaviour.
- Squamous cell carcinoma in situ of the cervix uteri, which is a complete diagnostic statement specifying the tumour's site (cervix uteri), its morphology (squamous cell carcinoma) and its behaviour (in situ).

The abstractor should carefully review all reports contained in the clinical record and note all details relating to the tumour's site and its morphology/behaviour.

The aim of a cancer registry is to register all new primary malignant tumours. For this reason it is important to identify the site in which the tumour originated. The primary site may at times be determined by a pathologist reviewing tissue from a secondary site. Example:

- It is possible to diagnose primary carcinoma of lung from excision and microscopic review of mediastinal lymph nodes.

It is also possible to deduce a primary site from the determination of a specific morphology. Example:

- A nodular melanoma of the neck indicates a malignancy of the skin of the neck.

It should be noted that sites such as 'head', 'thorax', 'limb', 'pelvis', 'abdomen' are poor descriptors of site, since a tumour may arise in a number of tissues (skin, soft tissue and bone) within these sites. For this reason, it is important to extract all the diagnostic information available in the record.

If there is no mention of the primary site in the record, but a secondary site(s) has been identified, note all available information regarding the secondary site(s). The information on the primary site may be added at a later date if it becomes available. Similarly if the histological diagnosis is stated using only non-specific terms such as 'malignant neoplasm', 'cancer' or 'malignant tumour', abstract these terms until more detailed information becomes available.

In abstracting histology, record the complete histological diagnosis as stated in the pathology report's Final Diagnosis. Do not modify the pathologist's final diagnosis by picking up descriptive terms found in the microscopic description of the tissue. Example:

- A final pathological diagnosis of adenocarcinoma may be described as mucin producing in the body of the report but the final abstracted morphological diagnosis remains adenocarcinoma.

If conflicting statements exist regarding the diagnosis, prefer statements from the pathology reports over other statements.

It is quite possible for one person to develop more than one primary tumour during his lifetime. (This is commonly called multiple primary and is discussed in detail in Chapter 4). If this is noted on the patient's medical record, then a separate abstract should be prepared for each new primary tumour.

In addition to a description of the site, and morphology/behaviour of a tumour, it is useful to assess the extent of involvement of the tumour throughout the body. This is tumour staging and is discussed in detail in Chapter 4.

Differentiation refers to the histological grading or the degree or extent to which neoplastic cells have the specific characteristics of a particular tissue or organ. Histological grading ranges from well differentiated to the anaplastic or undifferentiated type.

3.3.6 Sites of metastasis

Metastasis is the spread of tumour cells in a discontinuous fashion, from the primary site to other organs of the body, via the blood stream or through the lymphatic system.

This item is a low-priority item for population-based registries. However, for those who want to collect information on the site(s) of metastasis, a simple one digit code is suggested:

0	None	5	Brain
1	Distant lymph nodes	6	Ovary
2	Bone	7	Skin
3	Liver	8	Other
4	Lung/Pleura	9	Unknown

Several may be possible in the same patient and one can assign three or more per patient, in sequence; for example:

the first metastatic site was to a distant lymph node, the second metastatic site was to the lung, the third metastatic site was to the liver, the fourth metastatic site was brain.

This may be recorded as follows:

Site(s) of metastasis

1	4	3	5

The Registry personnel may record information on metastasis at the back of the abstract or in the space allocated for notes. This information may be gathered from the results of diagnostic procedures performed, from the operative record or from the pathological reports.

3.3.7 Treatment

Treatment is the therapy given by the reporting hospital, and/or other associated hospitals.

Definitive treatment is a specific therapy which modifies, controls, removes or destroys cancer tissues, both at the primary and at any metastatic sites. It is classified as definitive therapy even if it cannot be considered curative for a particular patient because of the extent of the disease, incompleteness of treatment or lack of apparent response.

Initial treatment describes the definitive cancer-directed therapy given to the patient and started within the first four months of diagnosis. This includes therapy given at the reporting hospital as well as those given in other facilities.

If so desired, for population-based registries data on treatment can be collected in broad categories such as groupings of the nature of the therapy. There should be a provision for identification of patients who did not receive the initial treatment since these are important in survival studies as well as in studies of the natural history of the disease. Give the possible reasons why the patient did not receive the initial treatment.

Categories of treatment:

Surgery: includes the surgical removal, totally or partially (except incisional biopsy) of tumour tissue of the primary or the metastatic site (including lymph nodes and endocrine glands).

Radiation therapy: external or beam radiation directed to cancer tissue regardless of the source of radiation.

This includes:

X-ray	Neutron beam
Cobalt	Helium ion
Linear accelerator	Spray radiation

Internal radiation: includes the internal use of radioactive isotopes whether given orally, intracavitarily, interstitially or by intravenous injection. Radioactive material such as radium, radon, radioactive gold, etc. can be given via implants, moulds, seeds, needles or applicators.

Chemotherapy: administration of drugs or chemicals to attack or treat cancer tissue. The cytotoxic effect does not result from a change in the hormone balance or in the host's immune response.

Endocrine or hormone therapy: use of any therapy which exercises its effect on cancer tissue through a change in the hormonal balance. This may be achieved through the use of hormones and antihormones or through ablative surgery or radiotherapy (oophorectomy, orchiectomy, hypophysectomy, etc.).

Immunotherapy: therapy which alters the immune system or changes the host response (defense mechanism) to the cancer. Another term for this is the use of biological response modifiers.

Other cancer-directed therapy

Suggested codes for treatment based on a grouping of the nature of therapy might be:

0 No treatment	4 Immunotherapy
1 Surgery	5 Hormonotherapy
2 Radiotherapy	8 Other relevant therapy
3 Chemotherapy	9 Unknown

Several treatments may have been given to a patient. Specify the dates when each therapy commenced and the hospital or institutions where these were given.
Instead of or in addition to the nature or type of treatment given, the registry may record the objectives or intended purpose of therapy.
A grouping of codes on the summary of the objectives of therapy might be:

1 Symptomatic only	5 Uncertain
2 Palliative	6 Other
3 Curative incomplete	7 No treatment
4 Curative complete	8 Unknown

These items are most relevant to hospital tumour registries. Population-based registries may collect them for specific research projects.

3.3.8 Follow-up items

Follow-up of patients after their initial diagnosis and treatment refers to their continuing to be seen by hospital or doctor. The registry may attempt to collect information about this follow-up process, although this is more usual for the hospital-based cancer registry than for the population-based registry. Follow-up may be active. This means that annually, or at agreed time intervals, requests from the registry are sent to the doctor responsible for information about the patient's status.
Passive follow-up means awaiting receipt of information from routine sources – particularly the death certificates of registered patients, showing that they have died.

(1) Date of last contact

Refers to the date at which the patient was last known to be alive. This may be obtained from follow-up visits to the hospital, by recording dates of follow-up at the hospital, contacting the patient's attending physician or the patients themselves. This date is

important if survival rates are to be calculated. If the patient is dead, the date of last contact would be the date of death. If it is not known whether the patient is alive or not, the date of last contact would be the date the patient was last seen in the hospital (outpatient or inpatient) or the latest information received from the patient's medical practitioner.

(2) Status at last contact

Population–based registries may only be able to obtain information on whether the patient is alive or dead. Active follow–up is an activity more characteristic of hospital tumour registries, which may also have information on whether the patient is alive with or without disease.

Suggested codes are:

1	Alive	3	Emigrated
2	Dead	4	Unknown

(3) Date of death

Give the complete date of death, including day, month and year, to facilitate tracing of information relating to the individual as well as tracing of the death certificates. This item is also important for survival studies as a measure of outcome.

(4) Cause of death

For recording the cause of death, there are two options:

- The registry may use the following codes:

1	Dead of cancer
2	Dead of other cause
3	Not known

- The registry may record the underlying cause of death as specified in the death certificate.

For coding the underlying cause of death, use the appropriate codes of the International Classification of Diseases (ICD–9 or ICD–10). The rules on the allocation of the underlying cause of death are often complex and may pose quite a problem in coding. If death certificates are obtained from, for example, vital or central statistics offices, these may already be coded according to the ICD.

(5) Place of death

Record whether the patient died in a hospital, at home or in a hospice, etc. The population–based registry can use this information in tracing back the case in the hospital where the patient died (in cases where the only information available is from the death certificate). This information may also be used as an indicator of certain aspects of medical care, e.g., a tendency to discharge terminal cases in order to diminish the number of deaths occurring in a hospital or clinic.

3.3.9 Diagnostic procedures

Below are general instructions to follow when abstracting diagnostic procedures, with the aim of determining the most valid basis of diagnosis, the extent of the disease (summary stage), the primary site of the tumour and its morphology and behaviour.

(1) The information to be recorded on the cancer

In each of the diagnostic procedures given one should record, whenever available, particular information on:

(a) The primary tumour

- its location within the primary organ (e.g. lung lobe, breast quadrant, etc.); record any mention of multiple tumours within the primary organ;
- the actual size of the lesion, noting down the dimensions (if given) and the units of measurement used in case of multiple tumours: record the size of the largest tumour;
- descriptions such as 'diffuse', 'entire circumference', and 'widespread'.

(b) The direct extension of the tumour

- pertinent information regarding invasion of adjacent structures and organs.

(c) Lymph nodes

- the specific location of the lymph node,

e.g. cervical – in the neck

axillary – in the axilla

inguinal – in the groin

- its laterality,

e.g. ipsilateral – same side as the tumour

contralateral – opposite side to the tumour

bilateral – both sides

- its actual size and number;
- record whether 'regional' or 'distant';
- record whether nodes are 'movable' or 'discrete', 'fixed', 'matted' or 'attached to deep structures';
- note down clinician's statement as to whether nodes are 'suspected of tumour involvement' or whether they are considered 'tumour free';
- for lymphomas and malignant tumours of lymphoid tissues (see Chapter 4), any mention of lymph nodes as 'enlarged', 'visible swelling' or 'palpable' is considered as involved and should be noted as such.

(d) Distant site involvement

- if distant metastasis is mentioned, record this.

(2) The information to be recorded on the diagnostic procedures

(a) History and physical examination (clinical only)

Review the history and physical examination described by the clinician and record the date(s) and the pertinent information as described above.

(b) X-rays, scans and other imaging techniques

Review the diagnostic reports of X-rays, scans, ultrasonography and other imaging techniques for mention of tumour involvement. Record the name of the procedure(s), the date(s) these procedures were done and the pertinent findings. Both positive and negative findings are required for determining the extent of the disease. For example, if a chest X-ray report is negative, record as 'negative' or '(–)'.

It is not necessary to copy details unrelated to cancer!

(c) Laboratory tests (blood chemistries, tumour markers, and haematological examinations)

Record the date(s), name of the procedure and result(s) of these tests or procedures in establishing the diagnosis of neoplasms or metastasis.

If no pertinent laboratory tests were done, state so in the abstract.

(d) Endoscopic examinations

Record all endoscopic procedures done in the diagnostic work-up prior to definitive therapy. Note pertinent findings, both positive and negative.

If biopsies are taken, locate the pathology report and abstract findings.

(e) Operative procedures

The exploratory surgery may be followed immediately by definitive surgery. In case the extent of the malignancy is such that resection of the tumour is not feasible, palliative procedures to relieve pain, distress or obstruction may be carried out (see Section 2.3). An example of a palliative procedure is a 'by-pass' operation. This involves the surgical formation of a connection (anastomosis) between two normally separate or unconnected (distinct) spaces or organs.

(f) Haematological examination

The registry personnel should take note of the suspected leukaemia cases and review the haematological reports, including the blood count (number of cells and percentage of the different types), peripheral smear and bone marrow examinations of these patients. In the presence of abnormally elevated white blood cell (WBC) counts, the WBC total number and differential (number of different types of white cell) counts should be recorded and the presence of immature cells should also be noted. In abstracting the peripheral smear report, record the name of the proce-

dure, date it was performed and the pertinent abnormal findings, particularly the presence of immature cells and the impression given by the haematologist.

It must be stressed that registry personnel are not expected to review all of the complete blood count reports in each hospital since this is a routine procedure done for very many conditions other than cancer. He or she should review only the reports for patients who are suspected of or diagnosed with leukaemia and other haematological malignancies. There must be an arrangement made with the haematology laboratory to identify these cases for the cancer registry.

(g) Cytological examination

Record the procedure performed and the source of specimen and date. Record the impression. Specify the highest class of cytological grade (I–V) from each. Note down information on possible primary site of suspected cancer (if available).

If there is more than one cytology report in the patient's medical record on the same type and source of specimen, record the findings on the first positive report. If the findings are based on different types and sources of specimens, summarize each pertinent report.

(h) Pathology reports

The histological examination offers the best information regarding the presence or absence of cancer. It may be made from a biopsy specimen, a surgical specimen or from an autopsy. There may be more than one pathology report in a patient's medical record. Each report should be summarized or abstracted, indicating the procedure, the date the procedure was done, the source of the specimen, the gross and microscopic pertinent findings (including negative as well as positive findings), and the slide number(s).

One possible procedure is to simply attach a copy of the pathological report to the registration document. Comonly a registry receives a copy of pathological reports mentioning cancer, from the Pathology Department of a hospital or from other pathology laboratories. These pathological reports are stapled to the registry abstract. This un-derlines the traditional importance of histopathology in the diagnosis of cancer.

In registries where abstracting of pathological reports has to be done actively, note the following:

Date of the report: This usually coincides with the date of the biopsy, not the date the slides were read nor the date of dictation.

The "gross description" of the report contains a description of the material received for examination. This will include the source of the specimen/ and the size of the tumour mass (if given). The size of the specimen or the size of the tissue fragments taken at biopsy are not important to the abstractor. The size of the tumour must be recorded.

The "microscopic description" of the report contains the pathologist's description of the specimen(s) examined. Note the total size of the tumour and its extent or the presence of metastasis. If there is a discrepancy between the microscopic and gross description of the excised tumour, the microscopic description takes precedence.

The 'diagnosis' section summarizes the microscopic findings of the specimen examined. It may confirm or deny gross findings of malignancy, giving the histological type of the malignancy and in certain cases, the grade of the tumour (or its degree of differentiation). Complete excision of the tumour may also be confirmed or denied by describing whether the lines of resection are free of cancer or are involved.

(i) The operative pathology report (surgical specimen)

The operative pathology report on the surgical specimen contains a description of the gross and microscopic examinations of the specimen. This report is very important to the tumour registrar since it determines the primary site of the tumour and gives or

describes the extent to which the tumour or malignancy had spread, and the organs or structures which are involved.

In abstracting the operative pathology report, record the following:

- date
- slide number
- specimen
- primary site
- tumour size: if there is more than one tumour, record the dimensions of the largest tumour
- histology: include the cell type and the tumour grade or differentiation (if given)
- extent of the disease within and beyond the primary site
- the pathologist's description of multiple tumours or multiple foci of tumour cells (multifocal or multicentric)
- direct extension of the tumour: record in detail the description of the primary tumour within the primary site including the depth of invasion
- direct extension of the tumour beyond the primary site
- the lymph nodes biopsied (regional or distant), indicating whether they are positive (involved) or negative (uninvolved), whether the nodes are fixed (perinodal extension of the tumour) or movable

Record any statement of laterality (homolateral or ipsilateral, contralateral or bilateral).

If given, record the number of positive nodes excised.

Record any and all sites of distant involvement.

(ii) The autopsy (necropsy) or post-mortem report

There are usually two types of reports made following autopsy:

- the Provisional Anatomical Diagnosis (PAD), based on the gross autopsy findings; and
- the Final Anatomical Diagnosis (FAD) based on microscopic examinations.

The final anatomical diagnosis (FAD) is the most important portion of the autopsy report as far as the abstractor is concerned. This usually gives the primary site, the histological type, the organs involved by direct extension or by metastases. All of the major organs are examined except in cases where the autopsy is restricted to certain organs. All pertinent findings should be recorded.

The autopsy findings should confirm the diagnosis of cancer made clinically prior to the patient's death or determine the primary site of a tumour which was incorrectly diagnosed or not known prior to death. If there is a discrepancy between the autopsy report and other previous pathology reports regarding histological type and primary site, the autopsy takes precedence.

In instances where the presence of cancer is incidentally discovered at the time of autopsy, review the history and physical findings to rule out a clinical diagnosis of cancer prior to death. If the diagnosis of cancer is first made at autopsy, the case should be abstracted and the method of first detection (Section 3.3.4) recorded as "diagnosed at autopsy". The date of diagnosis (Section 3.3.2) is the date of death.

If the diagnosis of cancer on autopsy is based on gross examination alone (PAD), this should be noted in the abstract. In this case, however, try to check with the pathology department whether a histological examination of the tissues removed from the body was done, since this is performed routinely.

3.3.10 Death certificates

If the registry has access to death certificates, then any certificate which mentions cancer as immediate, antecedent, underlying or contributory cause of death should be abstracted. A sample Death Certificate Abstract Form is given in Figure 5.

Department of Health – Rizal Cancer Registry, Rizal Medical Center
Pasig, Metro Manila

ABSTRACT OF DEATH CERTIFICATE					
PATIENT REGISTRY NO. □□□□□□					
(1)	NAME OF PATIENT ________ (Last name First name Middle name)				
(5)	Sex □ 1 Male	2 Female	3 Age		
(4)	Civil Status	1 Single 2 Married	3 Widowed 4 Others		
(5)	NATIONALITY				
(6)	Usual Residence				
(7)	Usual Occupation				
(8)	DATE OF DEATH □□□□□□				
(9)	PLACE OF DEATH	1 House			
		2 Hospital			
		Name of Hospital Address			
(10)	Surviving Spouse				
(11)	I. Disease or condition directly leading to death:				
	Immediate cause:	a.			
	Antecedent cause:	b.			
	Underlying cause:	c.			
	II. Other significant conditions contributing to death:				
(13)	Medical Attendance		With Without		
(14)	Certificate Correct by:		Private Physician		
			Public Health Officer		
			Hospital Authorities		
	Autopsy		Done Not Done Unknown	Diagnosis	
ABSTRACTED BY: ____________________					
Date: ________________					

Figure 5. Example of a death certificate abstract form

The completed abstracts are matched with the registry's index files to determine if they have been registered previously (see Chapter 5). Cases which have not been registered previously are traced back whenever possible to the hospital where the patient died or to the physician who signed the death certificate. They may also be matched with the Case-finding Lists from the different hospital data sources to determine if they were seen previously in a hospital and were missed on initial case-finding. If this is so, the case should be traced back to the appropriate hospital. Cases which could not be traced back or for whom no clinical or laboratory records could be found, may be registered under the "death certificate only" (DCO) category (basis of diagnosis). In the first few years of operation of the cancer registry, this is usually high since some cases diagnosed previous to the registry's reference date (prevalent cases) may be included erroneously. The number of these cases will decrease after a few years. The percentage of DCO cases is a measure of the completeness of cover (see Chapter 6).

(1) Composition of the death certificate

(a) Patient identification information:

name (last name, first name, and middle or maiden name)
sex
age
date of birth
address (place of residence)
civil status
race
occupation

(b) Information on patient's death:

place of death
date of death
causes of death:
immediate cause
antecedent cause
underlying cause
contributory cause

(c) Certified correct by:

private physician
public health officer
hospital authorities

Note: For DCO cases, be very careful to register the place of residence and not the place of death of the case.

(2) Coding the underlying cause of death

The underlying cause of death is defined as:

- the disease or injury which initiated the train of morbid events leading directly to death, or
- the circumstances of the accident or violence which produced the fatal injury.

For consistency, the World Health Assembly recommended a standard form of medical certification (Figure 6) designed to facilitate reporting of the underlying cause of death, as well as gathering of information on the sequence of events leading to the patient's death.

In Part I, the cause leading directly to death should be reported on line (a), the intervening antecedent condition (if any) on line (b) and the underlying cause of death on line (c). If the entry on line (a) or on lines (a) and (b) completely describe the sequence of events leading to death, then it is no longer necessary to put an entry on line (c).

Part II is for any condition which may contribute to death but is not related to the disease or condition causing the death.

The purpose of the definition of the underlying cause of death is to ensure that all relevant information is recorded and that the certifier does not select some conditions for entry and ignore others. The underlying cause of death is the main axis for the tabulation of mortality statistics.

Registry clerks will normally have to accept what is already entered. They should know that there are rules for selecting the 'underlying cause', but they will not be expected to do this (see ICD–9, Vol. 1, pp. 699–737 or ICD–10, Volume 2, pp 30–123).

Figure 6. International Form of Medical Certificate of Cause of Death

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death* ***Antecedent causes*** Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(a) ..... due to (or as a consequence of) (b) ..... due to (or as a consequence of) (c) ..... due to (or as a consequence of) (d)	....
II Other significant conditions contributing to the death, but not related to the disease or condition causing it	....	
This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.		

EXERCISES

Question 3(a)

On the following pages are 11 examples of reports from radiology, nuclear medicine and CT scan. Given the general instructions above, abstract the relevant information and compare with the suggested method of abstracting, which follows the examples.

Example A.

LUNG CENTER OF THE PHILIPPINES Q.C. RADIOLOGY DEPARTMENT			
Hosp. case No. 96–29–87	Date: 23 March 1987		
Patient: COSTALES, Esperanza	Age: 53	Sex: F	Status: M
Examination requested: Chest X–ray			
Requesting physician: Dr Paul Moon			

RADIOLOGICAL REPORT	
Chest X–ray showed scattered small nodular densities on both lung fields, more on the bases.	
Heart, diaphragm and sinuses unremarkable.	
IMPRESSION: pulmonary metastases	
	Dr E.X. Ray Radiologist

Example B.

X-ray series: an X-ray examination which requires the taking of a number of pictures, summarized in one report.

This example is an illustration of an X-ray report of a metastatic series. Abstract what you think is pertinent in the report and compare with the abstract suggested.

Plate No. 969238	Date examined: 12 March 1987		
Case No. 11-22-99	Date reported: 12 March 1987		
Pay X Charity ___ Out ___	Requested by O.S. Zeus, M.D.		
Examination requested: skeletal survey			
Patient: Fanny BONE	Age: 52	Sex: F	Status: M

RADIOLOGICAL REPORT		
Skeletal survey dated 12 March 1987 shows sclerotic changes involving several vertebral bodies with lytic lesions at T-10 and T-11, sclerosis at both femoral heads and neck and body of the right ilium; lytic lesions at both pubic bones with pathological fracture at the left; mixed lesions at the ascending ramus of the left ischium.		
Remarks: Consistent with osseous metastases		
		B.B. Bonnin, M.D. Radiologist

Example C.

Some of the radiological examinations using contrast media are:

- Angiography: radiological study of the vascular system
- Bronchography: radiological study of the bronchi of the lung
- Cholecystography: radiological study of the functions of the gallbladder and bile ducts after introduction of an opaque medium
- Cholangiography: radiological study of the bile ducts
- Lower GI series or Barium enema: X–ray studies of the large intestines
- Sialography: radiological study of the salivary ducts
- Urography: radiological study of the urinary tract, using contrast media

This example is an Upper GI series (UGIS) report. Abstract the pertinent information and compare with the abstract suggested.

RADIOLOGICAL REPORT			
Plate No. B–95693	Date examined: 25 March 1990		
Case No. 30–30–26	Date reported: 28 March 1990		
Pay ___ Charity X Out ___	Requested by: G.P. Andres, M.D		
Name: IMPORTANTE Salud S	Age: 57	Sex: F	Status: W
Address: No. 2 Shaw Blvd., Pasig, MMLA			
Type of examination: Upper GI series			
Scout film: There is a mass density on the left upper quadrant. There are no abnormal calcifications. No extraluminal air noted.			
Upper GI series: Serial examination after ingestion of contrast medium shows normal oesophagus. The stomach is moderately distended with mucosal irregularities noted on the antral area. There is minimal contrast medium noted distal to the gastric antrum.			
IMP: Partial gastric outlet obstruction Consider: malignancy			
	Esto Mack, M.D. Radiologist		

Example D.

This is an illustration of a urogram report. Abstract the pertinent information and compare with the suggested abstract.

Plate No. 76137	Date examined: 5 October 1986		
No. 11–39–44	Date reported: 8 October 1986		
Pay ___ Charity X Out ___	Requested by: R.T. Pascua, M.D.		
Name: Felix NAVIDAD	Age: 46	Sex: M	Status: M
Address: Ermita, Manila			
Type of examination: KUB–IVP			

REPORT		
Scout film: There is a soft tissue mass density in the left hemiabdomen, obliterating the left psoas shadow. There is no evidence of calcific density in the urinary tract.		
Intravenous pyelography: Serial examination after introduction of contrast material shows prompt opacification of the right collecting system and kidney which appears slightly enlarged. The right ureter and urinary bladder are unremarkable. The left collecting system and kidney were not visualized even in the four hour delayed film.		
IMP: Non–visualized left kidney Retroperitoneal mass, left, probably arising from the left kidney		
		Chris T. Mass, M.D. Radiologist

Note:

KUB refers to plain film of the kidney, ureter and bladder – also called scout film
IVP refers to intravenous pyelography

Example E.

This example is an illustration of an ultrasound report. Abstract the pertinent informationand compare with the suggested abstract.

Case No. 2265	Date: 16 February 1988		
Name: Susan AMARILLO	Requesting physician: I. Brown, MD		
Address: Binangonan, Rizal	Age: 44	Sex: F	Status: S

ULTRASOUND REPORT		
The liver is enlarged showing inhomogenous echo pattern. There is a solid mass noted in the superior aspect of the right lobe measuring 5.0 x 5.6 cm. Another sonolucent nodule is noted in the inferior aspect of the right lobe.		
There are no dilated intrahepatic ducts.		
The gallbladder is unremarkable.		
IMP: Hepatomegaly with multiple intrahepatic nodules Consider: Metastasis		
		B.B. Echo, M.D. Ultrasonologist

Example F.

This is a typical CT scan report. Abstract the pertinent information and compare with the suggested abstract.

Name: Paraiso, Antoinette	Age: 79	Sex: F	Room No. 103
Hosp. No. 123456			
Referring physician: Dr S.M. Rosas			RMC
CT No. 25435X	In ___ Out ___		

CONSULTATION REPORT		
C.T scan of the abdomen shows a poorly defined heterogeneous mass density in the retrogastric area that appears to arise from the pancreatic neck and body. This measures approximately 4.8 x 3.2 cm. There is no calcification nor focal cyst formation.		
The pancreatic head and tail appear normal.		
Visualized inferior vena cava and abdominal aorta as well as the retroperitoneal lymph nodes are not remarkable. Liver is relatively small and shows some surface nodularities; there is a moderate perihepatic and perisplenic ascites. The left adrenal gland is prominent but still tri-radiate in configuration, appearing homogeneous without mass effect. Right adrenal is completely normal.		
Both kidneys function well and reveal no structural abnormalities. The pelvi-calyceal system and ureters have normal course and configuration.		
There are small calcifications in the region of the splenic flexure in the upper abdomen, presumably from previous colonic contrast material.		
There are circumferential calcifications throughout the abdominal aorta without focal aneurysm formation.		
IMP: Moderate ascites and relatively small liver. There is also suggestion of a tumour mass density in the pancreatic neck – retrogastric region and body, measuring approximately 4.8 x 3.2 cm.		
Percutaneous C.T. guided aspiration biopsy of pancreas, under local anaesthesia recommended.		
		Flora Doria, M.D.

Example G.

Diagnostic nuclear medicine examination

In nuclear medicine, radioactive substances known as radioisotopes are administered to patients in order to diagnose disease. A radioactive isotope emits gamma rays within the body, enabling the physician to visualize internal abnormalities.

This is an example of a nuclear medicine report. Abstract the pertinent information and compare with suggested abstraction.

LUNG CENTER OF THE PHILIPPINES DEPARTMENT OF RADIOLOGY CONSULTATION REPORT			
Name: BRAZO, Mercedes	Age: 34	Sex: F	Status: S
Physician: U.R. Sweet, M.D			
Date: 12 April 1987	Pay X Charity ___		

BONE SCAN 20 mci Tc– 99 Pertechnetate		
Anterior and posterior whole body scans by section were obtained after three hours from the injection of radionuclide.		
Multiple retentions are noted in the skull, right humerus and right pubis.		
The rest of visualized skeleton appears symmetrical and uniform.		
IMP: Abnormal bone scan, as above described Suspect metastatic disease		
		C.S. Brown, M.D. Radiologist

Example H.

RADIOLOGY DEPARTMENT			
Serial No. Q–8902	Date: 5 December 1988		
Name: Dahlia FLORES	Age: 64	Sex: F	Status: M
Xay examination: Chest, lumbo–sacral spine, APL			
Requested by: I.N. Bloom, M.D.			

RADIOLOGICAL REPORT		
Findings: Chest: confluent densities noted in the right upper lobe.		
The rest of the lung fields are clear. Aortic knob is atheromatous. Heart and diaphragm appear normal. The right breast is absent.		
Lumbo–sacral spine: Osteoblastic and lytic changes noted in both proximal femur, pelvic as well as lumbar vertebral bodies. The pedicles of the L2 vertebral body are ill–defined. Disc spaces are preserved. The normal curvature is maintained.		
IMP: 1. Status post–mastectomy, right 2. PTB, minimal, activity undetermined 3. Osseous metastases		
		A. Garland, M.D. Radiologist

Example I.

X–ray No. 89–1736	Date: 18 January 1988		
Name: YUSI, Ma. Magdalena	Sex: F	Age: 72	Status: M
Attending physician: Lucas, U.R., M.D	Room/Bed No.: OP		
Radiological findings: MAMMOGRAPHY Examination of the left breast reveals no evidence of nipple retraction. No discrete mass lesions nor localizing calcifications. No normal mass noted. Skin and subcutaneous tissue were unremarkable. IMP: Essentially normal left breast.			
		N.V. Benigno, M.D. Radiologist	

Example J.

X–ray No. B–107114	Date: 15 January 1988		
Naime: Eric ALBA	Hosp. case No. 04–07–38	Age: 3	Sex: M
Attending physician: Dr Chekup			
Examination: X–ray, chest and abdomen			

RADIOLOGICAL REPORT		
IMP: Pulmonary nodules suggestive of pulmonary metastases.		
Chest X-ray: There are nodular and patchy infiltrates in both lung fields. The heart is not enlarged. Diagraphm and sinuses are intact. IMP: Pulmonary nodules suggestive of pulmonary metastases.		
Abdomen: There is a huge soft tissue density in the right hemiabdomen displacing the intestines upward and to the right. There are no calcifications. No evidence of extra–luminal air noted. The intestinal gas pattern is non–obstructive. IMP: Intra-abdominal mass Considerations: (1) Wilms' tumour (2) Neuroblastoma		
		X.R. Ray, M.D. Radiologist

Example K.

Name: TREMOR, Rogelio S.	Age: 44	Sex: M	Room No. 145
Hospital No. 10–02–10	Date: 27 November 1988		
Ref. physician: Dr B. Steddy	X In ___Out CT No. 39038		

CONSULTATION REPORT

C.T. scan of the head shows a solitary 5.6 x 3.8 cm cystic and solid tumour mass lesion in the left parieto–occipital region with a moderate amount of perifocal oedema and mass effect.

There is also indication of some haemorrhage within the tumour mass.

The midline is shifted slightly to the right side with a right sided subfalcial herniation.

The lateral ventricles are slightly dilated, with partial medial compression of the left segments.

The septum pellucidum is likewise displaced to the right. The brainstem appears slightly full but otherwise shows no evident tumour mass lesion.

The petromastoids are unremarkable.

IMP: Solitary 5.6 x 3.8 cm solid and cystic tumour mass lesion in the left parieto–occipital region presumably a gliomatous neoplastic growth.

		Cere B. Room, M.D.

Answers to Question 3(a)

The examples can be abstracted as follows

A.	23/03/87	CXR: scattered small nodular densities, both LF, more on bases IMP: Pulmonary metastases
B.	12/03/87	Skeletal survey: lytic lesions T–10 and T–11, both pubic bones, with pathologic fracture, (L); mixed lesions, ascending ramus, (L) ischium IMP: Osseous metastases
C.	25/03/88	UGIS: Mass density, LUQ Stomach mod. distended: (+) mucosal irregularities, antral area Oesophagus (–) IMP: Partial gastric outlet obstruction Malignancy considered
D.	05/10/86	KUB–IVP: Soft tissue mass density, (L) hemiabdomen Non–visualizing left kidney IMP: Retroperitoneal mass (L) probably arising from (L) kidney
E.	16/02/88	Ultrasound, liver: Solid mass 5.0 x 5.6 cm, sup. asp. (R) lobe, sonolucent nodule, inf. asp. (R) lobe, liver IMP: Hepatomegaly with multiple intrahepatic nodules. Metastasis considered
F.	04/11/87	CT scan. Abdomen: Heterogeneous mass density, 4.8 x 3.2 cm., pancreatic neck and body (retro–gastric area). IVC and abdominal aorta, retroperitoneal LN (–). Moderate ascites; relatively small liver
G.	12/04/87	Bone scan: Abnormal bone scan, skull, (R) humerus, (R) pubis IMP: Suspect metastatic disease
H.	05/10/88	X–ray, chest and L–S spine s/p mastectomy, (R) Osseous metastases, femur, pelvic and lunbar vertebrae
I.	18/01/88	Mammography, (L): Neg
J.	15/01/88	X–ray, chest and abdomen Pulmonary nodules, suggestive of metastases Mass, (R) hemiabdomen, consider: – Wilms' tumour – Neuroblastoma
K.	27/11/88	CT scan, head Solitary 5.6 x 3.8 cm tumour mass lesion, (L) parieto–occipital region, presumably gliomatous tumour

Question 3(b)

The following are two samples of endoscopy reports. Abstract what you think is relevant and compare with the suggested abstract which follow this exercise.

Example L.

DEPARTMENT OF HEALTH – RIZAL MEDICAL CENTER, Pasig, Metro Mla. GIT – LIVER STUDY UNIT PANENDOSCOPY			
Patient: NINA BONITA	Date: 10 July 1987		
Address: 673 Boni. Ave., Mandaluyong, MMLA Ward:		OPD Hosp. No. 22-01-00	
Referred by: Dr. P.O. Gee	Sex: F	Age: 46	
Recent alcohol intake: None Amount:			
Recent drug intake: None			
Recent gross haemorrhage: None Amount: _____ Date:			
Previous endoscopies: None Date:			
History: Started 3 years PTC as burning epigastric pain, slightly relieved by intake of antacids			
Diagnosis: Peptic ulcer disease			
X-ray findings:			
Pre-medications: Phenergan 50 mg IM Xylocaine Spray			
Findings: Oesophagus: Essentially Normal (E/N) C-E Junction: E/N Fundus: E/N Body: Anterior E/N Posterior: E/N Antrum: Eroded mucosa, distal half antrum Pyloric Ring: Enlarged Duodenal bulb: not visualized Duodenum: not visualized Biopsy no. 6			
Endoscopic diagnosis: Gastric CA, Pylorus, Antrum Outlet Obstruction			
Recommendations: Refer to Surgery		ESTO MACK, M.D., Endoscopist	

Example M.

Name of Patient: PROCTER, ANNIE	Date: 21 April 1987		
Address: Makati MMLA.Ward: OPD			
Hospital No.: 32/79–46	Status: Married	Sex: F	Age: 39
Referred by: Dr C.S. Long			
History: Bloody stools noted on and off 3 months PTC, irregular bowel movement.			
Rectal Examination: (+) mass 6 cm from the anal verge annular, constricting the rectal lumen			
Proctoscopy: Distance Scoped: 6 cm. Mucosa: congested Blood X Mucus X (moderate) Stools: Watery			
Endoscopic findings: Scope inserted up to 6 cm. with ease Fungating, annular mass noted 6 cm. from anal verge, almost completely obstructing lumen. Scope could not pass beyond 6 cm.			
Endoscopic Diagnosis: Rectal CA			
Disposition: Multiple biopsy			
		Examined by: NAT B. NINE, M.D.	

Answers to Question 3(b)

The findings in this exercise can be summarized on the Tumour Registry Abstract as follows:

L.	10/07/87	Gastroscopy: Eroded mucosa, distal half antrum; Pyloric ring enlarged; Multiple Bx taken.
		Impression: Gastric CA, Pyloric Antrum Pyloric Outlet Obstruction
M.	21/04/87	Proctoscopy: Fungating mass 6 cm. from anal verge, almost completely obstructing the rectal lumen. Multiple biopsy taken Endoscopic DX: Rectal CA

Question 3(c)

The following exercises are examples of biopsy reports. Abstract the pertinent findings and compare with the suggested abstracts which follow the four examples.

Remember to note down:	the date of the report the slide number source of specimen primary site tumour size histological diagnosis (and differentiation if given)

Example N.

SURGICAL PATHOLOGY – CONSULTATION REPORT			
NAME OF PATIENT: SY, CLAIRE	SP NO: S–86–2607	SEX: F	AGE: 44
Attending Physician: Med I.Co	Hospital: Morong General Hospital		
Examination Desired: Frozen Section (X) Histopath ( ) Others Specimen: Breast mass, left		Date: 29 September 1986	
HISTOPATHOLOGICAL DIAGNOSIS:			
INVASIVE DUCTAL CARCINOMA, BREAST MASS, LEFT			
GROSS/MICROSCOPIC DESCRIPTIONS:			
Specimen consists of grayish–white mass measuring 3.4 x 3 x 2 cm. Cut section shows an irregular margin and firm cut sections. Entire specimen submitted.			
Microsections disclose a malignant tumour consisting of polygonal neoplastic cells with pleomorphic and hyperchromatic nuclei arranged in cords, clusters and glands invading the surrounding fibrofatty tissues.			
		B.R. EAST, M.D. PATHOLOGIST	

O. and P. are other examples of pathological reports. Abstract the pertinent information and compare with the suggested abstract.

Example O.

Name: Ofelia Ramos	Status: M	Age: 39	Sex: F

Path No. S–87–2447	Address: Pasig, MMLA	
Nationality: Filipino	Case No. 41–91	Ward: Surgical
Surgeon: D.R. Medic, M.D.		
Clinical Summary: Condition started 4 months PTA when patient noticed a mass on the right breast. Biopsy done 2 months PTA showed invasive ductal CA, right breast. Pre–operative Diagnosis: Invasive ductal carcinoma, right breast, Stage III Specimen: Right breast and axillary tissues. Operation: Modified Radical Mastectomy, right		
Date Received: 18/06/87	Date Reported: 26/06/87	

PATHOLOGICAL REPORT

GROSS DESCRIPTION:

The specimen consists of the right breast with its axillary tail weighing 500 gms. The breast measures 16 x 10 cms. and is covered with a 12.5 x 6 cm. ellipse of skin showing a 2.5 cm. previous biopsy site at the upper outer quadrant. The 1x1 cm. nipple is unremarkable but the areola shows an area of dimpling at 6.00 o'clock. Serial inferior sections reveal a 6 x 6 cm. mass. Cut section shows chalky strips and yellowish fat–like areas occupying the right upper and lower quadrants. The axillary tail measures 9 x 8 cm.

A – nipple, Block 2	E – upper inner quadrant, Block 1
B – previous biopsy site, Block 1	F – lower inner quadrant, Block 1
C – upper outer quadrant, Block 1	G – Lower level, Block 20
D – lower outer quadrant, Block 1	H – upper level, Block 2

MICROSCOPIC SECTIONS:

Microsections from the right lower outer quadrant (D) reveal sheets of breast tissues with neoplastic glands displaying pleomorphic hyperchromatic nuclei, prominent and moderate eosinophilic cytoplasm. These glands show cribriform pattern with central necrosis and areas of calcification.

Microsections of the previous biopsy site(B) shows no residual but numerous foreign body giant cells are seen.

Microsections from the other quadrants (CEF)and the nipple are unremarkable. A total of twenty two(22) axillary lymph nodes are isolated, all are negative for metastases and show sinus histiocytosis.

DIAGNOSIS: S/P modified radical mastectomy, right invasive ductal carcinoma, right breast
0/22 Axillary lymph nodes positive for metastases

Examined by: RESS I. DENT, M.D.	Reviewed by: PAT O. LOGIST, M.D.

Example P.

LABORATORY SERVICE			
Name: PEDRO I. AMSIC	Sex:Male	Age: 53	Status: M
Path No. S—88–2889	Nationality: Filipino		
Address: Pakil, laguna	Case No. 33–22–11		
Service: SURGERY	Physician: Dr. Al Wright		
Clinical Summary: Started 6 months PTA as seizure associated with loss of consciousness. About five other episodes occured in a span of five months. CT scan, brain, revealed a left superior frontal cortical mass lesion. Pre–operative Diagnosis: Left superior frontal mass lesion.			
Date Received: August 17 1988	Date Reported: Aug. 25, 1988		

PATHOLOGICAL REPORT	
GROSS DESCRIPTION: The specimen consists of a piece of 5 x 4 x 3 cm brain–like soft tissue.	
MICROSCOPIC: Microsections disclose brain tissue with pleomorphic and bizarre–looking cells with enlarged, irregular nuclei, some of which are vesicular and with moderate amount of eosinophilic cytoplasm. There are some multinucleated giant cells; mitotic figures noted with areas of necrosis surrounded by neoplastic cells. The blood vessels are increased in number and dilated.	
DIAGNOSIS: ASTROCYTOMA, GRADE III	
Examined by: PATO RESSI DENT, M.D	Reviewed by: CERE B.RUM, M.D.

Example Q.
This is an example of an autopsy report. Abstract the pertinent findings and compare with the suggested abstract.

Autopsy No.: A–87–70

NECROPSY REPORT			
Name: FELIX CARGADOR	Age: 27		
Address: Nava St., Sta. Mesa, Mla			
Date Admitted: 16 December 1987	Date died: 20 December 1987		
Date Autopsied: 20 December 1987	Ward: Medicine		
TRUNK ONLY: Prosector: Ressie Dente, M.D.	Consultant: Pat. O. Loggie, M.D		
Clinical Impression: HEPATIC ENCEPHALOPATHY FULMINANT HEPATITIS R/O LAENNEC'S CIRRHOSIS			

CASE SUMMARY:
F.C. 27 years old, male, married, presently residing at 45 Nava St., Sta Mesa, Manila, was admitted to the R.M.C. for the second time on December 16, 1987, with a chief complaint of epigastric and back pains.
The present illness started about a month prior to admission as abdominal pain, localized at the epigastric area, moderately severe, radiating to the back, persistent, slightly relieved by intake of analgesics. Pain was associated with sensation of fullness of the abdomen and yellowish discoloration of the skin and sclerae. He consulted a private physician and was diagnosed as a case of amoebiasis. He was given antibiotics but these did not afford any relief. The signs and symptoms persisted so an abdominal ultrasound was requested. Result of the procedure was not known to the patient. A week prior to admission, he developed pedal oedema. He consulted a government hospital and was subsequently referred to R.M.C. for admission
Pertinent P.E. findings (on admission): General Survey: conscious, coherent, fairly nourished, fairly developed, with the following vital signs: BP – 100/70 PR – 90/min RR – 25/Min
HEENT: Normocephalic, pale palperal conjunctivae; icteric sclerae, pupils equally reactive to light; no aural nor nasal discharge; no throat congestion.
Chest/Lungs: Symmetrical on expansion; no retractions; no lagging; decreased breath sounds; no rales, no wheezes.
Heart: No precordial bulging; PMI at 5th ICS MCL; normal rhythm; no murmure.
Abdomen:Globular, soft, tender on deep palpation at the epigastric area, RUQ and RLQ of the abdomen; normoactive bowel sounds; (+) fluid wave.

CASE SUMMARY:		
Extremities: (+) oedema, both lower extremities. Skin: (+) yellowish discoloration, generalized		
ADMITTING IMPRESSION: HEPATIC ENCEPHALOPATHY FULMINANT HEPATITIS R/O LAENNEC'S CIRRHOSIS		
Laboratory Examinations: Urinalysis (12–17–87): Amber; turbid; acidic; sp. gr – 1.015 sugar – trace; albumin (–); WEC 1–2/hpf; Crystals – A.U. +++; uric acid – few Liver Function Test: Total Protein: 60 g/l	Albumin: 35 g/l A/G ratio: 1.4/1 CBC:Hgb : 143 Gms/l Hct – .42	Globulin: 25 g/l Alkaline phosphatase: 58 u./l WBC – 16.8 x 10 Eos–.03 Seg. –.80 Lympho–.17
Fecalysis: Yellowish brown; soft; (+) hookworm ova 3/cs Ascitic fluid examination (Q/Q): Yellowish Total Protein Mass Conc: 60 g/l Total cell count: 202/cu.mm Total RBC: 182/cu.mm Total WBC: 20/cu.mm 100% lymphocytes Ascitic fluid cytology: Smear shows few lymphocytes, RBC and mesothelial cells. No malignant cells seen.	Serum Creatinine (Dec. 16, 1987): 212 umol/l Ultrasound, Liver, Gallbladder and Pancreas: The liver is enlarged showing increased echo pattern. The intra–hepatic ducts are not dilated. The gallbladder is normal in size. No intraluminal echoes appreciated. Pancreas not appreciated. Spleen and right kidney show increased echo textures. There is evidence of ascites.	
IMPRESSION: Diffuse Liver, Spleen and Parenchymal Disease Ascites		
COURSE IN THE WARD: Patient stayed in the ward for 5 days. Patient had abdominal paracentesis on the 3rd HD. 20 cc. of ascitic fluid was obtained for cytology and cell block. Symptoms persisted and was later associated with dyspnea and back pain. On the 5th HD, patient expired in spite of resuscitative measures.		

AUTOPSY FINDINGS:
GROSS DESCRIPTION: Lung: the right lung weighs 685 gms, the left lung weighs 700 gms, yellowish brown with some nodulations on the surface. Cut section shows moderate congestion.
Ascitic fluid amounting to 1,000 cc. was recovered.
Pancreas: The pancreas weighs 245 gms (NV = 100 gms), reddish brown. Cut section shows whitish multiple nodules in the head and body, soft in consistency.
Liver: The liver weighs 3205 gms, meas. 36x21x12.5 cm. (NV = 1600 gms, 25–30 x 19 x 6–9 cm), yellow green with multiple nodulations. Cut section shows congestion, soft and rubbery mass. Common bile duct circumference = 2.2 cm.
Stomach: with gastrorrhagia amounting to 100 cc, with multiple micro–hemorrhages.
Kidneys: The left kidney weighs 130 gms, the right kidney weighs 132 gms, capsules easily peeled off.
MICROSCOPIC DESCRIPTION: Representative sections taken from the pancreas shows nests of cells with glandular formation and mucin production. These cells have acidophilic cytoplasm, hyperchromatic nuclei and prominent nucleoli. These cells are of uniform size and with some central areas of necrosis. There are areas of fibrosis surrounding some nests of neoplastic cells and chronic inflammatory cells. Some of these cells are within the blood vessels adhering to the endothelial surface. The pancreatic lymph nodes and liver were also infiltrated by these neoplastic cells. Representative sections taken from the stomach shows submucosal oedema with neutrophilic infiltrations. Representative sections taken from the lobes of the lungs and tracheo–bronchial lymph nodes show the same pattern and kind of cells. There are tumor emboli and areas of haemorrhages noted. There are some areas of segmental dilated alveoli with free–floating septae and slit–like spaces. Representative sections from the kidneys show eosinophilic granular casts with indistinct cellular borders on the tubules. Some bile pigments within the tubules were also seen. Microsections taken from the adrenals show neoplastic cells infiltrating the parenchyma and fatty change. Microsections taken from the spleen show destroyed follicular architecture with oedema. Microsections taken form the aorta show mild atheromatous plaque.

AUTOPSY FINDINGS:
PATHOLOGIST'S SUMMARY: This is a case of a 27 year old male who presented with the above signs and symptoms which are compatible with carcinoma of the body and head of the pancreas. Grossly it is hard to determine the origin of the lesions but correlating it to the late onset of jaundice and the massive metastasis, the tumor could have started from the body of the pancreas since early involvement of the head produces early signs and symptoms. The distention of the Glisson's capsule and involvement of the large autonomic trunks in the preperitoneal tissue by the tumour produces the epigastric pain. The compression of the distal common bile duct by the tumour mass causes some degree of obstruction producing jaundice. The increased portal venous pressure produces ascites and pedal oedema. Hypoalbuminemia is a contributory factor. The dyspnea is explained by the invasion of the lungs by these neoplastic cells. Resorption of air distal to the lesion produces segmental atelectasis and compensatory emphysema in other areas.
The most common sites of metastasis in cancer of the pancreas are in the liver, regional lymph nodes, peritoneum and lungs. Other sites which are also involved with metastasis include the adrenals, duodenum, kidneys, stomach and gallbladder. This patient had metastases in the liver, peri–pancreatic lymph nodes, lungs and adrenals. The liver and lung metastases were quite extensive but the ultrasound of the liver only revealed diffuse parenchymal disease.
PROVISIONAL ANATOMIC DIAGNOSIS: Pancreatic carcinoma with metastasis to the liver and lungs Stress Ulcer Ascites Pulmonary congestion Cholemic Nephrosis Congestion, Spleen
FINAL ANATOMICAL DIAGNOSIS: WELL DIFFERENTIATED DUCTAL ADENOCARCINOMA, PANCREAS with metastasis to the peri–pancreatic lymph nodes, liver, lungs, tracheo–bronchial lymph nodes and adrenals Acute Tubular Necrosis, kidneys Stress Gastritis Congestion, Spleen Mild Atherosclerosis

Answers to Question 3(c)

These examples should be abstracted as follows:

N.	29/09/86	Path Report S–86–2607: Invasive ductal CA, breast mass, left 3.4 x 3 x2 cm; with invasion of surrounding fibrofatty tissue.
O.	18/06/87	Path Report S–87–2447: s/p MRM (R): Invasive ductal CA (R) breast *lower outer quadrant* (LOQ), 6 x 6 cm.; all 22 axillary lymph nodes negative for metastases.
P.	17/08/88	Path Report S–88–2889: Astrocytoma Grade III; 5 x 4 x 3 cm, left superior frontal cortical lesion.
Q.	20/12/87	Autopsy No. A–87–70: Well differentiated Ductal Adenocarcinoma, pancreas with metastases to peripancreatic LN, liver, lung, tracheo–bronchial LN, and adrenals In Section 3.3.4, this case would be entered as: 'Method of Detection = Autopsy'. Basis of diagnosis code would be: autopsy, with histology.

Appendix 3.1

Reportable list

This includes:

A. All carcinomas and sarcomas

B. All tumours specified as malignant in ICD-O (1990 edition)

C. All tumours not specified as malignant but with /3 behaviour codes

	Diagnosis	Morphology/ Behaviour codes
1.	Acute differentiated progressive histocytosis	M 9722/3
2.	Acute erythremia	M 9841/3
3.	Acute erythremia myelosis	M 9841/3
4.	Acute myelofibrosis	M 9932/3
5.	Acute panmyelosis	M 9931/3
6.	Acute progressive histiocytosis X	M 9722/3
7.	Adomantiroma of long bones	M 9261/3
8.	Adamantinoma, tibial	M 9261/3
9.	Adenoacanthoma	M 8570/3
10.	Adenocarcinoid tumour	M 8245/3
11.	Adenoma, bronchial, carcinoid	M 8240/3
12.	Adenoma, bronchial, cylindroid	M 8200/3
13.	Alpha heavy chain disease	M 9762/3
14.	Anaplastic choroid plexus papilloma	M 9390/3
15.	Angioendotheliomatosis	M 9712/3
16.	Askin's tumour	M 8803/3
17.	Astroblastoma	M 9430/3
18.	Astrocytoma	M 9400/3
19.	Astroglioma	M 9400/3
20.	Balloon cell melanoma	M 8722/3
21.	Basal cell epithelioma	M 8090/3
22.	Bednar tumour	M 8833/3
23.	Biphasic mesothelioma, NOS	M 9053/3
24.	Blastoma, NOS	M 8000/3
	Blastoma, pulmonary	M 8972/3
25.	Bowen's tumour	M 8081/2
26.	Burkitt's tumour	M 9677/3
	Burkitt's lymphoma	M 9687/3

27.	Carcinoid tumour (except Appendix)	M 8240/3
28.	Cervical intraepithelial neoplasia, Grade III	M 8077/2
	CIN III, NOS	M 80772/2
	CIN III, with severe dysplasia	M 80772/2
29.	Chain disease, gamma heavy	M 9763/3
30.	Chloroma	M 9930/3
31.	Chordoma	M 9370/3
32.	Chorioepithelioma	M 9100/3
	Chorionepithelioma	M 9100/3
33.	Chronic erythaemia	M 9842/3
34.	Cutaneous lymphoma	M 9709/3
35.	Cylindroma, NOS	M 8200/3
36.	Cyst, dermoid, with malignant transformation	M 9084/3
37.	Cystadenoma, papillary, borderline malignancy	M 8451/3
38.	Cystadenoma, mucinous, borderline malignancy	M 8473/3
39.	Cystadenoma, papillary pseudomucosis, borderline malignancy	M 8473/3
40.	Cystadenoma, papillary serose, borderline malignancy	M 8462/3
41.	Cystadenoma, pseudomucinous, borderline malignancy	M 8472/3
42.	Cystadenoma, serous, borderline malignancy	M 8442/3
43.	Dé Englielmo's disease	M 9841/3
44.	Diktyoma	M 9501/3
45.	Dysgerminoma	M 9060/3
46.	Embryonal hepatoma	M 8970/3
47.	Embryonal teratoma	M 9080/3
48.	Endodermal sinus tumour	M 9071/3
49.	Ependymablastoma	M 9392/3
50.	Ependymoma, NOS	M 9391/3
	– Epithelial ependymoma	M 9391/3
51.	Epithelial cell melanoma	M 8771/3
52.	Epithelioma, NOS	M 8011/3
53.	Erythroleukaemia	M 9840/3
54.	Erythroplasia, Queyrat's	M 8082/2
55.	Esthesio neuroblastoma	M 9522/3
55.	Esthesio neurocytoma	M 9521/3
56.	Esthesio neuroepithelioma	M 9522/3
57.	Ewing's tumour	M 9240/3
58.	Erythromammary Paget's disease (except Paget's disease of bone)	M 8542/3
59.	Extramedullary plasmocytoma	M 9731/3
60.	Franklin's disease	M 9763/3
61.	Ganglioneuroblastoma	M 9490/3
62.	Gemistocytoma	M 9411/3
63.	Germ cell tumour	M 9064/3
64.	Germinoma	M 9064/3
65.	Glioblastoma multiforme	M 9440/3
66.	Glioma, NOS (except nasal glioma)	M 9380/3
67.	Grawitz tumour	M 8312/3
68.	Hepatoblastoma	M 8970/3
69.	Hepatoma, NOS	M 8170/3
70.	Histiocytic medullary reticulosis	M 9720/3

71.	Histiocytosis X, acute progressive	M 9722/3
72.	Hodgkin's disease	M 9650/3
	Hodgkin's granuloma	M 9661/3
	Hodgkin's paragranuloma	M 9660/3
73.	Hutchinson's melanotic freckle, NOS	M 8742/3
74.	Hypernephroma	M 8312/3
75.	Immature teratoma	M 9080/3
76.	Immunocytoma	M 9671/3
77.	Immunoproliferative disease	M 9760/3
	Immunoproliferative small intestinal disease	M 9764/3
78.	Klatskin tumour	M 8162/3
79.	Krukenberg tumour	M 8490/6
80.	Langhanz, Wackernde struma	M 8332/3
81.	Lennert's lymphoma	M 9704/3
82.	Lentigo maligna	M 8742/2
83.	Letterer-Siwe's disease	M 9722/3
84.	Leukaemia	M 9800/3
85.	Linitis plastica	M 8142/3
86.	Lymphoblastoma	M 9685/3
87.	Lymphoepithelioma	M 8082/3
88.	Macroglobulinemia, Waldenstrom's	M 9761/3
89.	Medullary histiocytic reticulosis	M 9720/3
90.	Medulloblastoma	M 9470/3
91.	Medulloepithelioma, NOS	M 9501/3
92.	Medullomyoblastoma	M 9472/3
93.	Melanoma, NOS	M 8420/3
93.	Merkel cell tumour	M 8247/3
94.	Mesodermal mixed tumour	M 8951/3
95.	Mesonephroma, NOS	M 9110/3
96.	Mesothelioma, NOS	M 9050/3
97.	Microglioma	M 9594/3
98.	Mucocarcinoid tumour	M 8293/3
	Mullerian mixed tumour	M 8950/3
99.	Mycosis fungoides	M 8910/3
100.	Multiple myeloma	M 9732/3
	– Plasma cell myeloma	
	– Solitary myeloma	
	– Myelomatosis	
101.	Nephroblastoma, NOS	M 8940/3
102.	Nephroma, NOS	M 8940/3
103.	Neuroblastoma, NOS	M 9500
104.	Neuroectodermal tumour, primitive	M 9473/3
105.	Neuroepithelioma, NOS	M 9503/3
106.	Neurogenic tumour, olfactory	M 9520/3
107.	Non-Hodgkin lymphoma (see malignant lymphoma)	M 9591/3
108.	Non-lipid reticuloendotheliosis	M 9722/3
109.	Oligoastrocytoma	M 9382/3
110.	Oligodendroblastoma	M 9460/3
111.	Oligodendroglioma	M 9450/3

112.	Orchioblastoma	M 9071/3
113.	Paget's disease of breast	M 8540/3
114.	Pancreatoblastoma	M 8971/3
115.	Peripheral neuroectodermal tumour	M 9364/3
116.	Pheochromoblastoma	M 8700/3
117.	Pineablastoma	M 9362/3
118.	Plasma cell leukaemia	M 9830/3
119.	Plasma cell myeloma	M 9732/3
120.	Plasmocytic lymphoma	M 9671/3
121.	Plasmocytoma	M 9731/3
122.	Pleomorphic Xantho astrocytoma	M 9424/3
123.	Pneumoblastoma	M 8972/3
124.	Polyembryoma	M 9072/3
125.	Polymorphic reticulosis	M 9713/3
126.	Polyvesicular vitelline tumour	M 9071/3
127.	Precancerous melanosis, NOS	M 8741/2
128.	Primitive polar spongioblastoma	M 9443/3
129.	Pseudomyxoma peritonei	M 8480/6
130.	Pulmonary blastoma	M 8972/3
131.	Retinoblastoma	M 9510/3
132.	Rodent ulcer	M 8090/3
133.	Schminke tumour	M 8082/3
134.	Sclerosing tumour, nonencapsulated	M 8350/3
135.	Seminoma, NOS	M 9061/3
136.	Spermatocytoma	M 9063/3
137.	Spongioblastoma	M 9422/3
138.	Spongioneuroblastoma	M 9504/3
139.	Sympathicoblastoma	M 9500/3
140.	Sezary's syndrome	M 9701/3
141.	Systemic tissue mast cell disease	M 9741/3
142.	Teratoid medulloepithelioma	M 9502/3
143.	Teratoma, embryonal	M 9080/3
	– immature	M 9080/3
	– malignant	M 9080/3
	– with malignant transformation	M 9084/3
144.	True histiocytic lymphoma	M 9723/3
145.	VAIN, III	M 8077/2
146.	VIN, III	M 8077/2
147.	Vipoma	M 8155/3
148.	Wilms' tumour	M 8960/3
149.	Wuchernde Struma Langhans	M 8332/3
150.	Yolk sac tumour	M 9071/3

4
Coding

Section 3.3.5 describes the extracting and abstracting of information on the cancer diagnosis from medical records and other medical reports. Chapter 4 will deal with the next step of converting the actual diagnosis of cancer into coded form. Thorough and precise abstracting will simplify this phase of cancer registration considerably.

4.1
Classification

Although several medical classification systems exist, two will be discussed in this section because of their particular relevance to cancer registration:

- the International Classification of Diseases for Oncology (ICD–O) (WHO, 1976, 1990), and
- the International Classification of Diseases (ICD) (WHO, 1977, 1992, 1993, 1994)

The ICD is a classification system used by many developing and developed countries worldwide for morbidity (primary and secondary care) and mortality (cause of death) coding. It provides codes for all diseases and injuries currently known to man and as such is much more complete in scope than ICD–O. However, ICD codes provide less detail on specific diseases. For instance, ICD cancer codes generally identify only the behaviour and the site of the tumour.

ICD–O, on the other hand, was created specifically for describing cancers and allows for the coding of site (topography), cell type (morphology), behaviour, as well as grading or differentiation. ICD–O was designed in such a way that it may be converted to ICD, so that comparisons are possible between cancer data coded by the two systems.

In deciding which classification system to use for coding of tumours, the cancer registry must take into consideration the following factors:

- the degree of detail desired,
- internal comparability of long time series, and
- international comparability between registries.

As a minimum, cancer registries should classify tumours as to:

(i) their primary site or anatomical location,

(ii) their histological type or morphology, and

(iii) behaviour.

In order to do this it is highly recommended that the ICD–O be used. On the other hand, if the coding of causes of death is also done within the cancer registry, this must be done using the ICD, so that non–cancer deaths may be included.

4.2
The International Classification of Diseases for Oncology (ICD-0)

The International Classification of Diseases for Oncology (ICD–O) is an extension of the chapter on "Neoplasms" in the ICD (Chapter 2). It is widely accepted internationally, which permits comparison of data between registries all over the world. It also facilitates collaboration between these agencies.

The First Edition of ICD–O appeared in 1976 and was based on the 9th Revision of the ICD. The Second and most recent Edition of ICD–O (1990) is an extension of the 10th revision of the ICD. All reference to ICD–O in this Manual will be to the Second Edition (1990) unless otherwise specified. Where ICD–O codes are provided, these will be Second Edition codes first with First Edition codes listed in brackets.

Key features of the ICD–O will be discussed below. However, it is imperative that users of the ICD–O manual become familiar with its contents, especially the introduction, pp. i – xliii. It is recommended that paragraphs or

sections of the introduction to which a coder often refers be highlighted or marked in a special way to permit quick reference.

4.2.1 General Description of ICD–O

The ICD–O consists of five main sections:

(a) Instructions for use

(b) Topography, numerical list

This is a numerical list of four–character codes ranging from C00.0 to C80.9. The decimal point (.) indicates subdivisions or subsites of the three–character categories. The codes C00.0 to C80.9 are adapted from the ICD–10 neoplasms chapter. In ICD–10, these codes represent the location (topography) of the tumour and the behaviour of the tumour. In ICD–O, only the site of the tumour is indicated by the topography code; a separate digit is attached to the morphology code to denote the behaviour of the tumour.

(c) Morphology, numerical list

This numerical list of five–digit code numbers ranges from 8000/0 to 9989/1. The first four digits indicate the specific histology, and the fifth digit, after the slash, is the behaviour code.

A sixth digit may be added to the morphology/behaviour code to indicate grading or differentiation. For lymphomas or leukaemias, this sixth digit is used to identify T– and B–cell origin.

(d) Alphabetic index

This is a listing of terms describing topography, morphology, and selected tumour–like lesions and conditions.

For each term, a code is provided which begins with a "C" if the term describes a site, or an "M" if the term describes a histology. Note that although the "C" is an essential component of the four–character topography code, the "M–" shown in the alphabetical index is only an indication that the following five digits constitute the morphology code.

It should also be noted that terms in the alphabetical index are bold–faced only if three or more modifying terms are listed below it; therefore, the word "Abdominal" is bold–faced as it is followed by the modifiers "aorta", "esophagus", "lymph node" and "vena cava", but the word "Abducens nerve" is not bold–faced.

Terms describing topography and terms describing morphology are always separated by a space before and after each group.

Terms which may be confused with neoplasms (called tumour–like lesions and conditions) are listed in the index with an M and seven dashes (M———). This is a reminder to the coder that the diagnosis is not that of a cancer and therefore not normally considered reportable.

(e) Differences in morphology between first and second editions

4.2.2 Use of alphabetical index and numerical lists

The alphabetical index should always be used for coding. The numerical lists are provided for confirmation of codes found in the index and for decoding and retrieval.

4.2.3 ICD–O complete code

A tumour, to be completely identified using ICD–O, will be assigned a 10–character code, as in the following example:

Diagnosis	**Poorly differentiated squamous cell carcinoma of the cervix uteri, NOS**		
ICD–0 codes:	C53.9	M–8070/33	(T180.9 M–8070/33)
Description:	Topography	C53.9	4 characters
	Histology	M–8070	4 digits
	Behaviour	/3	1 digit
	Grade:	3	1 digit
		10 characters	

4.2.4 Meaning of "NOS" and how it is used

The acronym NOS means "Not Otherwise Specified". It is used extensively in ICD–O, and coders must be familiar with this convention.

In the numerical lists and in the alphabetical index, "NOS" is used to indicate to the coder

and to the decoder that other modifiers of the term are listed elsewhere.
In the alphabetical index, "NOS" is first listed, followed by the alphabetical listing of the modifying words or adjectives. The code number for "NOS" is assigned when a topographic or a morphological term is not modified or when its adjective is not listed elsewhere in the ICD–O. In the latter case, "NOS" has a meaning equivalent to "NEC" (Not Elsewhere Classified) in the ICD.

Examples:

- In the alphabetical index, "Papillary carcinoma" is followed by a list of modifying words, with their specific morphology code numbers. If the diagnosis is "Papillary carcinoma", assign morphology to M–8050/3 (Papillary carcinoma, NOS).
- If the diagnosis given is "Occult sclerosing papillary carcinoma", again assign morphology code number M–8050/3, since neither the term "occult" nor the term "sclerosing" is listed among the modifying terms for papillary carcinoma.

4.2.5 Format of the ICD–O terms

Coders will find it useful to understand the format of terms appearing in the numerical lists. Each topographic and morphological term is listed only once. The first listed term is the preferred term and is printed in bold type under a particular code. Synonyms are indented under the preferred (first) term. Other 'equivalent' terms are listed below the preferred term but are not indented.

Example:

- C75.1 (T194.3) Pituitary gland
  Pituitary, NOS
  Hypophysis
  Rathke's pouch
  Sella turcica
  Pituitary fossa

In this example, pituitary gland would describe all cases coded to C75.1 (T194.3). Its synonyms are "Pituitary, NOS" and "Hypophysis". Its topographical subdivisions are "Rathke's pouch", "Sella turcica" and "Pituitary fossa", all of which are assigned to the same topography category C75.1 (T194.3) in the alphabetical index.

4.2.6 Topography

In cancer registries, the topography code is used to *report the site of origin of the tumour or its primary site*, not the secondary or metastatic site(s). The following guidelines will assist coders in selecting the most appropriate topography code when only difficult or unclear diagnoses are available.

*(1) Ill–defined sites (Rule 2)**

Some tumour sites are described only as regions or ill–defined body sites, for example, "lower limb", "head", "abdomen", "arm"; the tissue in which the tumour originated is not specified and such sites may have several component tissues. When further precision is not available, ill–defined sites are coded to C76 (T195).

To assist coders, the ICD–O index lists in parentheses at ill–defined sites examples of common neoplasms which may arise in specific tissues of those sites and provides a more precise topography code. In these cases, the topography code number to be assigned depends on the morphology of the tumour.

Examples:

- Diagnosis: Melanoma of arm

  ICD–O index: Arm

  C76.4 (T195.4) NOS

  C44.6 (T173.6) NOS (carcinoma, melanoma, nevus)

  C49.1 (T171.2) NOS (sarcoma, lipoma)

Comment: the coder is guided by the index to select code C44.6 (T173.6) if the site "arm" is "Not Otherwise Specified" and the morphology is stated to be "melanoma". By referring to the Topography numerical list, the coder notes that C44.6 (T173.6) is the category for "skin" of arm.

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*Rules referenced in parentheses in sections 4.1.2 and 4.1.3 are ICD-0 Second Edition rules which have been summarized on pages xli–xliii of the Introduction to ICD–0 Second Edition.

- Given a diagnosis of "Fibrosarcoma of trunk", the primary site is "Connective tissue, trunk" C49.6 (T171.7) not Trunk NOS C76.7 (T195.8).

(2) Peripheral nerves and connective tissues

Peripheral nerves, C47.–, and connective tissues, C49.–, include a variety of tissues which were grouped together in one category, T171, of ICD–O First Edition. In the Second Edition, C47 includes autonomic nervous system, ganglia, nerve, parasympathetic nervous system, peripheral nerve, spinal nerve, sympathetic nervous system; C49 includes adipose tissue, aponeuroses, artery, blood vessel, bursa, connective tissue, fascia, fatty tissue, fibrous tissue, ligament, lymphatic, muscle, skeletal muscle, subcutaneous tissue, synovia, tendon, tendon sheath, vein, vessel. Not all of these terms are listed in the alphabetical index for all regions of the body. Coders should therefore refer to the Topography numerical list for precise coding.

Example:

- a tumour of the fascia of hand should be coded to C49.1 (T171.1) even though the terms fascia of hand are not located in the alphabetical index.

(3) Adjectival forms

In general, noun forms appear in the numerical list and alphabetical index. When a tumour site is described using an adjective, as in "pyloric" instead of "pylorus", the coder will have to convert the adjective to its noun form before locating the term in ICD–O.

(4) Prefixes (Rule 3)

Prefixes such as peri–, para–, pre–, supra–, infra–, etc. are often used with topographic sites and various organs of the body. A few are listed in ICD–O and given specific code numbers; for example, "Periadrenal tissue", "Peripancreatic tissue" and "Retrocaecal tissue" have been listed and assigned to category C48.0 (T158.0) "Retroperitoneum". In practice, the use of such prefixes indicates that the topographic site is ill–defined. It is therefore suggested that code C76 (T195) be used for ill–defined sites not listed in ICD–O. The same general rule should also be used for other imprecise designations such as in the "area of" or in the "region of" a topographic site.

(5) Malignant neoplasms overlapping site boundaries (Rule 4)

It is the objective of tumour registries to report all malignant tumours according to their site of origin (i.e. the organ or tissue where their growth began). As this is not always possible, special ".8, overlapping lesion" codes are available for most three-digit categories and within most groupings of codes by body system. These ".8" subcategories should be used when:

(a) a tumour overlaps* two or more ICD–O three-digit site categories, or four–digit subcategories within a three-digit site category,

– AND –

(b) it is not known where the tumour originated.

Example:

- a malignant tumour of "skin of earlobe and neck" describes a tumour of overlapping sites only if the tumour extends from one site (earlobe, C44.2) to the next (neck, C44.4), and the site of origin is not known. In this case, the overlapping lesion code C44.8 should be reported.

If there are two tumours, one of the earlobe and one of the neck, or if the sites mentioned are not contiguous, or if the site of origin is known, then the special ".8" code is not appropriate.

CAUTION: When an overlapping site combination is specifically indexed, as in "carcinoma of oesophagus and stomach C16.0", the code provided in the index must be given priority.

*Overlapping sites are sites which are next to one another (contiguous) and in which the tumour is continuous from one site to the other

(6) Topography codes for lymphomas (Rule 12)

Lymphomas usually arise from lymph nodes. Hence if no site is indicated with a diagnosis of lymphoma, code to C77.9 (T196.9) "Lymph node, NOS".

If multiple nodes are involved, code to C77.8 (T196.8) "Lymph nodes of multiple regions".

Approximately 25% of lymphomas arise from lymphatic cells in organs such as stomach, intestine, skin and breast. These are extranodal lymphomas and should be coded to the organ in which they arise, for example "Stomach" C16.9 (T151.9).

Remember that all attempts should be made to report the primary site of the tumour and not the site of biopsy or metastasis.

(7) Topography code for leukaemias (Rule 13)

All leukaemias except myeloid sarcoma and leukaemic reticulo-endotheliosis should be given the site code C42.1 "Bone marrow". Leukaemias are considered to be site-specific morphology terms (see 4.2.7 (5)).

(8) Topography code for unknown primary site

If the primary site of the tumour:

- is not specified or not known
- cannot be determined by the morphological description (e.g. lymphoma or leukaemia)

assign the topography code number C80.9 (T.199.9) "Unknown primary site".

4.2.7 Morphology

The morphology code number in ICD-O consists of four digits, a slash mark or solidus, and a fifth digit: ——/–. The first four digits indicate the histology of the tumour and the fifth digit represents its behaviour.

Together the morphology or histology of the tumour and its behaviour provide one of the most important items of medical information about a tumour. Registries using the more general ICD should note that the morphology codes from ICD-O have been incorporated in the Index of ICD to allow more complete tumour reporting.

Not all tumours are diagnosed microscopically by a pathologist. The diagnosis may be stated using non-specific terms instead of a specific histological type; for example malignant neoplasm, cancer, malignant tumour.In such cases, morphology code 8000/3 "Malignant neoplasm, NOS" is selected based on the physician's stated description.

*(1) **Behaviour codes (Rule 5)***

Behaviour refers to the degree of malignancy or how the tumour is expected to behave. ICD-O provides six one-digit codes for recording behaviour:

/0.....	Benign
/1.....	Uncertain whether benign or malignant Borderline malignancy Low malignant potential
/2.....	Carcinoma *in situ* Intraepithelial Noninfiltrating Noninvasive
/3.....	Malignant, primary site
/6.....	Malignant, metastatic site Malignant, secondary site
/9.....	Malignant, uncertain whether primary or metastatic site

Only behaviour digits /2 and /3 are routinely used in cancer registries. Behaviour code /0 may be used if a registry chooses to report certain benign tumours such as brain tumours. Some registries may also wish to register diagnoses of borderline malignancy, in which case /1 will be used. But codes /6 and /9 should never be used by cancer registries. The function of the registry is to identify primary malignancies. When only a metastatic site has been diagnosed, behaviour code /3 is used with topography code C80.9 (T199.9) "Unknown primary site". For example if a person has a carcinoma which has metastasized to the lung and the site of origin is unknown, the appropriate code is C80.9 (T199.9) "Unknown primary site" and M-8010/3 "Carcinoma, NOS".

Behaviour codes /6 and /9 are useful to pathologists wishing to identify all specimens as sites of primary tumour, extension or metastases.

(2) Morphology code matrix (Rule 5)

The morphology code numbers for terms in ICD–O can be easily understood by listing examples in a matrix form as shown in Table 1. In the first example, there are four terms with their morphology code numbers as printed in ICD–O. "Adenoma, NOS" is a benign tumour and has the behaviour code /0. "Adenocarcinoma, NOS" is the malignant equivalent of "Adenoma, NOS" and has the behaviour code of /3. "Adenocarcinoma, *in situ*" has the behaviour code of /2. "Bronchial adenoma" is a potentially malignant tumour, so a behaviour code of /1 is assigned to indicate that it is uncertain whether a particular bronchial adenoma will behave in a benign or a malignant manner.

In the second example in the matrix, (b), there are three terms listed at the four-digit morphology code number, 9130. "Hemangioendothelioma, benign" has the appropriate behaviour code of /0. Its malignant counterpart, "Hemangioendothelioma, malignant" or "Hemangioendothelial sarcoma" has the behaviour code for malignant tumours, /3. "Hemangioendothelioma, NOS", however, is assigned a behaviour code of /1, because it is uncertain whether a particular hemangioendothelioma, NOS will take a malignant or a benign course. The code number 9130/2 has not been used in the ICD–O.

In the third example in the matrix, (c), only one term, "Chordoma" is listed. The tumour is usually considered as malignant and has been assigned a behaviour code number of /3. Other numbers in the 9370 matrix code are available and could be used for appropriate diagnoses.

Any behaviour code may be attached to any four-digit morphology code number in the ICD–O; for example, if the in–situ form of a neoplasm is diagnosed, the behaviour code /2 is attached to the appropriate four-digit morphology code. The resulting combination of morphology/behaviour codes is valid whether or not it appears in the ICD–O Morphology numerical list.

If there is a conflict between the behaviour code specified by the ICD–O for a histological subtype and the behaviour described by a pathologist in the final pathological diagnosis, the pathological diagnosis generally takes precedence. For example, 'Malignant fibroma': Fibroma is assigned a behaviour code /0 in the ICD–O because it is a benign tumour. Its malignant counterpart is fibrosarcoma. However, since the pathologist designated the term malignant to describe fibroma, the behaviour code to be assigned in this case should be /3, since the pathological diagnosis takes precedence.

(3) Histological grading (Rule 6)

A one–digit code is provided to designate the grade or differentiation of malignant neoplasms. The histological grading code shown below is added to the five-digit morphology code, thus creating a complete six-digit code number, for example M–8040/32.

If a diagnosis indicates two different degrees of differentiation, the higher number grading code should be used. For example, "moderately differentiated squamous cell carcinoma with poorly differentiated areas" should be assigned the grading code 3; the complete code number is therefore M–8070/33.

Histological grading or differentiation refers to the degree or extent by which neoplastic cells have specialized characteristics of a particular tissue or organ. In general, the greater the differentiation, the more a tumour resembles the normal tissue from which it arose; the less differentiated, the more aggressive the tumour. The practice of grading varies among pathologists and many malignant tumours are not routinely graded. Individual registries must therefore decide whether they will use the sixth digit grading code.

For leukaemias and lymphomas, the sixth digit code is used to denote T– or B–cell origin (see 4.2.7 (9)).

Table 1 – Morphology and behaviour code matrix

5th digit behaviour code numbers				
Examples of four-digit morphology code numbers	/0 Benign	/1 Uncertain whether benign or malignant	/2 Carcinoma-*in-situ* Noninvasive Nonilfiltrating Intraepithelial	/3 Malignant primary site
(a) 8140	8140/0 Adenoma NOS	8140/1 Bronchial adenoma (C34.–) (T-162.–)	8140/2 Adenocarcinoma-*in-situ*	8140/3 Adenocarcinoma, NOS
(b) 9130	9130/0 Haemangioendothelioma, benign	9130/1 Haemangioendothelioma, NOS	9130/2	9130/3 Haemangioendothelioma, malignant
		Angioendothelioma		Haemangioendotheliosarcoma
(c) 9370	9370/0	9370/1	9370/2	9370/3 Chordoma

Table 2 - 6th digit code for histological grading and differentiation

Code No.		
1	Well differentiated	(Grade I)
2	Moderately differentiated	(Grade II)
3	Poorly differentiated	(Grade III)
4	Undifferentiated (Anaplastic)	(Grade IV)
9	Grade not determined, not stated or not applicable	

(4) Ca. in situ and CIN III

The term intraepithelial neoplasia has become widely accepted by cytologists and pathologists worldwide. When used in relation to the cervix uteri, the diagnosis "cervical intraepithelial neoplasia, grade III, (CIN III)" causes coding and reporting difficulties. CIN III, by definition, includes both carcinoma *in situ* (a reportable diagnosis) and severe dysplasia (a non–reportable diagnosis).

After consultation with experts in the field, the decision has been made that, for purposes of cancer registration, CIN III could be considered as synonymous with carcinoma *in situ*. The same guideline applies to the diagnosis of intraepithelial neoplasia in the vagina (VAIN III) and in the vulva (VIN III).

(5) Site–specific morphology terms (Rule 8)

Certain types of tumours arise exclusively or usually in specific organs or tissues. In other words, certain morphologies are site-specific.

Examples:

- hepatomas usually arise in the liver
- renal cell carcinomas usually arise in the kidney
- retinoblastomas usually arise in the retina
- follicular carcinomas usually arise in the thyroid

To assist coders, site–specific morphology terms have a topography code listed in parentheses beside them in the

numerical list and the alphabetical index. For example, cystadenofibroma is followed by the topography code for ovary, C56.9 (T183.0).

Use the topography code assigned to the morphology term when:

- no site is specified in the diagnosis, e.g. nephroblastoma, C64.9 (T189.0), kidney;
- the site given is an "ill-defined site", e.g. osteogenic sarcoma of arm, C40.0 (T170.4), bone of arm; or
- only a metastatic site is diagnosed, e.g. metastatic follicular carcinoma of femur, C73.9 (T193.9), thyroid gland.

DO NOT use the topography code assigned to the morphology term if:

- the site designated by the physician is different from the suggested T-site in ICD-O. For example, papillary cystadenocarcinoma of pancreas, C25.9 (T157.9), pancreas. In this case the suggested topography code C56.9 (T183.0), ovary, is ignored because the primary site of origin of the tumour is stated to be the pancreas.

(6) Pseudo-topographic morphology terms (Rule 9)

Certain neoplasms have morphological names which seem to imply a topographic location but these should not necessarily be coded to that site. For example, "Bile duct carcinoma" (M-8160/3) is a specific histology usually arising from the intrahepatic bile ducts of the liver, C22.1 (T-155.0). Do not code to bile duct C24.0 (T156.1) as primary site.

"Minor salivary gland" is a general term describing neoplasms of several histological types which can be found anywhere in the oral cavity and neighbouring organs. Coders should disregard the words "minor salivary gland" in a diagnosis and code to the more precise site and histology provided. For example "Minor salivary gland adenoid cystic carcinoma of the hard palate" should be coded to "Adenoid cystic carcinoma" M-8200/3, and "Hard palate" C05.0 (T145.2).

Use the topography code for oral cavity, C06.9 (T145.9) if no site of origin is given in a diagnosis.

(7) Compound morphology diagnoses (Rules 10 and 11)

Some tumours have more than one histological pattern and have been assigned special code numbers to show their compound nature.

Examples:

- embryonal carcinoma and teratoma, M-9081/3
- adenocarcinoma and squamous cell carcinoma, or adenosquamous carcinoma, M-8560/3
- basal-squamous cell carcinoma, M-8094/3
- papillary and follicular adenocarcinoma, M-8340/3

Compound morphology diagnoses are indexed in the ICD-O but not all combinations and permutations will appear. For example, "fibromyxosarcoma" is listed but the synonymous term myxofibrosarcoma is not listed. Coders must check all possible permutations before selecting a morphology code.

In cases where a single tumour is described by two or more adjectives which are normally assigned two or more morphology codes, SELECT THE HIGHER CODE NUMBER, as it is usually more specific. For example, a tumour described as a "transitional cell epidermoid carcinoma" should not be reported twice (once as a "transitional cell carcinoma", M-8120/3, and once as an "epidermoid carcinoma", M-8070/3). In this example only one tumour is reported. Select M-8120/3 as it is the higher, more specific number.

(8) Non-Hodgkin lymphomas

The greatest change and a major improvement from the First to the Second Edition of ICD-O is in the section on lymphomas. A reorganization and the addition of new terms and new

morphological categories simplify the task of coding. These improvements were made possible by the introduction of a Working Formulation (WF) for Non–Hodgkin Lymphomas (NHL). The WF is not a new classification but a means of translation between the more recognized classifications of NHL, for example, Rappaport, Dorfman, Lukes and Collins, Dr Lennert's Kiel classification, the British Lymphoma scheme (Dr Henry) and the WHO classification.

As shown in Table 3, the WF is divided into three main groupings: Low Grade, Intermediate Grade and High Grade. The Table shows the ten basic histological groups (A to J) of the WF and the equivalent terms in the Rappaport and Kiel classifications.

The WF is based primarily on the Lukes and Collins classification which groups lymphomas according to the cellular structure (small cells vs. large cells which may be either cleaved or non–cleaved).

Lymphomas are characterized by neoplastic proliferation of lymphocytes or histiocytes. The Rappaport classification is based on this terminology – the proliferation of either lymphocytes (lymphocytic lymphoma) or histiocytes (histiocytic lymphoma). The term "nodular" used in the Rappaport classification means the same as "follicular" used in the other classifications. The WF uses the term "follicular" in preference to "nodular" to indicate the architectural pattern.

Dr Lennert from Kiel, Federal Republic of Germany, used the terms centrocytic, which is equivalent to cleaved, and centroblastic, which is equivalent to non–cleaved.

Table 3. Non-Hodgkin lymphomas working formulation with related terms in Rappaport and Kiel classification and ICD-0 numbers

Working formulation Group terms	ICD-0 Code	Rappaport	Kiel
Low Grade			
A. Malignant lymphoma (ML) small lymphocytic plasmacytoid	9670/3 9671/3	Lymphocytic, wd. 9670/3 ML, plasmacytoid 9670/3	ML, lymphocytic 9670/3 ML, lymphoplasmacytic 9671/3
ML, consistent with chronic lymphocytic leukaemia (CLL)	9823/3		ML, consistent with CLL 9823/3
B. ML, follicular, small cleaved cell (FCC)	9695/3	ML, nodular lymphocytic wd. 9693/3, int. 9694/3	ML, centroblastic/centrocytic 9692/3
C. ML, follicular, mixed small cleaved and large cell	9691/3	ML, nodular mixed lymphocytic/histiocytic 9691/3	ML, centroblastic/centrocytic 9692/3
Intermediate Grade			
D. ML, follicular, large cell	9698/3	ML, nodular histiocytic 9698/3	ML, centroblastic, follicular 9697/3
E. ML, diffuse, small cleaved	9672/3	ML, diffuse lymphocytic, pd. 9672/3, int. 9673/3	ML, centrocytic 9674/3
F. ML, diffuse, mixed small and large cell	9675/3	ML, diffuse mixed lymphocytic/histiocytic 9675/3	ML, diffuse centroblastic centrocytic 9676/3

Table 3 contd.

Working formulation	ICD-0 Code	Rappaport	Kiel
G. ML, diffuse, large cell cleaved non/cleaved	9680/3 9681/3 9682/3	ML, diffuse, histiocytic 9680/3	ML, diffuse centroblastic 9683/3
High Grade			
H. ML, large cell, immunoblastic (diffuse)	9684/3	ML, diffuse, histiocytic 9680/3	ML, immunoblastic 9684/3 T-zone lymphoma 9703/3
I. ML, lymphoblastic (diffuse)	9685/3	ML, lymphoblastic, convoluted/non-convoluted 9685/3	ML, lymphoblastic 9685/3
J. ML, small, non/cleaved (diffuse)	9686/3	ML, undifferentiated, non-Burkitt's 9686/3	
Burkitt's	9687/3	ML, undifferentiated, Burkitt's 9687/3	Burkitt's type lymphoma 9687/3

Table 4 – 6th digit code for T–cell and B–cell designation for lymphomas and leukaemias

5	T–cell	
6	B–cell Pre–B B–Precursor	
7	Null cell Non T–non B	For leukaemias only
9	Cell type not determined, not stated or not applicable	

NHL can either be diffuse or follicular (nodular). Since the majority (85%) of NHL are diffuse, the NOS or unspecified lymphomas are grouped with the diffuse. For example, Malignant lymphoma, small cleaved cell, NOS has the same code as Malignant lymphoma, small cleaved cell, diffuse, M–9672/3.

For quick reference, all lymphomas are indexed under l–lymphoma, malignant in the alphabetical index.

T– or B–cell should not be coded unless the information is provided by a pathologist or in a marker study report.

(10) Multiple neoplasms (Rule 14)

It is quite possible for one person to develop more than one tumour. The second tumour may develop in the same organ, or elsewhere. It may be of the same histological type as the first tumour, or quite different. Such 'multiple tumours' may appear at more or less the same time or be separated by an interval. The increasingly intensive investigation and follow–up of the cancer patient (so that small or minimal lesions are detected), the use of treatments which are of themselves carcinogenic, and the prolongation of survival have led to the more frequent recognition of multiple primary tumours in the same individual.

The problem for the cancer registry is to decide whether the second tumour is a 'new' cancer – which is to be registered – or an extension or recurrence of the first cancer which is already registered. The registry should have clear procedures for coding and reporting multiple tumours.

For purposes of consistency and comparability of data between different registries, it is essential that similar rules are used. IARC and IACR have developed a set of rules which can be used in com-

parative studies. These rules are simple to apply, and relatively conservative in classifying fewer multiple cancers as second primaries than many other schemes. Because of this feature, it should be easy for registries to recode second primaries, as defined by their own rules, according to the IARC/IACR criteria, when the data are to be used for inter-registry comparisons. These rules are as follows:

(a) The recognition of the existence of two or more primary cancers does not depend on time.

(b) A primary cancer is one which originates in a primary site or tissue and is thus neither an extension, a recurrence nor a metastasis.

(c) Only one tumour shall be recognized in an organ or pair of organs or tissue. For tumours where site is coded by the First Edition of ICD-O (or by ICD-9) an organ or tissue is defined by the different three digit codes.

ICD-O (Second Edition) and ICD-10 have a more detailed set of topography codes. Some goups of codes are considered to be a single organ for the purposes of defining multiple tumours. These topography code groups are shown in Table 5.

Multifocal tumours – that is, discrete masses apparently not in continuity with other primary cancers originating in the same primary site or tissue (e.g. bladder), are thus counted as a single cancer.

(d) Rule (c) does not apply in two circumstances:

(i) For systemic or multicentric cancers potentially involving many discrete organs. Three histological groups – lymphomas, leukaemias and Kaposi's sarcoma (groups 7,8 and 9 in Table 6) – are included. They are counted only once in any individual.

(ii) Other specific histologies – groups 1,2,3,5 and 6 in Table 6 – are considered to be different for the purpose of defining multiple tumours. Thus, a different 'cancer' in the same organ is counted as a new tumour. Groups 4 and 10 include tumours which have not been satisfactorily typed histologically, and cannot therefore be distinguished from the other groups.

Table 5. Groups of topography codes from ICD-0 second edition which are considered a single site, in the definition of multiple cancers

C01 C02	Base of tongue Other & unspecified parts of tongue	(ICD-O-1 141)
C05 C06	Palate Other and unspecified parts of mouth	ICD-O-1 145)
C07 C08	Parotid gland Other and unspecified major salivary glands	(ICD-O-1 142)
C09 C10	Tonsil Oropharynx	(ICD-O-1 146)
C12 C13	Pyriform sinus Hypopharynx	(ICD-O-1 148)
C19 C20	Rectosigmoid junction Rectum	(ICD-O-1 154)
C23 C24	Gallbladder Other and unspecified parts of biliary tract	(ICD-O-1 156)
C30 C31	Nasal cavity and middle ear Accessory sinus	(ICD-O-1 160)
C33 C34	Trachea Bronchus and Lung	(ICD-O-1 162)
C40 C41	Bones, joints & articular cartilage of limbs Bones, joints & articular cartilage of other & unspec. sites	(ICD-O-1 170)
C60 C63	Penis Other and unspecified male genital organs	(ICD-O-1 187)
C64 C65 C66 C68	Kidney Renal pelvis Ureter Other and unspecified urinary organs	(ICD-O-1 189)
C74 C75	Adrenal gland Other endocrine glands and related structures	(ICD-O-1 194)

Table 6. Group of malignant neoplasms considered to be histologically 'different' for the purpose of defining multiple tumours (adapted from Berg, 1994)

Group		
	Carcinomas	
1	Epidermoid carcinomas	805–813
2	Adenocarcinomas	814,816,818–822,825–850,852–855, 857, 894
3	Other specific carcinomas	803–804, 815, 817, 823, 824,851,856, 858–867
4	Unspecified ('Carcinomas NOS')	801–802
5	Sarcomas & other soft tissue tumours	868–871,880–892, 899, 904,912–913, 915–934, 937,954–958
6	Other specified types of cancer	872–879,893,895–898, 900–903,905–911, 935–936, 938–953, 972–974 (976 for ICD–O–2 only)
7	Lymphomas	959–971 (975 for ICD–O–1 only)
8	Leukaemia	980–994
9	Kaposi's sarcoma	914
10	Unspecified types of cancer	800 (999 for ICD–O–1 only)

The numbers in parentheses refer to the first 3 digits of the ICD–O morphology code.

The groups numbered 1, 2, 3, 5, and 6 are considered specific histologies and thus are 'different' for the purpose of determining multiple tumours.

Example:

- Squamous cell carcinoma, nasopharynx

  Metastatic adenocarcinoma, supraclavicular lymph node.

These are considered two different histological types (groups 1 and 2) and thus are considered two different tumours.

On the other hand, the groups numbered 4 and 10 are not specific. They include tumours which have not been satisfactorily typed histologically (carcinoma, not otherwise specified or neoplasms, NOS or malignancy, NOS). Thus they cannot be considered as separate or distinct from the other groups.

Example:

- Carcinoma, NOS, cervix uteri

  Adenocarcinoma, endocervix

These cannot be considered as two different tumours because carcinoma, NOS cannot be separate from the specific histology, adenocarcinoma.

(a) Multifocal tumours

Tumours are multiple, discrete, and apparently not in continuity with the other similar primary tumours originating in the same primary site or tissue.

Example:

- bladder tumours or skin tumours.

(b) Multicentric tumours

Primary cancer originating in different parts of the lymphatic or haematopoietic tissue.

Multifocal as well as multicentric tumours would only be counted once, unless of 'different' histology.

For each independent cancer, a separate registry abstract is prepared, assigning the same patient registry number but with a higher sequence number.

(c) Sequence number

Sequence number refers to the order in which a primary malignancy is discovered in relation to the total number of primaries for a given patient. For example: the first primary tumour has a sequence number of 1; the second primary tumour has a sequence number of 2, and the third has a sequence number of 3. If multiple primaries are diagnosed simultaneously, assign lower sequence number to the tumour with the poorest prognosis and/or furthest extent of disease.

CODING EXERCISES

For the six sample cases described below, select the primary site of the malignancy and code according to ICD–O topography. The answers follow the exercises.

1. A 55-year old male complained of productive cough and chest pain, of 2 months duration. The patient is a

known smoker consuming about 1 pack of cigarettes daily since age 20. Physical examination revealed 1 x 1 cm firm to hard, fixed node on the left supraclavicular region. Chest X-ray revealed a pulmonary mass on the left upper lobe. Biopsy of the supraclavicular lymph node revealed metastatic squamous cell carcinoma, probable lung primary.

Primary site:

ICD-O T-code:

2. The final diagnosis on a pathology report is malignant lymphoma, lymphocytic, poorly differentiated, ileum.

Primary site:

ICD-O T-code:

3. A 40-year old female was found to have a 3 x 5 cm mass on the upper outer quadrant of the left breast, associated with a 2 x 2 cm mass on the left axilla. Section biopsy of the mass, left breast, revealed invasive duct carcinoma.

Primary site:

ICD-O T-code:

4. A 25-year old female had a violaceous soft tissue mass on the right shoulder region of 6 months duration. The mass gradually increased in size. About 2 months later she noted other similar masses at the arm and axilla. Biopsy of the mass on the right shoulder region revealed malignant haemangioendothelioma.

Primary site:

ICD-O T-code:

5. Ultrasonography of the liver in a 25-year old male complaining of right upper quadrant pain and abdominal enlargement revealed a solid mass measuring about 5 x 5 cm at the inferior portion of the right lobe of the liver. Other solid masses were noted on both lobes of the liver. Ultrasound-guided liver biopsy revealed hepatocellular carcinoma.

Primary site:

ICD-O T-code:

6. Pathological diagnosis: Metastatic follicular carcinoma of lung.

Primary site:

ICD-O T-code:

Code the following diagnoses according to ICD-O Topography and Morphology:

7. Secondary melanoma of liver.

ICD-O T-code:

ICD-O M-code:

8. Neuroblastoma.

ICD-O T:

ICD-O M:

9. Central giant cell granuloma of left leg.

ICD-O T:

ICD-O M:

Determine whether each of the following cases should be reported as multiple primaries or as one tumour only:

10. Carcinoma, appendix.

Carcinoma, descending colon.

Number of primaries reported:

11. Carcinoma, left breast.

Carcinoma, right breast.

Number of primaries reported:

12. Papillary serous cystadenocarcinoma, right ovary. Immature teratoma, left ovary.

Number of primaries reported:

13. Adenocarcinoma of lung.

Carcinoma of lung, 5 years later.

Number of primaries reported:

14. Basal cell carcinoma, skin, nose.

Basal cell carcinoma, skin, cheek.

Number of primaries reported:

15. Poorly differentiated lymphocytic lymphoma, ascending colon (July 1987).

Mucinous adenocarcinoma, sigmoid colon (April 1989). Number of primaries reported:

16. Invasive duct carcinoma, left breast (1981).

Metastatic ductal carcinoma, left supraclavicular region, probable breast origin (1981).

Number of primaries reported:

17. Papillary carcinoma and follicular carcinoma co-existing in the same mass, right lobe, thyroid gland.

Number of primaries reported:

ANSWERS

1. Left lung, upper lobe C34.1 (T162.3)

   (The mass on the left supraclavicular region was specified as metastatic)

2. Ileum C17.2 (T152.2)

   (Ileum is an extranodal site of malignant lymphoma)

3. Left breast, upper outer quadrant C50.4 (T174.4)

4. Soft tissue, right shoulder region C49.1 (T171.2)

5. Liver C22.0 (T155.0)

6. Thyroid gland C73.9 (T193.9)

   (Lung is NOT correct – it is the site of metastasis. In the ICD–O alphabetical index, the code C73.9 (T193.9) is given after Carcinoma, follicular, NOS, indicating that follicular carcinoma is a site–specific morphology to be reported as a primary of thyroid gland unless a different primary site is specified.)

7. ICD–O T C80.9 (T199.9) M–8720/3

8. ICD–O T C80.9 (T199.9) M–9500/3

9. This is a non–reportable diagnosis.

10. One tumour. According to the rules for multiple neoplasms only one tumour shall be recognized if arising in the same three-digit site (Appendix C18.1 (T153.5) and Descending colon C18.6 (T153.2)) and if the histologies are the same (Carcinoma M–8010/3).

11. Only one tumour. Even though the tumour arose bilaterally, the site codes C50.9 (T174.9) are the same at the three-digit level; the morphology codes are the same; and the existence of two or more primary tumours does not depend on time.

12. Two tumours. The tumour histologies are considered different: Papillary serous cystadenocarcinoma, M–8460/3, is from Group 2 and Immature teratoma, M–9080/3 from Group 6.

13. One tumour. The sites are the same, and Carcinoma NOS is considered the same as the more specific Adenocarcinoma.

14. One tumour. Sites are the same at the three-digit level and morphologies are the same. Also, this is considered a multifocal tumour and as such should be counted only once.

15. Two tumours. Although the sites are the same at the three-digit level (C18.2 (T153.6), Ascending colon, and C18.7 (T153.3) Sigmoid colon), there are two different or separate histological types: M–9672/3 (M–9630/3), Poorly differentiated lymphocytic lymphoma from Group 7, and Mucinous adenocarcinoma M–8480/3 from Group 2.

16. One tumour. The metastatic tumour is considered to have arisen from the first reported primary (1981).

17. One tumour. This is considered a tumour of compound morphology and is assigned code M–8340/3 (Papillary and follicular carcinoma). It is also site-specific to the thyroid gland.

4.3 The International Classification of Diseases (ICD)

The ICD is the principal classification system used internationally for classifying diseases. It was originally known as the International List of Causes of Death. Its name was changed to the International Classification of Diseases when the need for classifying causes of illness as well as death was recognized (1948, Sixth Revision). Publication of the ICD has been the responsibility of the World Health Organization (WHO) since WHO's creation after the Second World War. The ICD is revised approximately every ten years, and while the Ninth Revision (ICD–9) is still largely in use, many countries are changing or will soon change to the Tenth Revision (ICD–10).

The purpose of this section is to present a general overview of the ICD, with special emphasis on the neoplasms chapter from which the ICD–O topography axis is derived. Because section 4.2 provides a detailed description of the Second Edition of ICD–O, this section will deal with its parent classification, the ICD–10, rather than ICD–9. The basic structure of the neoplasms chapter of the ICD has remained unchanged over the more recent revisions, and it is intended here to provide cancer registries with a useful reference to the general characteristics of the ICD. Those persons wishing

to do statistical analyses over time (trends) are advised to review and compare in detail each revision in use during the period being studied.

With the Tenth Revision, the title of the classification has been changed to 'International Statistical Classification of Diseases and Related Health Problems' although it will continue to be referred to as the 'ICD'.

ICD–10 consists of a three-volume set:

- Volume 1: Tabular List
- Volume 2: Instruction Manual
- Volume 3: Alphabetical Index ICD–10 contains 21 chapters based on:
- aetiology, for example Chapter 1 – Certain infectious and parasitic diseases;
- anatomy, for example Chapter 10 – Diseases of the respiratory system;
- circumstances, for example Chapter 15– Pregnancy, childbirth and the puerperium.

See Table 7 for a listing of chapters.

Table 7. Chapters of ICD–10

Chap.	
I	Certain infectious and parasitic diseases (A00–B99)
II	Neoplasms (C00–D49)
III	Diseases of the blood and blood–forming organs and certain disorders involving the immune mechanism (D50–D99)
IV	Endocrine, nutritional and metabolic diseases (E00–E99)
V	Mental and behavioural disorders (F00–F99)
VI	Diseases of the nervous system (G00–G99)
VII	Diseases of the eye and adnexa (H00–H49)
VIII	Diseases of the ear and mastoid process (H50–H99)
IX	Diseases of the circulatory system (I00–I99)
X	Diseases of the respiratory system (J00–J99)
XI	Diseases of the digestive system (K00–K99)
XII	Diseases of the skin and subcutaneous tissue (L00–L99)
XIII	Diseases of the musculoskeletal system and connective tissue (M00-M99)
XIV	Diseases of the genitourinary system (N00–N99)
XV	Pregnancy, childbirth and the puerperium (000–O99)
XVI	Certain conditions originating in the perinatal period(P00–P99)
XVII	Congenital malformations, deformations, and chromosomal abnormalities (Q00–Q99)
XVIII	Symptoms, signs and abnormal clinical and laboratory findings not elsewhere classified (R00–R99)
XIX	Injury, poisoning and certain other consequences of external causes (S00–T99)
XX	External causes of morbidity and mortality (V00–Y99)
XXI	Factors influencing health status and contact with health services (Z00–Z99).

ICD–10 codes are alphanumeric, the first character being a letter and the remaining characters, numbers. The use of an alpha character is a major change from the previous ICD revisions and serves to double the size of the classification.

The majority of chapters have been assigned a unique letter which provides 100 three–character codes, for example Chapter VI, "Diseases of the nervous system", has been assigned categories G00–G99. The neoplasms chapter has been assigned 150 three–character categories and it shares the letter D with "Diseases of the blood and blood–forming organs and certain disorders involving the immune mechanism". The letter U has been reserved for future additions and changes and for possible individualized assignment at the national level.

Within chapters the three-character categories are grouped into blocks containing similar disease entities. Within the blocks, each three-character category may be further sub-divided into four-character codes for additional detail. Table 8 shows the broad groups or blocks within Chapter II, 'Neoplasms'. Notice that neoplasms are grouped first according to behaviour (malignant C00–C97, *in situ* D00–D09, benign D10–D36, and un-certain and unknown behaviour D37–D48).

Table 8. Chapter II: Neoplasms (C00-D48)

C00–C75	Malignant neoplasms of specified sites, except of lymphoid, haematopoietic and related tissue	
	C00–C14	Lip, oral cavity and pharynx
	C15–C26	Digestive organs
	C30–C39	Respiratory and intrathoracic organs
	C40–C41	Bone and articular cartilage
	C43–C44	Melanoma and other malignant neoplasms of skin
	C45–C49	Mesothelial and soft tissue
	C50	Breast
	C51–C58	Female genital organs
	C60–C63	Male genital organs
	C64–C68	Urinary tract
	C69–C72	Eye, brain and other parts of central nervous system
	C73–C75	Thyroid and other endocrine glands
C76–C80	Malignant neoplasms of ill–defined, secondary and unspecified sites	
C81–C96	Malignant neoplasms of lymphoid, haematopoietic and related tissue	
C97	Malignant neoplasms of independent (primary) multiple sites	
D00–D09	*In situ* neoplasms	
D10–D36	Benign neoplasms	
D37–D48	Neoplasms of uncertain and unknown behaviour	

It is important to be familiar with the differences between ICD–10 and ICD–O if comparing data collected by the two systems. Specific features of ICD–10 and how these features differ in ICD–O are discussed below.

4.3.1 Differences between ICD-0 and ICD-10

The differences between ICD–O and ICD–10 are detailed on pages xii–xiv of the Second Edition of ICD–O. Because of their importance they are reproduced here to assist those who wish to:

- use both systems to code cancer registry data,
- compare data from the two systems, or
- use coded cause of death information (which is coded only to ICD–10).

There are basic differences between the structure of ICD–O and that of ICD. Chapter II, "Neoplasms", of ICD is basically a topography code that takes into account the behaviour of the neoplasm, i.e., malignant, benign, *in situ*, or uncertain whether malignant or benign, by using a specific block of categories to identify each of these types of behaviour. ICD–O has one set of four characters for topography based on the malig-nant neoplasm section of ICD–10, and the behaviour code, incorporated in the morphology field identifies whether the neoplasm is malignant, benign, etc.

Table 9 shows the correspondence between the behaviour code of ICD–O and the different sections of Chapter II of ICD–10. This table may be used by cancer registry personnel as a basic editing tool to check that there is general agreement between the ICD–O and ICD–10 codes assigned to the same diagnosis. For example, a case coded to ICD–O behaviour digit /2 could only have an ICD–10 code in the range D00–D09.

Table 9. ICD-0 morphology and corresponding section of ICD-10, Chapter II.

Behaviour code	Category	Term
/0	D10–D36	Benign neoplasms
/1	D37–D48	Neoplasms of uncertain and unknown behaviour
/2	D00–9	*In situ* neoplasms
/3	C00–C76, C80–C97	Malignant neoplasms, stated or presumed to be primary
/6	C77–C79	Malignant neoplasms, stated or presumed to be secondary

The ICD–10 alphabetical index has under the word "Neoplasm" a table of five columns with the following headings: Malignant, Secondary or metastatic, *In situ*, Benign, Uncertain and unknown behaviour, and listing the appropriate ICD–10 category for each site of the body in alphabetical order.

For example, the entry for lung is:

LUNG	
Malignant	C34.9
Secondary or metastatic	C78.0
In situ	D02.2
Benign	D14.3
Uncertain and unknown	D38.1

In ICD–10 five different categories of four characters each are therefore needed to describe all lung neoplasms. In ICD–O there is only one topography code (C34.9) for lung: the behaviour code is part of the morphology code denoted by the letter M and changes according to the nature of the tumour. For example in ICD–O, malignant neoplasm of the lung, e.g. Carcinoma, is coded C34.9, M–8010/3; a benign neoplasm of lung, e.g., Adenoma, is denoted C34.9, M–8140/0. Note that the topography code (C34.9) remains the same for both. In ICD–10 the benign neoplasm would be coded D14.3. Another fundamental difference between ICD and ICD–O is that very few histological types are identified in ICD. There is no way to distinguish between an Adenocarcinoma of the lung and a Squamous cell carcinoma of the lung. Both would be coded to C34.9 in ICD–10. In ICD–O an Adenocarcinoma of lung would be coded C34.9, M–8140/3 whereas a Squamous cell carcinoma of lung is C34.9, M–8070/3. Until the publication of ICD–10, there were only four histological types of malignant tumour with their own ICD categories: Lymphomas, Leukaemias, Melanoma of skin and Choriocarcinoma. However, in ICD–10 several more categories based on histological type have been added, principally Mesothelioma (C45) and Kaposi's sarcoma (C46). In addition, liver cancer (C22) has been divided into 'subsites' comprising morphological entities.

4.3.2 ICD-0 categories not used in ICD-0, Second Edition

As noted previously, the ICD–10 categories C00–C97 include a few categories which are either based on morphology or denote metastatic or secondary neoplasms which are taken care of by the behaviour code in ICD–O. The ICD–10 categories omitted from the topography section of ICD–O are:

ICD-0 category	Term	Equivalent ICD-0 behaviour code
C43	Melanoma of skin	/3
C45	Mesothelioma	/3
C46	Kaposi's sarcoma	/3
C78	Secondary malignant neoplasms of respiratory and digestive systems	/6
C79	Secondary malignant neoplasm of other specified sites	/6

C81–C96	Malignant neoplasms of lymphoid, haematopoietic and related tissue	/3
C97	Malignant neoplasms of independent (primary) multiple sites	/3
D00–D09	*In Situ* neoplasms	/2
D10–D36	Benign neoplasms	/0
D37–D48	Neoplasms of uncertain and unknown behaviour	/1

The C81–C96 section of ICD–10 is used for malignant neoplasms stated or presumed to be primary in lymphoid, haematopoietic and related tissue. In ICD–O these are assigned specific morphology code numbers and the behaviour code /3, combined with the appropriate topography code in the range C00–C80. For example, Lymphocytic lymphoma of the stomach is coded C83.0 in ICD–10 but in ICD–O the topography would be coded Stomach C16.9 and the morphology M–9670/3.

The C97 category in ICD–10 is not included in ICD–O as each multiple site is usually coded separately.

4.3.3 *Special Codes in ICD–O for Topography of Lymph Nodes (C77) and Haematopoietic and Reticuloendothelial Systems (C42)*

In ICD–10 the category C77 is used for Secondary and unspecified malignant neoplasms of lymph nodes; the same code number is used for both primary and metastatic neoplasms of lymph nodes in ICD–O. Thus, most of the malignant lymphomas (C81–C85) in ICD–10 are coded to the topography code number C77 in ICD–O.

C42 is an unused category in ICD–10 that is used in ICD–O to designate several topographic sites within the haematopoietic and reticuloendothelial system. This category is used principally as the topography site for most of the leukaemias C42.1 (bone marrow) and related conditions which are coded C90–C95 in ICD–10. The listing for C42 in ICD–O is as follows:

C42 haematopoietic and reticuloendothelial systems	
C42.0	Blood
C42.1	Bone marrow
C42.2	Spleen
C42.3	Reticuloendothelial system, NOS
C42.4	Haematopoietic system, NOS

For example, Chronic lymphocytic leukaemia is coded C91.1 in ICD–10 whereas in ICD–O it is coded C42.1 (topography for bone marrow), M–9823/3 (to denote chronic lymphocytic leukaemia).

The ICD–10 category for malignant neoplasm of spleen (C26.1) does not appear under digestive organs in ICD–O, Second Edition. Following the practice of ICD–O, First Edition, the spleen is assigned code C42.2, under the Haematopoietic and Reticuloendothelial system.

4.3.4 *Hydatidiform Mole and Neurofibromatosis (von Recklinghausen's Disease except bone)*

The final differences between ICD–O and Chapter II of ICD–10 are that "Hydatidiform mole, NOS", C58.9 M–9100/0 in ICD–O, is not classified in Chapter II, "Neoplasms", of ICD–10 but in Chapter XV, "Pregnancy, childbirth and the puerperium" (Category O01.9, Hydatidiform mole), and Neurofibromatosis including Von Recklinghausen's disease except of bone, M–9540/1 in ICD–O, appears in Chapter XVII "Congenital malformation" as category Q85.0.

4.4 Staging

Staging is the attempt to assess the size of a tumour and its extent of involvement throughout the body. It is a simple, clear way of assigning patients to groups which differ in the extent of their disease.

There are several reasons for staging of tumours:

(1) Staging sorts individuals into groups which can be compared, from a local to an international level.

(2) It helps in comparisons of outcome – for example the results of different treatments in groups of patients. Such comparisons should be made between patients with a similar extent of disease at diagnosis.

(3) Staging helps in planning appropriate treatment for cancer patients.

(4) It assists in prognosis (description of the likely outcome of the disease, e.g., survival).

4.4.1 Staging systems

There are many different staging systems, some of which are general (apply to all types of tumours), and some of which are specific to certain types of tumours. Examples of staging systems are:

TNM Staging System: this was introduced by the International Union Against Cancer (UICC) and the American Joint Committee on Cancer (AJCC) (see section 4.4.2).

SEER Summary Staging: developed by the Surveillance Epidemiology and End Results (SEER) program of the National Cancer Institute of the USA.

FIGO Staging System: developed by the International Federation of Gynecology and Obstetrics for staging of female reproductive site cancers.

Dukes' Staging System: a staging system for colon and rectum based on the depth of invasion into the intestinal wall and the presence of lymph node involvement.

Clark's level: a pathological staging system for melanoma, skin, based on the depth of invasion into the different layers of the skin.

Breslow's: this is also a pathological staging system for melanoma, skin, measuring thickness of the tumour in millimetres.

Jewett/Marshall: a pathological system for bladder cancer based on the depth of invasion into the bladder wall.

American/Whitmore: a staging system used for prostate cancer, based on extent and site of the tumour.

Ann Arbor: a staging system for lymphomas (Hodgkin's disease and non-Hodgkin lymphoma) based on lymph node and visceral involvements.

Smith/Skinner: a staging system for cancer of the testis.

Jackson: a staging system for cancer of the penis.

National Wilms's Tumour Study Group: a staging system for Wilms's tumour of the kidney.

The staging system used may vary from registry to registry. It is important that the system used by a particular registry be specified and guidelines should be clearly written. A simple classification which may be used by population-based registries to describe the extent of spread of a particular cancer may be limited to:

In-situ

Localized

Regional

Distant

Unknown

The stage of disease is assigned after the extent of the tumour in the body has been determined. This requires:

(1) Determination of the site of origin (primary site)

(2) Review of:
- History
- Physical examination
- X-rays/scans and other imaging techniques endoscopy reports
- Operative reports
- Pathology reports (including cytology, haematology, surgical pathology and autopsy)
- Progress notes
- Discharge summary

Many staging systems are concerned with the clinical (pre-treatment) assessment of the extent of spread of the tumour, for example the American Joint Committee on Staging and the International Union Against Cancer (TNM system). The staging is therefore based on all available diagnostic evidence prior to the start of treatment.

Other staging systems are based on all available diagnostic and therapeutic evidence obtained during the first course of treatment, which includes the operative findings as well as pathological reports following surgery.

The summary stage should be determined after considering all the available information pertaining to the degree of spread of the tumour from the history, physical examination, laboratory results, radiological findings, endoscopic and operative findings, and pathological reports.

In the next sections, two of the more common staging systems used will be presented, namely the TNM Staging System and Summary Staging.

4.4.2 The TNM Staging System

A classification scheme used frequently for clinical staging is the TNM classification, which attempts to define the primary site by extent, degree of nodal disease and presence or absence of distant metastasis.

The TNM classification was promulgated by the International Union Against Cancer (UICC), through its Committee on Clinical Stage Classification and Applied Statistics (1954), later known as the TNM Committee. The American Joint Committee on Cancer (AJCC) organized in 1959 as the American Joint Committee for Cancer Staging and End-Results Reporting also decided to use the TNM system in describing the anatomical extent of the tumour prior to treatment. However, there were some instances when the recommendations of these two committees regarding staging have not been uniform. In the latest revision (the third edition) of the "Manual for Staging of Cancer" (AJCC, 1988), efforts have been made to reach uniform recommendations of the two groups in order to arrive at a single staging scheme which can be used all over the world.

The primary basis for TNM staging is the anatomical extent of the tumour. However, for some tumours, the histological grading (soft tissue sarcomas) and age (thyroid cancer) are also important considerations.

The TNM staging system describes the anatomical extent of the disease based on three elements: T, N, and M.

- "T" stands for the primary tumour. The letter T is followed by a number, the suffix, to describe increasing sizes of the tumour and/or involvement by direct extension, e.g., T0, T1, T2, T3, etc.
- "N" stands for regional lymph node involvement. The letter N is followed by a number, the suffix, to describe the absence of involvement or the increasing degree of involvement of these lymph nodes (e.g., N0, N1, N2, etc.)
- "M" refers to distant metastasis. There are two suffixes, 0 and 1, to describe the absence of such metastasis (**M0**) or their presence (**M1**).

The general classification rules for all sites are as follows:

(1) All cases should be confirmed histologically. Cases not confirmed must be reported separately.

(2) Four classifications are described for each site, namely:

Clinical classification designated as **cTNM**: uses all information available prior to the first definitive treatment, including evidence arising from physical examination, imaging, endoscopy, biopsy, surgical and other relevant findings.

Pathological Classification (**pTNM**): uses all information acquired before treatment, supplemented or modified by evidence from pathological examination of the resected specimen. This entails the pathological assessment of the primary tumour (pT), the regional lymph nodes (pN) and distant metastasis (pM).

Retreatment Classification (**rTNM**): uses all information available at the time of re-treatment (further definitive treatment planned after a disease free interval), to stage a recurrent tumour. Microscopic confirmation of the recurrence is necessary.

Autopsy Classification (**aTNM**): a classification used only when the cancer is first diagnosed at autopsy; uses all

pathological information following a post-mortem examination.

(3) After the T, N and M or pT, pN and pM have been determined these may be grouped into stages, which are more or less similar with respect to survival.

The **stage groupings** are:

Stage 0 (*in situ*)

Stage I

Stage II

Stage III

Stage IV

Once established, the TNM classification and stage groupings will remain unchanged. The clinical stage is important in selecting treatment, while pathological stage is for prognosis and the evaluation of results of treatment.

(4) When in doubt as to the correct T, N or M category, assign to the less advanced category.

(5) If the registry records TNM staging, this can only be abstracted if TNM is recorded in the clinical notes. This cannot be allocated by the abstractor.

The staging comparison charts on the following pages are intended as reference for tumour registrars who commonly record Summary Staging on their abstracts but frequently see terminology such as Stage IA, Dukes' B or Level III in the medical records. Summary Staging is described in the next section (4.4.3).

LIP AND ORAL CAVITY Relationship of summary stage to TNM (AJCC, 1988)					
Summary stage	Extent of disease	AJCC stage	T	N	M
In-situ	Carcinoma *in situ*	0	Tis	NO	MO
Localized	Tumour ≤ 2 cm in size	I	T1	NO	MO
	Tumour 2–4 cm in size	II	T2	NO	MO
	Tumour ≥ 4 cm in greatest dimension, without infiltration of adjacent structure	III	T3	NO	MO
Regional	Tumour 2–4 cm in size, with metastasis to single ipsilateral LN ≤ 3 cm in greatest dimension	III	T1 T2	N1 N1	MO MO
	Tumour ≥ 4 cm in size, with ipsilateral LN ≤ 3 cm in greatest dimension		T3	N1	MO
Distant	Tumour invades adjacent structures (through cortical bone, deep muscles of tongue, skin, maxillary sinus)	IV			
	Tumour any size, with LN metastases ≥ 3 cm in greatest dimension		Any T	N2,N3	MO
	Metastasis to distant organs		Any T	Any N	M1

PHARYNX Relationship of summary stage to TNM (AJCC, 1988)					
Summary stage	Extent of disease	AJCC stage	T	N	M
In-situ	Carcinoma *in situ*	0	Tis	NO	MO
Localized	Tumour ≤ 2 cm in size limited to one subsite (e.g., nasopharynx or hypopharynx), not fixed	I	T1	NO	MO
Regional	Tumour 2–4 cm in size invades more than one subsite, or an adjacent site	II	T2 T3	N1 N0	M0 M0
	With metastasis to single ipsilateral LN ≤ 3 cm in greatest dimension		T1 T2 T3	N1 N1 N1	M0 M0 M0
Distant	Tumour invades adjacent structures (skull and/or cranial nerves for nasopharynx; cartilage or soft tissues, neck for hypopharynx)		T4 T4	N0 N1	M0 M0
	With metastasis to single or multiple ipsilateral LN > 6 cm in size, or to contralateral or bilateral LN > 6 cm in size		Any T Any T	N2 N3	M0 M0
	With metastasis to distant organs		Any T	Any N	M1

LUNG Relationship of summary stage to TNM: (AJCC, 1988)					
Summary stage	Extent of disease (based on AJCC definitions)	AJCC stage	T	N	M
In-situ	Carcinoma *in situ*	0	Tis	NO	MO
Localized	Tumour ≤ 3 cm in size; surrounded by lung or visceral pleura, without invasion more proximal than the lobar bronchus	I	T1	NO	MO
	Tumour ≥ 3 cm in size, involving main bronchus ≥ 2 cm distal to carina with or without atelectasis or obstructive pneumonitis extending to the hilar region	I	T2	NO	MO
Regional	Tumour ≤ 3 cm, peripheral with involvement of ipsilateral intrapulmonary, peribronchial and/or hilar lymph node(s)	II	T1	N1	M0
	Tumour ≥ 3 cm, peripheral or involving the main bronchus, ≥2 cm distal to carina with invasion of visceral pleura, with involvement of ipsilateral, intrapulmonary, peribronchial and/or hilar lymph node(s)	II	T2	N1	M0
	Tumour of any size invading the parietal pleura, parietal pericardium, mediastinal pleura and diaphragm with or without ipsilateral peribronchial or hilar lymph node involvement	IIIA N1	T3	N0	M0
	Tumour in the main bronchus ≤ 2 cm distal to the carina but not involving the carina with atelectasis or obstructive pneumonitis of entire lung	IIIA	T3	N0	M0
	Tumour of any size, with involvement of the ipsilateral diastinal and/or subcarinal lymph node(s)	IIIA	Any T	N2	M0
	Tumour of any size, with invasion of the mediastinum, heart, great vessels, trachea, oesophagus, vertebral body, carina or with malignant pleural effusion	IIIB	T4	Any N	M0
Distant	Involvement of bilateral mediastinal and/or hilar lymph node(s)	IIIB	Any T	N3	M0
	Involvement of ipsilateral or contralateral scalene or supraclavicular lymph node(s)	IIIB	Any T	N3	M0
	Involvement of distant organs	IV	Any T	Any N	M1
Note: Vocal cord paralysis, superior vena caval obstruction and compression of trachea or oesophagus are related to metastases in mediastinal nodes. These should be classified as N2 (ipsilateral) or N3 (contralateral). A discontinuous lesion outside the parietal pleura in the chest wall is M1.					

BREAST Relationship of summary stage to TNM: (AJCC, 1988)					
Summary stage	Extent of disease	AJCC stage	TNM T	N	M
In situ	Carcinoma *in situ* Intraductal carcinoma Lobular carcinoma in situ Paget's disease of the nipple with no tumour	0	Tis	N0	M0
Localized	Tumour < 2 cm in size without fixation topectoral fascia or skin	I	T1a) T1b) T1c)	N0	M0
	Tumour 2-5 cm in size, without fixation to pectoral fascia or skin	IIA	T2	N0	M0
	Tumour > 5 cm in size, without fixation to pectoral fascia or skin	IIB	T3	N0	M0
Regional	Tumour < 2 cm in size, with metastasis to movable ipsilateral axillary lymph node(s)	IIA	T1	N1	M0
	Tumour 2-5 cm in size, with metastasis to movable ipsilateral axillary lymph node(s)	IIB	T2	N1	M0
	Tumour < 5 cm in size, with metastasis to ipsilateral axillary node(s) fixed to one another or to other structures	IIIA	T0 T1 T2	N2	M0
	Tumour > 5 cm in size with metastasis to movable or fixed ipsilateral axillary lymph node(s)	IIIA	T3	N1 N2	M0
	Tumour, any size, with direct extension to chest wall or skin	IIIB	T4	ANY N	M0
	Metastasis to ipsilateral internal mammary lymph node(s)	IIIB	Any T	N3	M0
Distant	Metastasis to ipsilateral supraclavicular lymph nodes or metastasis to distant organs	IV	Any T	Any N	M1

CERVIX Relationship of summary stage to TNM (AJCC, 1988)						
Summary stage	FIGO	Extent of disease (based on FIGO definitions)	AJCC stage	T	N	M
In situ	0	Carcinoma *in situ* Intraepithelial	0	Tis	N0	M0
Local-ized	Ia Ia1 Ia2	Microinvasive carcinoma Minimal microscopic stromal invasion Invasion of ≤ 5mm from base of epithelium and ≤ 7 mm in horizontal spread	IA	T1a T1a1 T1a2	N0	M0
	Ib	Tumour larger than T1a2	IB	T1b	N0	M0
Regional	IIa	Cervical carcinoma invades beyondthe uterus, up to upper 2/3 of vagina without parametrial invasion	IIA	T2a	N0	M0
	IIb	Extension to parametria but not to the lateral pelvic wall	IIB	T2b	N0	M0
	IIIa	Extension to the lower third of vagina. No extension to pelvic wall	IIIA	T3a	N0	M0
	IIIb	Extension to the pelvic wall and/or hydronephrosis or non-functioning kidney	IIIb	T3b	N0	M0
		Regional lymph node metastases Extension to the wall of the rectumor bladder (excluding mucosa), cul-de-sac or bullous oedema of the bladder	IIIB IIIB	T1–T3 T3b	3N1 Any N	M0 M0
Distant	IVa	Extension to mucosa of bladder or rectum and/or extension beyond the true pelvis	IVA	T4	Any N	M0
	IVb	Distant metastasis	IVB	Any T	Any N	M1

4.4.3 Staging (Final extent of the disease)

Summary staging refers to the classification of a cancer case into broad categories (in-situ, localized, regional and distant), representing the extent of involvement of the tumour as determined using all diagnostic and therapeutic evidence available at the end of the first course of therapy, or within four months of the date of diagnosis, whichever is earlier. It must be supported by the information abstracted on diagnostic procedures.

Clinical staging pertains to the extent of the disease or most extensive tumour involvement as assessed clinically (physical examination, clinical investigations, manipulative procedures), prior to initiation of any treatment.

Surgical-cum-pathological extent of disease before treatment contains information on the extent of the disease based on clinical observations prior to treatment, and augmented by findings at surgery, including histological information on lymph node involvement and extension of the tumour to other organs as well as distant metastasis, or by findings at autopsy if the patient died before treatment could be given. This staging procedure presents a more accurate picture of the spread of the malignancy from the origin.

There are several classification systems used to describe the stage or extent of the disease. It is important that the system used by a particular registry be specified, and guidelines clearly written. The most detailed is the TNM system, but more compact systems exist, for example the SEER Summary Staging, given below with suggested codes:

1 In-situ
2 Localized
3 Regional: direct extension to adjacent organs or tissues
4 Regional: lymph node involvement
5 Regional: direct extension and lymph node involvement
6 Distant metastasis
7 Not applicable
8 Unknown or unstageable (stage cannot be determined from the information available

A simple classification would be limited to:

In-situ
Localized
Regional
Distant
Unknown

(1) Definitions of these terms are as follows:

(a) *In-situ.* Based on microscopic examination of tissue or cells, the tumour has all the characteristics of malignancy, except that the lesion has not extended beyond the basement membrane of the epithelium.

Certain terms indicate an in-situ stage:

- Non-infiltrating
- Non-invasive
- Pre-invasive
- Confined to epithelium
- Involvement up to but not including the basement membrane
- No stromal invasion
- Intraepidermal
- Intraepithelial
- Intraductal
- Adenocarcinoma in an adenomatous polyp with no invasion of stalk
- Stage 0
- Clark's Level I for melanoma (limited to epithelium)
- CIN III (Cervical Intraepithelial Neoplasia, Grade III)
- Queyrat's erythroplasia

The behaviour code in the ICD-O system for a tumour designated as in-situ is /2.

(b) *Localized.* The tumour is invasive but is still confined entirely to the organ of origin.

For most sites, the tumour might be widely invasive within the organ, but as long as it does not extend beyond the outer limits of the organ and there is no evidence of metastasis to other parts of the body including the regional lymph nodes, the tumour is considered localized.

Intraluminal extension of the tumour to the immediately contiguous segment of the large bowel is considered localized, unless the invaded segment has an identifiably different pattern of lymph node drainage.

For tumours where the primary site or the regional lymph nodes are inaccessible, like the oesophagus, lung and pancreas, clinical diagnosis alone may not suffice to stage the tumour as localized, unless clinical investigations such as CT scans provide enough information to rule out spread of the disease. If surgery has been performed, study the operative report to look for evidence of extension of the tumour to other organs, spread to lymph nodes, or presence of metastasis.

(c) *Regional.* The tumour has grown beyond the organ of origin. It has spread to adjacent organs or tissues by direct extension and/or to regional lymph nodes. Make sure that there is no evidence of distant metastasis based on radiological and scan examinations of the lung, bone, and liver. Check progress notes as well as the discharge summary for any mention of metastasis.

The Summary Staging Guide for the Cancer Surveillance, Epidemiology and End Results Reporting (SEER) program provides a list of structures or organs considered to be regional for each site. It also provides a list of regional lymph nodes for each specific site (see Appendix 4.1).

(d) *Distant.* The tumour has extended beyond the primary site by:

- direct extension beyond the adjacent organs or tissues specified as regional by the Summary Staging Guide (see Appendix 4.1);
- metastasis to distant lymph nodes;
- development of secondary or metastatic tumours in completely different organs of the body for example brain, liver, lung or bone metastasis.

This category also includes contralateral or bilateral lymph node metastasis if the primary site is not situated in the midline of the body.

The different types of systemic malignant tumours are also included in this stage:

- the leukaemias
- multiple myeloma
- malignant histiocytosis

(e) *Unknown or unstageable.* The information in the medical record is not sufficient to assign a stage, and/or the primary site is not known.

(f) *Not applicable.* Cases in which the diagnosis of cancer is based on clinical examination alone, especially when the primary site and regional lymph nodes are not accessible.

OTHER TERMS commonly used to describe stage include:

(i) *Invasion.* Local spread of a neoplasm by infiltration into or destruction of adjacent tissue.
(ii) *Microinvasive.* The earliest invasive stage. In cervical cancer, microinvasive stage refers to a limited stromal invasion.
(iii) *Direct extension.* Extension in a continuous fashion from the primary site to other parts of the body .
(iv) *Regional.* Organs or tissues related to a site by physical proximity. This also applies to the first chain of lymph nodes draining the area of the site (see Appendix 4.1).

(2) Ambiguous Terms

Physicians sometimes use ambiguous terms to indicate involvement of a tissue or an organ by a tumour. Interpret the following terms as *involvement*:

- Apparently
- Compatible with
- Consistent with
- Encroaching upon
- Extension or invasion
- Induration (used to describe surrounding fibrous or connective tissue adjacent to the tumour and is to be interpreted as extension of the malignant growth)
- Favour
- Most likely
- Presumed
- Probable
- Suspect(ed)
- Suspicious
- to, into, onto or out onto
- Typical of/for

Do not consider the following terms as evidence of involvement:

- Approaching
- Rule out
- Equivocal
- Suggests
- Possible
- Very close to
- Questionable
- Worrisome

(3) Special Rules for Lymph Nodes

Mass NOS: When a mass is found in the mediastinum, retroperitoneum and/or mesentery, and there is no specific information about the tissue involved, assume that the mass is a lymph node.
Lymphomas: For lymphomas, if lymph nodes are described as "enlarged", "palpable", or "visibly swollen", consider the nodes to be involved.

(4) Procedures for Summary Staging

How to determine the extent of disease before assigning stage:

(a) Determine the site of origin (primary site) of the tumour.
(b) Study the medical record very well and consider all diagnostic and therapeutic information available up to the end of the first course of therapy or within four months from diagnosis.
(c) Review:
History
Physical examination
X-rays/scans and other imaging techniques
Endoscopy reports
Operative reports
Pathology reports (including cytology, haematology, surgical pathology and autopsy)
Progress notes
Discharge summary
(d) Note the presence of terms such as "in-situ" or "metastasis" in the pathology report or the mention of "metastasis" in the clinical, radiological, operative, or pathological records.
(e) *Staging by physicians:* In some records, the physician has assigned a stage of the disease, using staging systems such as: TNM, FIGO, Dukes' or other systems. In these cases, use the information as a guide in coding the stage, especially if the information in the medical record regarding the extent of tumour involvement is incomplete. However, one should consider the following:

Physicians may use different versions of a staging system and a specific designation may have different meanings depending on the version of the system used. It is therefore important for the registrar to know the version of the staging used by the physician in order to translate it into in-situ, localized, regional or distant, based on the criteria formulated by the cancer registry.

Example: For colo-rectal cancer, the staging used may be the original Dukes' Classification or its modifications. Duke's classification C (Regional involvement but without distant metastasis) is equivalent to Regional.

For some staging systems, only information based on clinical (pre-treatment) assessments of the extent of the tumour is used (Clinical Staging). In contrast, other staging schemes make use of information based on diagnostic procedures carried out prior to treatment and supplemented by findings during surgery and the pathological examination of the resected specimen (Pathological Staging). For example, the FIGO classification of cancer of the cervix makes use of clinical findings only. While clinical staging is satisfactory for accessible sites, it is relatively unsatisfactory for staging internal cancers such as stomach, intestines, pancreas, brain and ovaries. A more extensive lesion may often be found

on surgery in contrast to what is anticipated clinically.
In the absence of any pathological information, accept the clinical stage given by the physician.

(f) Conflicting reports: If the stage recorded in one report clearly contradicts another report, ask the attending physician or the registry's medical consultant for clarification.

Exercises on primary site, histology coding, most valid basis for diagnosis and SEER summary staging

1. A 40–year old female was admitted on 20 August 1987 with a 4 x 5 1/2 cm. mass on the upper half of the right breast, movable, with no skin dimpling. There were axillary masses, discrete, movable on the right axilla.	
Chest X–ray : Negative	Aspiration biopsy, right breast (10/08/87)
Cytology: (+) for malignant cells	Section biopsy, right breast (15/08/87)
Pathological report: Lobular carcinoma–*in–situ*, right breast	
Modified radical mastectomy (22/08/87)	
Pathological report: Infiltrating lobular carcinoma, right breast; 5/12 axillary lymph nodes (+) for metastases.	
Give the following:	Primary Site:
M–code:	T–Code
Histology:	SEER Summary Stage:
Most Valid Basis of Diagnosis:	

2. A 38 year old female was admitted on 12/07/86 complaining of vaginal bleeding.	
Physical Examination: (+) 3 x 3 mm. lesion, anterior lip of exocervix; uterus not enlarged; adnexae (–)	
Papanicolaou smear (cervical cytology) done on 12/03/86	Class V consistent with squamous cell carcinoma
Biopsy, cervix under colposcopy (12/03/86).	Pathological report: Squamous cell carcinoma–*in–situ* with questionable microinvasion
Pathological report: Extensive squamous cell carcinoma in situ; margins of resection clear.	Conization, cervix (12/08/86)
Give the following:	Primary Site:
M–code:	Code
Histology:	SEER Summary Stage:
Basis for Diagnosis:	

3. A 67 year old male, consulted the LCP with the complaints of productive cough of 2 months duration, associated with weight loss. No haemoptysis. Patient is a chronic smoker.	
On physical examination there were no lymphadenopathies noted. Harsh breath sounds were noted on both lung fields.	No rales nor wheezes appreciated.
Fiberoptic bronchoscopy (15/11/88) findings: Narrowed and deformed opening to the upper lobe segments, with an area of bleeding near the anterior segment.	Operative Diagnosis: Bronchogenic carcinoma, right upper lobe.
Bronchial biopsy (15/11/88): Squamous cell carcinoma, poorly differentiated, right upper lobe	Cytology, bronchial washings (15/11/88): Class III
Pathological report: Poorly differentiated squamous cell carcinoma, right upper lobe; 0/3 lymph nodes (+) for metastasis.	Right upper lobe lobectomy (22/11/88)
Give the following:	Primary Site:
M–code:	T–Code
Histology:	SEER Summary Stage:
Most Valid Basis of Diagnosis:	

ANSWERS:

1. PRIMARY SITE: Breast, upper half	T–code: C50.8 (174.8)
HISTOLOGY: Inf. lobular carcinoma	M–code: 8520/3
MOST VALID BASIS OF DIAGNOSIS: Histology of primary	
SEER SUMMARY STAGE: Regional, by lymph node involvement	
2. PRIMARY SITE: Exocervix	T–code: C53.1 (180.1)
HISTOLOGY: Squamous cell carcinoma–in–situ M–code: 8070/2	
MOST VALID BASIS OF DIAGNOSIS: Histology of Primary	
SEER SUMMARY STAGE: In–Situ	
3. PRIMARY SITE: Right upper lobe	T–code: C34.1 (162.3)
HISTOLOGY: Squamous cell carcinoma M–code: 8070/3	
MOST VALID BASIS OF DIAGNOSIS: Histology of Primary	SEER SUMMARY STAGE: Localized

Appendices

The appendices to this section can serve as a guide when abstracting and assessing extent of the disease.

Appendix 4.1

Summary Staging Guide (SEER)

In-situ, localized, regional and distant extent of disease by site.

Appendix 4.2

Examples of abstracting instructions for lung, breast and cervix, based on the SEER Summary Staging Guide (SEER, 1977).

Appendix 4.3

Definitions of anatomical sites according to the Manual for Staging of Cancer of the American Joint Committee on Cancer Staging (AJCC, 1988).

Appendix 4.1

Summary Staging Guide

The Summary Staging Guide groups together the different disease categories into:

- in-situ
- localized
- regional
- distant

The Summary Stage groupings take into consideration all of the observations noted during clinical examination, during surgery (operative findings) and the results of the pathological examination of any specimen removed. The order of priority is

- pathological
- operative
- clinical

1. Summary staging definitions

IN-SITU	intraepithelial, noninvasive, noninfiltrating
LOCALIZED Within organ	a. Invasive cancer confined to organ of origin b. Intraluminal extension where specified. *Example:* intraluminal extension to immediately contiguous segments of the colon is considered localized unless the invaded segment has a different pattern of lymph node drainage.
REGIONAL Beyond the organ of origin	a. By direct extension to adjacent organs/tissues b. To regional lymph nodes c. Both by direct extension or lymph node involvement.
DISTANT Direct extension of metastasis	a. Direct continuity to organs other than above b. Discontinuous metastasis c. To distant lymph nodes

2. Site staging definitions

The International Classification of Diseases for Oncology (ICD-0) topography codes are indicated under each specified site. The ICD-0 second edition T–code is given first, followed by the 1st edition T–code.

IN-SITU:	Non-invasive	
LOCALIZED	Vermilion surface Labial mucosa (inner lip) Multiple foci	Skin of lip Musculature Localized, NOS
REGIONAL, DIRECT EXTENSION	Commissure(s) of lips Buccal mucosa (inner cheek)	Maxilla Lower lip Gingiva, upper Nose
REGIONAL, LYMPH NODES	Facial: buccinator Parotid: infra-auricular, preauricular Submental Submandibular (submaxillary)	
DISTANT, DIRECT EXTENSION OR METASTASIS DISTANT, LYMPH NODES	Internal jugular Upper cervical (including cervical, NOS) Supraclavicular (transverse cervical) Other distant nodes	

LOWER LIP (T–C00.1, C00.4; 140.1, 140.4)		
IN–SITU	Non–invasive	
LOCALIZED	Vermilion surface Labial mucosa(inner lip) Multiple foci	Skin of lip Musculature Localized, NOS
REGIONAL, DIRECT EXTENSION	Commissure(s) of lips Buccal mucosa (inner cheek) Mandible	Upper lip Gingiva, lower
REGIONAL, LYMPH NODES	Facial: mandibular Submental	Submandibular (sub-maxillary)
DISTANT, DIRECT EXTENSION OR METASTASIS DISTANT, LYMPH NODES	Internal jugular Upper cervical (including cervical, NOS)	Supraclavicular (transverse cervical) Other distant nodes

COMMISSURE OF LIP (T–C00.6; 140.6)		
IN–SITU	Non–invasive	
LOCALIZED	Vermillion surface Labial mucosa (inner lip)	Localized, NOS Skin of lip Musculature
REGIONAL, DIRECT EXTENSION	Both lips Buccal mucosa (inner cheek) Nose	Maxilla Gingiva Mandible
REGIONAL, LYMPH NODES	Facial: mandibular Parotid: infra–auricular, preauricular	Submental Submandibular (submaxillary)
DISTANT, DIRECT EXTENSION OR METASTASIS DISTANT, LYMPH NODES	Internal jugular Upper cervical (including cervical, NOS)	Supraclavicular (transverse cervical) Other distant nodes

BASE OF TONGUE (T–C01.9; 141.0)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to posterior 1/3 of tongue on one side	Midline tumour; tumour has crossed midline Localized, NOS
REGIONAL, DIRECT EXTENSION	Anterior 2/3, tongue Gingiva, lower Sublingual gland Floor, mouth Epiglottis, lingual (pharyngeal surface)	Vallecula (including pharyngo-epiglottic and glosso–epiglottic folds) Lateral pharyngeal wall (tonsillar pillars, fossae and tonsils
REGIONAL, LYMPH NODES	Submandibular (submaxillary)	Internal jugular: subdigastric Upper cervical (or cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Mandible Soft palate, including uvula	Larynx Hypopharynx
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

ANTERIOR 2/3 OF TONGUE (T–C02.0–C02.4; 141.1–141.4, 141.6)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to ant. 1/3 of tongue, on one sidewith or without invasion of musculature	Midline tumour; tumour crossed midline Localized, NOS
REGIONAL, DIRECT EXTENSION	Floor, mouth Base, tongue Sublingual gland	Lower gingiva Mandible
REGIONAL, LYMPH NODES	Submandibular (submaxillary) Sublingual Submental	Internal jugular: subdigastric, supraomohyoid Upper cervical (cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Lateral pharyngeal wall Soft palate, including uvula	Other distant involvement Maxilla
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

PAROTID GLAND (T–C07.9; 142.0)		
IN–SITU	Non–invasive	
LOCALIZED	Entirely within benign tumour capsule Substance of parotid gland not invaded	Multiple foci but confined to substance of parotid Localized, NOS
REGIONAL, DIRECT EXTENSION	Periglandular soft tissue Nerves: facial; auricular; spinal accessory Skeletal muscles: digastric, sternocleidomastoid, masseter, pterygoid, styloid Periosteum of mandible Pharyngeal mucosa Submandibular (submaxillary) gland	Skin Mandible Major blood vessel(s): carotid artery; facial artery or vein; maxillary artery; jugular vein Mastoid process External auditory meatus Skull
REGIONAL, LYMPH NODES	Parotid: intra–parotid; infra–auricular; preauricular	Submandibular (submaxillary)
DISTANT, DIRECT EXTENSION OR METASTASIS DISTANT, LYMPH NODES	Upper cervical (including cervical, NOS)	Supraclavicular (transverse cervical) Other distant nodes

UPPER GUM (GINGIVA) (T–C03.0; 143.0)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa Invasion of lamina propria (mucoperiosteum)	Localized, NOS
REGIONAL, DIRECT EXTENSION	Maxilla Buccal mucosa (inner cheek) Lateral pharyngeal wall (tonsillar pillars, tonsillar fossae, tonsils)	Soft tissue of face Hard or soft palate Labial mucosa, upper lip
REGIONAL, LYMPH NODES	Facial: mandibular Submandibular (submaxillary) Upper cervical (including cervical, NOS)	Retropharyngeal Internal jugular
DISTANT, DIRECT EXTENSION OR METASTASIS	Maxillary antrum Skull, including floor, orbit	Other distant involvement Skin Nasal Cavity
DISTANT LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

LOWER GUM (GINGIVA) AND RETROMOLAR TRIGONE (T–C03.1, C06.2; 143.1, 145.6)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa	Invades lamina propria Localized, NOS
REGIONAL, DIRECT EXTENSION	Mandible; periosteum Floor, mouth Buccal muocsa (inner cheek) Labial mucosa, lower lip	Tongue Lateral pharyngeal wall Soft palate; uvula Soft tissue, face
REGIONAL, LYMPH NODES	Facial: mandibular Submandibular (submaxillary) Submental	Internal jugular: subdigastric; supraomohyoid Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Skin	Other distant involvement Skull
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

FLOOR OF MOUTH (T-C04.0–C04.1, C04.8–C04.9; 144.0–144.1, 144.8, 144.9)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa, one side submucosa invaded musculature invaded	Midline tumour; tumour crossed midline Localized, NOS
REGIONAL, DIRECT EXTENSION	Lower gum Ant. 2/3, tongue Submandibular (submaxillary) gland(s) Sublingual gland Periosteum, mandible Mandible Base of tongue	Vallecula (pharyngoepiglottic & glossoepiglottic folds) Epiglottis, pharyngeal (lingual) surface Lateral pharyngeal wall (tonsillar pillars, tonsillar fossae, tonsils) Underlying soft tissues Skin
REGIONAL, LYMPH NODES	Submandibular (submaxillary) Submental Sublingual Internal jugular: subdigastric, supraomohyoid	Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS		
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

CHEEK (BUCCAL) MUCOSA AND VESTIBULE, MOUTH (T–C06.0, C06.1; 145.0, 145.1)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa Localized, NOS	Submucosa invaded
REGIONAL, DIRECT EXTENSION	Soft tissue, cheek Lateral pharyngeal wall Skin	Gingiva Lip(s)
REGIONAL, LYMPH NODES	Facial: buccinator; mandibular Parotid: preauricular, infra–auricular	Submandibular (submaxillary) Internal jugular: subdigastric Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Base or ant. 2/3 of tongue Hard or soft palate	Bone: maxilla, mandible, skull Other distant involvement
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

HARD PALATE (T-CO5.O; 145.2)		
IN-SITU	Non-invasive	
LOCALIZED	Confined to mucosa, one side Localized, NOS	Midline tumour; tumour crossed midline
REGIONAL, DIRECT EXTENSION	Soft palate; uvula Palatine bone Buccal mucosa (inner cheek)	Upper gingiva Maxilla
REGIONAL, LYMPH NODES	Submandibular (submaxillary) Retropharyngeal	Internal jugular: subdigastric Upper cervical including cervical, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Nasal cavity; floor of nose Maxillary antrum (sinus)	Other distant involvement Nasopharynx
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

SOFT PALATE AND UVULA (T-C05.1, C05.2; 145.3, 145.4)		
IN-SITU	Non-invasive	
LOCALIZED	Confined to mucosa, one side Invasion, submucosa/musculature on one side	Midline tumour; tumour has crossed midline Localized, NOS
REGIONAL, DIRECT EXTENSION	Hard palate, mucosa Lateral pharyngeal wall Buccal mucosa	Upper gingiva (inner cheek) Nasal cavity floor
REGIONAL, LYMPH NODES	Submandibular (submaxillary) Retropharyngeal	Internal jugular: subdigastric Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Tongue Nasopharynx Maxillary antrum (sinus) Palatine bone	Other distant involvement Maxilla Mandible
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

OROPHARYNX (T–C09.8, C09.9, C10.9; 146.0–146.9)		
IN-SITU	Non-invasive	
	(Tumours not fixed) Confined to posterior wall, anterior wall or lateral walls(s)	Localized, NOS
REGIONAL DIRECT EXTENSION	Tumour not fixed but extends into: Soft tissue, neck Base, tongue Pyriform sinus Soft palate; uvula Gum (gingiva), posterior Tumour described as 'fixed to adjacent tissues'	
REGIONAL LYMPH NODES	Retropharyngeal Internal jugular: subdigastric; supraomohyoid	Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Both lateral wall involved *via* soft palate or base of tongue Other distant involvement	Hard palate Mandible Parotid gland
DISTANT, LYMPH NODES	Submandibular Supraclavicular (transverse cervical)	Other distant nodes

NASOPHARYNX (T- C11.0–C11.3, C11.8–C11.9; 147.0–147.3, 147.8–147.9)		
IN-SITU	Non-invasive	
LOCALIZED (tumour is not fixed)	Confined to posterior superior wall (vault), and/or lateral wall(s) into eustachian tube or middle ear	Localized, NOS
REGIONAL, DIRECT EXTENSION	Tumour not fixed, but extends into: Oropharynx; nasal cavity Skull including floor of orbit Pterygopalatine fossa Soft palate, including uvula	Tumour described as "fixed to adjacent tissues"
REGIONAL, LYMPH NODES	Retropharyngeal Internal jugular	Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Brain, including cranial nerves Accessory sinus: maxillary, sphenoid, ethmoid, frontal Hard palate	Hypopharynx Soft tissues of neck Other distant involvement
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical) Submandibular	Other distant nodes

HYPOPHARYNX (T–C12.9, C13.0, C13.1, C13.2, C13.8, C13.9, C14.1; 148.0–148.3, 148.8–148.9)		
IN-SITU	Non-invasive	
LOCALIZED (tumour is not fixed)	Confined to: Priform sinus and/or postcricoid area and/or posterior pharyngeal wall	Localized, NOS
REGIONAL, DIRECT EXTENSION	Tumour not fixed, but extends into: Oropharynx; larynx Soft tissues of neck Prevertebral muscle(s)	Upper oesophagus Tumour described as "fixed to adjacent tissues"
REGIONAL, LYMPH NODES	Retropharyngeal Internal jugular: subdigastric, supraomohyoid	Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Nasopharynx Base of tongue	Floor, mouth Other distant involvement
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

CERVICAL OR UPPER OESOPHAGUS (T–C.15.0, C15.3; 150.0,150.3)		
IN–SITU	Non–invasive	
LOCALIZED	Mucosa, upper oesophagus Mucosa but extends to middle oesophagus	Invades muscularis Localized, NOS
REGIONAL, DIRECT EXTENSION	Adventitia and/or soft tissues, neck Major blood vessel(s): carotid artery, subclavian artery, jugular vein Thyroid gland Oesophagus is described as "fixed"	Extension to: Hypopharynx; larynx Trachea, including carina Cervical vertebra(e)
REGIONAL LYMPH NODES	Paraoesophageal Internal jugular	Anterior deep cervical: laterotracheal (recurrent) Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS	Main stem bronchus Lung and/or pleura	Other distant involvement
DISTANT, LYMPH NODES	Posterior mediastinal Supraclavicular (transverse cervical)	Other distant nodes

THORACIC OR MIDDLE OESOPHAGUS (T–C15.1–C15.4; 150.1, 150.4)		
IN–SITU	Non–invasive	
LOCALIZED	Mucosa of middle oesophagus Mucosa but extends to upper and/ lower oesophagus	Involvement of muscularis Localized, NOS
REGIONAL, DIRECT EXTENSION	Adventitia and/or soft tissue Major blood vessel(s):aorta, vena cava Main stem bronchus pulmonary artery or vein Oesophagus is described as "fixed" Trachea Carina	Extension to: Lung, via bronchus Pleura Pericardium Ribs Mediastinal structure(s), NOS Diaphragm Thoracic vertebra(e)
REGIONAL, LYMPH NODES	Paraoesophageal Tracheobronchial: peritracheal, carinal (bifurcation) hilar (pulmonary roots) Posterior mediastinal	Internal jugular Left gastric: cardiac, lesser curvature Upper cervical (including cervical, NOS)
DISTANT, DIRECT EXTENSION OR METASTASIS		
DISTANT, LYMPH NODES	Supraclavicular (transverse cervical)	Other distant nodes

ABDOMINAL OR LOWER OESOPHAGUS (T–C15.2, C15.5; 150.2, 150.5)		
IN–SITU	Non–invasive	
LOCALIZED	Mucosa, lower oesophagus Mucosa but extends to middle oesophagus	Muscularis involvement Localized, NOS
REGIONAL, DIRECT EXTENSION	Adventitia and/or soft tissue Oesophagus described as "fixed"	Involvement of: Diaphragm: Cardia of stomach Major blood vessels: aorta, gastric artery/vein,vena cava
REGIONAL, LYMPH NODES	Paraoesophageal Left gastric: cardiac, lesser curvature, perigastric, NOS	Posterior mediastinal
DISTANT, DIRECT EXTENSION OR METASTASIS	"Diaphragm is fixed" (indicates phrenic nerve involvement by tumour)	Other distant involvement
DISTANT, LYMPH NODES	Caeliac Para–aortic	Other distant nodes

STOMACH (Excluding Cardiooesophageal Junction) (T–C16.0–C16.6, C16.8–C16.9; 151.0–151.6, 151.8–151.9)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/submucosa/muscularis propria Stalk invaded (if polyp) Subserosal tissue invaded (includes extension through the wall, NOS)	Implants inside the stomach Localized, NOS
REGIONAL, DIRECT EXTENSION	Perigastric fat Lesser omentum Ligaments: gastrocolic, gastrohepatic, gastrosplenic Gastric artery Invasion of (through) serosa Diffuse involvement of entire thickness of stomach wall (linitis plastica)	*Extension to :* Oesophagus Diaphragm Duodenum Liver Spleen Pancreas Omentum (greater) Jejunum, ileum Transverse colon, hepatic and splenic flexures
REGIONAL, LYMPH NODES	*Inferior gastric:* gastrocolic, gastroepiploic, right/NOS greater curvature greater omentum infrapyloric pyloric subpyloric *Splenic hilar:* left gastroepiploic pancreaticolienal peripancreatic splenic	*Superior gastric:* cardiac cardiooesophageal gastrohepatic left gastric lesser curvature lesser omentum paracardiac Perigastric, NOS Nodule(s) in perigastric fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Left kidney Adrenal gland(s) Ovary (Krukenberg tumour)	Other distant involvement Abdominal wall Retroperitoneum
DISTANT, LYMPH NODES	Caeliac Hepatic Mesenteric, superior/inferior Other distant nodes	Para–aortic Portal Retroperitoneal

DUODENUM (T–C17.0; 152.0)		
IN–SITU	Non–invasive	
LOCALIZED	Invasive cancer confined to a polyp Confined to submucosa/ muscularis and/or serosa	Intraluminal to jejunum Localized, NOS
REGIONAL, DIRECT EXTENSION	Periduodenal tissue Mesentery, including mesenteric fat Stomach Extrahepatic bile duct(s), including ampulla of Vater Pancreas, including pancreatic duct Greater omentum Major blood vessels: aorta, superior mesenteric artery or vein, vena cava , portal vein,	renal vein, gastro–duodenal artery Small intestine *via* serosa Transverse colon, including hepatic flexure Right and/or quadrate lobe, liver Gallbladder Right kidney Right ureter Diaphragm Abdominal wall Retroperitoneum
REGIONAL, LYMPH NODES	Hepatic: pancreaticoduodenal, infrapyloric, gastroduodenal	
DISTANT, DIRECT EXTENSION OR METASTASIS		
DISTANT, LYMPH NODES	Superior mesenteric	Other distant nodes

JEJUNUM AND ILEUM (T–C17.1, C17.2; 152.1, 152.2)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to a polyp Confined to submucosa/muscularis/ serosa Intraluminal to ileocecal valve/ cecum or ileum	Intraluminal to duodenum from jejunum Localized, NOS
REGIONAL, DIRECT EXTENSION	Mesentery, including mesenteric fat Abdominal wall Retroperitoneum	Small intestine via serosa Large intestine, including appendix
REGIONAL, LYMPH NODES	Posterior caecal (terminal ileum only)	Ileocolic (terminal ileum only) Superior mesenteric
DISTANT, DIRECT EXTENSION OR METASTASIS	Bladder Uterus Ovary	Fallopian tube Other distant involvement
DISTANT, LYMPH NODES		

CAECUM (T–C18.0; 153.4)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa, submucosa, muscularis propria Stalk invaded (if polyp) Superficial invasion Subserosal tissue invaded (including ext. through wall)	Intraluminal to appendix, caecum or ileocaecal valve, ileum, ascending colon Implants inside the caecum Localized, NOS
REGIONAL, DIRECT EXTENSION	Mesentery, including mesenteric fat Pericolic (pericaecal) fat Adjacent tissue(s), NOS Invasion of (through) serosa	Extension to: greater omentum, retroperitoneum, abdominal wall, small intestine other than ileum
REGIONAL, LYMPH NODES	Epicolic Ileocolic Right colic (including colic, NOS) Mesenteric, superior or NOS	Nodule(s) in pericolic fat Paracolic Middle colic
DISTANT, DIRECT EXTENSION OR METASTASIS	Uterus Ovary Fallopian tube Urinary bladder	Gallbladder Other segment of colon *via* serosa Other distant involvement
DISTANT, LYMPH NODES	Inferior mesenteric Para–aortic	Retroperitoneal Other distant nodes

ASCENDING COLON (T–C18.2; 153.6)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis propria Stalk invaded (if polyp) Superficial invasion Subserosal tissue invaded (including extension through the wall, NOS)	Intraluminal to caecum, appendix, ileocaecal valve, transverse colon Implants inside the ascending colon Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Pericololic fat Retroperitoneal fat Adjacent tissue(s), NOS Invasion of (through) serosa Extension to: Right ureter	Right kidney Liver, right lobe Greater omentum Retroperitoneum Abdominal wall Small intestine
REGIONAL, LYMPH NODES	Epicolic Paracolic Ileocolic Nodule(s) in pericolic fat	Right colic (including colic, NOS) Middle colic Mesenteric,superior, or NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Uterus Urinary bladder Ovary Gallbladder	Fallopian tube Other distant involvement Other segment of colon, *via* serosa
DISTANT, LYMPH NODES	Inferior mesenteric Para–aortic	Retroperitoneal Other distant nodes

TRANSVERSE COLON (Including flexures) (T–C18.3, C18.4, C18.5; 153.0, 153.1, 153.7)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis mucosae Stalk invaded (if polyp) Superficial invasion Subserosal tissue invaded (including extension through the wall, NOS)	Intraluminal to ascending or descending colon Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Mesentery (mesenteric fat); moesocolon Pericolic fat Greater omentum; gastrocolic ligament Adjacent tissue(s), NOS Invasion of (through) serosa	Extension to: Stomach Pancreas Small intestine Liver Gallbladder/bile ducts Spleen Kidney Retroperitoneum Abdominal wall
REGIONAL, LYMPH NODES	Epicolic Paracolic Right colic for hepatic flexure only Middle colic Colic, NOS Left colic for splenic flexure only	Inferior mesenteric for splenic flexure only Superior mesenteric for hepatic flexure and transverse colon only Mesenteric, NOS Nodule(s) in pericolic fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Other segment of colon, *via* serosa Diaphragm Ureter	Adrenal gland Ovary Other distant involvement
DISTANT, LYMPH NODES	Para–aortic or retroperitoneal Inferior mesenteric for hepatic flexure and transverse colon only	Superior mesenteric for splenic flexure only

DESCENDING COLON (T–C18.6; 153.2)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis propria Stalk invaded (if polyp) Superficial invasion Subserosal tissue invaded (including extension	through the wall, NOS) Intraluminal to splenic flexure, transverse colon, sigmoid colon Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Pericolic fat, NOS Retroperitoneal fat Adjacent tissue(s), NOS Invasion of (through) serosa Extension to: Small intestine	Retroperitoneum Greater omentum Spleen Abdominal wall or pelvic wall Left ureter Left kidney
REGIONAL, LYMPH NODES	Epicolic Paracolic Left colic (including colic, NOS)	Mesenteric, inferior or NOS Nodule(s) in pericolic fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Uterus Ovary Fallopian tube	Other segment of colon *via* serosa Other distant involvement
DISTANT, LYMPH NODES	Para–aortic Retroperitoneal	Superior mesenteric Other distant nodes

SIGMOID COLON (T–C18.7; 153.3)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis propria Stalk invaded (if polyp) Superficial invasion Subserosal tissue invaded	(including extension through the wall, NOS) Intraluminal to descending colon, rectosigmoid or rectum Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Mesentery (including mesenteric fat); moesosigmoid Pericolic fat Adjacent tissue(s), NOS	Invasion of (through) serosa Extension to: Greater omentum Abdominal or pelvic wall Small intestine
REGIONAL, LYMPH NODES	Epicolic Superior hemorrhoidal Paracolic Superior rectal Colic, NOS	Sigmoidal Nodule(s) in pericolic fat Mesenteric, inferior or superior
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Uterus Cul de sac (rectouterine pouch) Ovary Fallopian tube	Ureter Urinary bladder Other segment of colon *via* serosa Other distant involvement
DISTANT, LYMPH NODES	Para–aortic Retroperitoneal	Superior mesenteric Other distant nodes

RECTOSIGMOID (T-C19.9; 154.0)		
IN-SITU	Non-invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis propria Stalk invaded (if polyp) Superficial invasion	Subserosal tissue invaded (including through the wall, NOS) Intraluminal to sigmoid colon or rectum Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Mesentery, including mesenteric fat Pericolic (perirectal) fat Adjacent tissue(s), NOS Invasion of (through) serosa	Extension to: Small intestine Cul de sac (rectouterine pouch) Pelvic wall/ pelvic plexuses
REGIONAL, LYMPH NODES	Paracolic (including colic, NOS) Pararectal Hemorrhoidal, superior or middle	Sigmoidal Internal iliac (hypogastric) Mesenteric, inferior or NOS Nodule(s) in pericolic fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Uterus Vagina Urinary bladder and/or ureter Prostate	Skeletal muscles of pelvic floor Fallopian tube Ovary Other segment of colon *via* serosa Other distant involvement
DISTANT, LYMPH NODES	Para-aortic Retroperitoneal	Superior mesenteric Other distant nodes

RECTUM (T–C20.9; 154.1)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to mucosa/ submucosa/ muscularis propria Stalk invaded Superficial invasion	Invasion through muscularis propria (including extension through wall, NOS) Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to : Perirectal fat Rectovaginal septum Adjacent tissue(s), NOS Invasion of (through) serosa Intraluminal extension to rectosigmoid or anus	Extension to: Colon, Anus (except intraluminal) Vagina Cul de sac (rectouterine pouch)
REGIONAL, LYMPH NODES	Pararectal Hemorrhoidal, superior or middle Sacral	Sigmoidal Mesenteric, inferior or NOS Internal iliac (hypogastric) Nodule(s) in perirectal fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Uterus Urinary bladder Sacrum Sacral plexus	Bones of pelvis Ovary Urethra Perineum: perianal skin Other distant involvement
DISTANT, LYMPH NODES	Para–aortic Retroperitoneal Other distant nodes	Superior mesenteric Inguinal

LIVER AND INTRAHEPATIC BILE DUCTS (T–C22.0–C22.1; 155.0–155.1)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to one lobe Satellite nodule(s) confined to one lobe	Localized, NO
REGIONAL, DIRECT EXTENSION	More than one lobe involved by contiguous growth Gallbladder from right lobe of liver Extrahepatic blood vessel(s): hepatic artery, vena cava, portal vein(s) Extrahepatic bile duct(s) Diaphragm	Peritoneum Ligament(s): falciform, coronary, triangular, hepatogastric, hepatoduodenal Lesser omentum
REGIONAL, LYMPH NODES	Cardiac Diaphragmatic: pericardial Posterior mediastinal	Lateral aortic (retroperitoneal): coronary, renal artery
DISTANT, DIRECT EXTENSION OR METASTASIS	Satellite nodules in more than one lobe of liver, surface or parenchymal Hepatic: hepatic pedicle, inferior vena cava, hepatic artery	Extension to pleura, pancreas, stomach Other distant involvement
DISTANT, LYMPH NODES		

PANCREAS (HEAD) (T–C25.0; 157.0)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to head of pancreas/body of pancreas	With obstruction, but no invasion, of extrahepatic bile duct(s) Localized, NOS
REGIONAL, DIRECT EXTENSION	Extrahepatic bile duct(s), including ampulla of Vater Duodenum Stomach adjacent to head of pancreas; stomach, NOS Liver Major blood vessels(s): hepatic, pancreaticoduodenal and/or gastroduodenal arteries, superior mesenteric	artery or vein, portal vein Transverse colon, including hepatic flexure Peritoneum Mesentery, moesocolon, mesenteric fat Greater and lesser omentum Gallbladder Tumour described as 'fixed to adjacent tissues'
REGIONAL, LYMPH NODES	Peripancreatic Hepatic: periportal, pancreatocoduodenal, infrapyloric	Superior mesenteric Lateral aortic (retroperitoneal) Celiac
DISTANT, DIRECT EXTENSION OR METASTASIS	Extension to: Body of stomach Kidney and/or ureter Adrenal gland	Retroperitoneum Jejunum and ileum Other distant involvement
DISTANT, LYMPH NODES		

LARYNX (Excluding cartilage) (T–C32.0–C32.2, C32.8–C32.9; 161.0–161.2, 161.8–161.9)		
IN–SITU	Non–invasive	
LOCALIZED	Tumour limited to one area within a region Supraglottic region: Laryngeal (posterior) surface of epiglottis Arytenoid Aryepiglottic fold Ventricular band (false vocal cord, vestibula fold) Ventricular cavity Glottic region: Vocal cord, one side Commissure Subglottic region on one side Tumour extends to adjacent area(s) within a region Supraglottic region More than one of the above areas	Glottic region (normal mobility) Cord and commissure Both vocal cords Subglottic region on both sides Glottic region: Fixation of cord(s) Tumour involves adjacent region(s) Supraglottic region Glottic region (with or without fixation) Subglottic region Involves intrinsic muscle(s): aryepiglottic, arytenoid, cricothyroid, thyroepiglottic, thyroarytenoid, vocalis Localized, NOS
REGIONAL, DIRECT EXTENSION	Pyriform sinus Postcricoid area Hypopharynx, NOS Vallecula	Base of tongue from laryngeal surface of epiglottis Extends into cricoid and/or thyroid cartilage
REGIONAL, LYMPH NODES	Internal jugular: subdigastric Anterior deep cervical: prelaryngeal, pretracheal, laterotracheal (recurrent)	Cervical, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Extrinsic muscle(s): omohyoid, sternohyoid, sternothyroid, thyrohyoid (strap muscles) Soft tissues of neck Thyroid	Skin Trachea Upper oesophagus Other distant involvement
DISTANT, LYMPH NODES	Superclavicular Submandibular	Other distant nodes

BRONCHUS AND LUNG (Excluding carina) (T–C34.0–C34.3, C34.8–C34.9; 162.2–162.5,162.8–162.9)		
IN–SITU	Non–invasive	
LOCALIZED	Single tumour 2 cm from carina and confined to one lung and/or main stem bronchus Single tumour of any size <2 cm from carina and confined to one lung or main stem bronchus	Multiple masses confined to one lung and/or main stem bronchus Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Pleura, visceral/NOS Pericardium, parietal, NOS Pulmonary ligament Involves: carina, trachea, oeso-phagus Involves nerve(s) Recurrent laryngeal: vagus; phrenic	Cervical symphatetic (Horner's syndrome) Major blood vessel(s) Pulmonary artery or vein Azygos vein Superior vena cava Extrapulmonary mediastinal extension, NOS
REGIONAL, LYMPH NODES	Intrapulmonary Hilar (bronchial; parabronchial; pulmonary root) Subcarinal; carinal	Mediastinal (paratracheobronchial; paratracheal; pericardial; para–oesophageal; para–aortic–above the diaphragm)
DISTANT, DIRECT EXTENSION OR METASTASIS	Brachial plexus from superior sulcus or Pancoast tumour Lung and/or main stem bronchus, contralateral Visceral pericardium; heart Pleura, parietal Extension to: rib, sternum, vertebra	Chest (thoracic) wall; skeletal muscle and skin, chest Diaphragm Abdominal organs and/ or other distant involvements
DISTANT, LYMPH NODES	Contralateral hilar or mediastinal or bilateral Supraclavicular (transverse cervical)	Scalene Cervical, NOS Other distant nodes

BONE (T–C40.0–C40.3, C40.8–C40.9, C41.0–C41.4, C41.8–C41.9; 170.0–170.9)		
LOCALIZED	Confined to bone Tumour has broken through periosteum but not beyond	Abnormal configuration of bone Localized, NOS
REGIONAL, DIRECT EXTENSION	Surrounding tissues, including skeletal muscle(s)	Adjacent bone
REGIONAL, LYMPH NODES	First chain of nodes involved in the area of the tumour	
DISTANT, DIRECT EXTENSION OR METASTASIS	Skin	Other distant involvement
DISTANT, LYMPH NODES		

MALIGNANT MELANOMA, SKIN (T–C44.0–C44.7, C51.0–C51.2, C51.8–C51.9, C60.0–C60.1, C60.8–C60.9; 173.0–173.7, 184.1–184.4, 187.1–187.2, 187.4 HISTOLOGY: 8720 – 8790)		
IN–SITU	Intraepidermal (Clark's level 1)	
LOCALIZED	Invasion of papillary dermis (Clark's level 2) or thickness/depth of invasion 0.75 mm Invasion of papillary–reticular dermal interface (Clark's level 3) or thickness/depth of invasion of 0.76 – 1.50 mm	Invasion of reticular dermis (Clark's level 4) or thickness/depth of invasion >1.50 mm Subcutaneous tissue (through entire dermis) (Clark's level 5) Localized, NOS; confined to skin/dermis, NOS
REGIONAL	Satellite nodule(s) within immediate area (2 cm from the primary lesion) Intransit metastasis directed toward regional lymph nodes (including satellite nodule(s) 2 cm from the primary lesion)	Note: 1. Skin ulceration does not alter classification 2. Clark's level takes precedence over thickness or depth of invasion in case of discrepancy
REGIONAL, LYMPH NODES (by primary site)		
Parotid: preauricular, infra–auricular Forehead; temporal region; malar region Lateral half of eyelids; outer canthus Anterior half of ear	Submandibular (submaxillary) Midline, forehead Inner canthus Medial half of eyelids Nose	Cervical Occipital scalp, posterior ear Head and neck tumours, any location Scapula above transverse line
Supraclavicular (transverse cervical) Chest wall, anterior and posterior Neck	Axillary Arm, hand, shoulder Chest wall, anterior and posterior Scapula (upper back), below transverse line	Epitrochlear Hand, forearm
Superficial inguinal Lumbar region (lower back) Abdominal wall, anterior and posterior Perineum and perianal region	Femoral Lower extremities (excluding heel) Perineum Perianal region	Popliteal Heel, posterior leg
DISTANT, DIRECT EXTENSION OR METASTASIS	Underlying cartilage, bone, muscle	Metastatic (generalized) skin lesions Other distant involvement
DISTANT, LYMPH NODES	Other than above	

BREAST (T-C50.0-C50.9; 174.0-174.9 (Female), C50.0-C50.9; 175.9 (Male))		
IN-SITU	Non-infiltrating; intraductal without infiltration	
LOCALIZED	Confined to breast, including nipple and/or areola	Note: Skin changes such as dimpling, tethering, attachment, induration and thickening or Paget's disease of nipple do not alter the classification.
REGIONAL, DIRECT EXTENSION	Invasion of subcutaneous tissue Skin infiltration of primary breast Skin oedema, peau d'orange, 'pigskin' En curraise, lenticular nodules Inflammation of skin, erythema	Ulceration of skin of breast Satellite nodules in skin of primary breast Pectoral fascia or pectoral muscle involvement Invasion of (or fixation to) chest wall, ribs, intercostal or serratus anterior muscles
REGIONAL, LYMPH NODES	Axillary: low (adjacent to tail of breast) mid (central, interpectoral, Rotter's node) high (subclavicular, axillary vein nodes, apical)	Internal mammary (parasternal) Nodules in axillary fat
DISTANT, DIRECT EXTENSION OR METASTASIS	Skin over sternum, upper abdomen, contralateral axilla or breast Satellite nodule(s) in skin other than primary breast	Breast, contralateral Other distant involvement
DISTANT, LYMPH NODES	Infraclavicular Supraclavicular Cervical, NOS	Axillary and/or internal mammary, contralateral Other distant nodes

CERVIX UTERI (T-C50.0-C50.1, C53.8-C53.9; 180.0-180.1, 180.8-180.9)		
IN SITU	Non-invasive, pre-invasive, intraepithelial (FIGO Stage 0)	
LOCALIZED	Minimal stromal invasion: "microinvasion"	Invasive cancer confined to cervix (FIGO Stage I)
REGIONAL, DIRECT EXTENSION	Extension to corpus uteri Extension to upper 2/3 of vaginal wall, including fornices and vagina, NOS Parametrium Ligaments: broad, uterosacral, cardina (FIGO Stage II)	Extension to lower third of vaginal wall Pelvic wall(s) (FIGO Stage III) Rectal and/or bladder wall (excluding mucosa) Bullous oedema of bladder mucosa Cul de sac (rectouterine pouch)
REGIONAL, LYMPH NODES	Hypogatric Iliac (common, internal, external) Parametrial/pelvic, NOS	Sacral (laterosacral, presacral, sacral promontory, uterosacral) Obturator Paracervical
DISTANT, DIRECT EXTENSION OR METASTASIS	Bladder mucosa Rectal mucosa Sigmoid colon Small intestine "Frozen pelvis"	Other distant involvement (FIGO Stage IV) Ureter Urethra Vulva Ovary/fallopian tube
DISTANT, LYMPH NODES	Aortic (para-aortic, periaortic, lumbar)	Inguinal Other distant nodes

CORPUS UTERI (T-C54.0-C54.3, C54.8-C54.9; 182.0-182.1, 182.8)		
IN-SITU	Pre-invasive; non-invasive	
LOCALIZED	Invasive cancer confined to endometrium Invasion of myometrium/serosa (perimetrium)	Invasive cancer confined to corpus clinically Localized, NOS
REGIONAL, DIRECT EXTENSION	Cervix uteri, including endocervix Parametrium Ligaments: broad, round, uterosacral Pelvic wall(s)	Ovary and/or fallopian tube(s) Rectal and/or bladder wall (excluding mucosa)
REGIONAL, LYMPH NODES	Hypogastric Iliac (common, internal, external) Obturator Paracervical Parametrial/pelvic NOS	Sacral (laterosacral, sacral promontory, uterosacral) Superficial inguinal Lateral aortic, preaortic
DISTANT, DIRECT EXTENSION OR METASTASIS	Vagina Vulva Cul de sac (rectouterine pouch) Rectum or bladder mucosa Ureter	Sigmoid colon Small intestine Serosa of abdominal organs "Frozen pelvis" Other distant involvement
DISTANT, LYMPH NODES		

OVARY (T-C56.9; 183.0)		
LOCALIZED	Confined to ovarian tissue – one ovary, or if not specified to be metastatic, both ovaries	Localized, NOS
REGIONAL, DIRECT EXTENSION	Peritoneum (pelvic; immediately adjacent, not implants) Broad ligament, ipsilateral	Moesovarium, ipsilateral Fallopian tube, ipsilateral Adnexa, ipsilateral
REGIONAL, LYMPH NODES	Aortic (lateral and preaortic) Hypogastric Iliac (common, internal, external)	Obturator Retroperitoenal/pelvic, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Sigmoid Omentum Cul de sac (rectouterine pouch) Uterus Rectosigmoid, rectum Small intestine Bladder, ureter	Implants on ovary, fallopian tube, cul de sac (rectoouterine pouch), peritoneum, omentum Metastatic to contralateral ovary and/or fallopian tube Other distant involvement
DISTANT, LYMPH NODES	Inguinal	Other distant nodes

PROSTATE (T-C61.9; 185.9)		
IN-SITU	Non-invasive	
LOCALIZED	Confined to prostatic capsule (intra-capsular) Invasion of prostatic capsule or prostatic urethra	Localized, NOS
REGIONAL, DIRECT EXTENSION	Extension to: Periprostatic tissues Seminal vesicle(s) Through prostatic capsule, including "fixation"	Extension to : Rectovesical (Denonviller's) fascia; Bladder; Rectum; Extraprostatic urethra (membranous urethra)
REGIONAL, LYMPH NODES	Hypogastric Iliac (common, internal, external) Obturator	Periprostatic/pelvic, NOS Sacral (lateral sacral, sacral promontory, presacral)
DISTANT, DIRECT EXTENSION OR METASTASIS	Skeletal muscles: levator ani Pelvic bone Pelvic wall Ureter Sigmoid colon Penis	"Frozen pelvis" Other distant involvement
DISTANT, LYMPH NODES	Aortic (para-aortic, periaortic, lumbar) Inguinal	Other distant nodes

TESTIS (T-C62.0-C62.1, C62-9; 186.0, 186.9)		
IN-SITU	Non-invasive, intratubular	
LOCALIZED	Confined to tunica albuginea (encapsulated tumour) Tunica vaginalis involved	Localized, NOS
REGIONAL, DIRECT EXTENSION	Epididymis Scrotum, ipsilateral	Spermatic cord, ipsilateral Vas deferens
REGIONAL, LYMPH NODES	Aortic, below level of renal arteries External iliac	Retroperitoneal/pelvic, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Ulceration of scrotum Scrotum, contralateral Testis, bilateral Penis Kidney	Adrenal gland Retroperitoneum Other distant involvement
DISTANT, LYMPH NODES	Inguinal	Other distant nodes

SKIN OF PENIS (T-C60.0-C60.1, C60.8-C60.9; 187.1, 187.2, 187.4)		
IN-SITU	Non-invasive (Bowen's disease)	
LOCALIZED	Invasive cancer confined to skin of penis, prepuce,and/or glans	Localized, NOS
REGIONAL, DIRECT EXTENSION	Corpus cavernosum Urethra	Satellite nodule(s) on prepuce or glans Skin: pubic, scrotal, abdominal, perineum
REGIONAL, LYMPH NODES	External iliac Internal iliac (hypogastric)	Superficial inguinal Deep inguinal: Rosenmuller's or Cloquet's node
DISTANT, DIRECT EXTENSION OR METASTASIS	Testis	Other distant involvement
DISTANT, LYMPH NODE	Note: Malignant melanoma of the penis is classified according to the staging scheme for melanoma	

BLADDER (T-C67.0-C67.6, C67.8-C67.9; 188.0-188.6,188.8-188.9)		
IN-SITU	Non-invasive; intraepithelial	
LOCALIZED	Confined to mucosa Submucosa (subepithelial connective tissue; tunica propria; lamina propria) invaded Superficial muscle (less than 1/2 through muscle coat)	Deep muscle (half-way or more through muscle coat) Localized, NOS; no detailed information of above
REGIONAL, DIRECT EXTENSION	Invasion of perivesical fat Invasion of (through) serosa; peritoneum Surrounding connective tissue (including periprostatic tissue); adjacent tissue, NOS Extension to: Prostate (including prostatic urethra); Ureter; vas deferens; Seminal vesicle; Rectovesical (Denonvillier's) fascia	Rectum, male; Parametrium and uterus, in female Bladder is "fixed" Vagina Pubic bone Urethra, female
REGIONAL, LYMPH NODES	Perivesical Hypogastric Iliac (common, internal, external) Obturator	Sacral (laterosacral, presacral, sacral promontory) Pelvic, NOS; regional, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Tumour fixed to (invading) pelvic wall Bones, excluding pubic bone Sigmoid	Other distant involvement Abdominal wall Rectum, female
DISTANT, LYMPH NODES	Aortic (para-aortic, periaortic, lumbar) Inguinal	Inguinal Other distant nodes

KIDNEY (RENAL) PARENCHYMA (T–C64.9; 189.0)		
IN–SITU		
LOCALIZED	Tumour confined to kidney cortex or kidney medulla Invasion of renal pelvis or calyces	Localized, NOS
REGIONAL, DIRECT EXTENSION	Perirenal tissue (fat) Renal (Gerota's) fascia Retroperitoneal soft tissues (retroperitoneal space) *Blood vessels*: perirenal veins, extrarenal portion of renal vein, aorta, renal artery, hilar blood vessels, vena cava Adrenal gland, ipsilateral	Ureter, including implant(s), ipsilateral Peritoneum Diaphragm Tail of pancreas Ascending colon from right kidney Descending colon from left kidney Duodenum from right kidney
REGIONAL, LYMPH NODES	Hilar (small nodes at renal pelvis)	Lateral aortic (retroperitoneal)
DISTANT, DIRECT EXTENSION OR METASTASIS	Kidney, bilateral Ureter, contralateral Adrenal gland, contralateral Ribs	Stomach Spleen Liver Other distant involvement
DISTANT, LYMPH NODES		

RENAL (KIDNEY) PELVIS (T–C65.9; 189.1)		
IN–SITU	Non–invasive; intraepithelial	
LOCALIZED	*Invasive cancer confined to:* submucosa musculature	Localized, NOS
REGIONAL, DIRECT EXTENSION	Peripelvic tissue Retroperitoneal soft tissue (retroperitoneal space) Major blood vessel(s): aorta, renal artery or vein, vena cava	Ureter, including implants Kidney parenchyma Adrenal gland Duodenum from right renal pelvis
REGIONAL, LYMPH NODES	Hilar (renal hilus)	Lateral aortic (retroperitoneal)
DISTANT, DIRECT EXTENSION OR METASTASIS	Bladder Spleen Pancreas	Liver Descending colon Other distant involvement
DISTANT, LYMPH NODES		

URETER (T–C66.9; 189.2)		
IN–SITU		
LOCALIZED	*Invasive cancer confined to:* submucosa; musculature	Localized, NOS
REGIONAL, DIRECT EXTENSION	Periurethral tissue Retroperitoneal soft tissue (retroperitoneal space) Psoas muscle Implant(s) distal in ureter Bladder	Kidney, ipsilateral Duodenum from right ureter Ascending colon from right ureter Descending colon from left ureter
REGIONAL, LYMPH NODES	Periureteral Hypogastricc Iliac (common, internal, external)	Lateral aortic Retroperitoneal/pelvic, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Uterus Pancreas	Implants in bladder Prostate Other distant involvement
DISTANT, LYMPH NODES		

THYROID GLAND (T–C73.9; 193.9)		
IN–SITU	Non–invasive	
LOCALIZED	Confined to one lobe and/or isthmus Involves both lobes or thyroid gland capsule	Multiple foci but confined to thyroid gland Through capsule of gland, but not beyond Localized, NOS
REGIONAL, DIRECT EXTENSION	Pericapsular tissues Strap muscle(s): sternothyroid, omohyoid, sternohyoid Nerve(s): recurrent laryngeal, vagus Major blood vessel(s): carotid artery, thyroid artery or vein, jugular vein Soft tissues of neck	Oesophagus Larynx, including thyroid and cricoid cartilages Sternocleidomastoid muscle tumour is described as "fixed to adjacent tissues"
REGIONAL, LYMPH NODES	Anterior deep cervical: prelaryngeal, pretracheal , laterotracheal (recurrent) Internal jugular: subdigastric	Retropharyngeal Cervical, NOS
DISTANT, DIRECT EXTENSION OR METASTASIS	Trachea Mediastinal tissues Skeletal muscle, other than strap muscles and sternocleidomastoid	Bone Other distant involvement
DISTANT, LYMPH NODES	Submandibular (submaxillary) Submental	Other distant nodes

LYMPH NODES AND LYMPHOID TISSUE (T – C02.4, C09.8–C09.9, C11.1, C14.2, C37.9, C42.2, C77.0–C77.9; 196.0–196.9,141.6, 146.0, 147.1, 149.1, 164.0, 169.2) Histology: 959, 969, 968; 959, 969, 975		
STAGE I (LOCALIZED)	Confined to one lymphatic region above or below the diaphragm	
STAGE II (REGIONAL)	Involvement of more than one lymphatic region on only one side of the diaphragm	
STAGE III (DISTANT)	Involvement of lymphatic regions on both sides of the diaphragm	
STAGE IV (DISTANT)	Bone Bone marrow Lung and/or pleura Liver Kidney	Gastrointestinal tract (but not primary G.I.) Skin lesions or subcutaenous nodules (but not primary skin)
SYSTEMIC SYMPTOMS:	Night sweats Unexplained fever	Pruritis Unexplained weight loss
NOTE: Lymphoid tissue includes spleen, lingual and palatine tonsils, adenoids (pharyngeal tonsils), thymus and Waldeyer's ring, NOS.		

HODGKIN'S DISEASE AND NON-HODGKIN'S LYMPHOMA** Histology: 9590–9595, 9650–9698, 9702–9714; 959–969, 975 (Applicable to all primary site codes)		
STAGE I (LOCALIZED)	Confined to one lymphatic region above or below the diaphragm or Confined to a single extranodal organ or site	
STAGE II (REGIONAL)	Involvement of more than one lymphatic region on only-**one side** of the diaphragm or Involvement of an **extranodal organ** or site with (1) direct extension to adjacent organs or tissues, or (2) involvement of one or more lymphatic regions on the same side of the diaphragm, or (3) both (1) and (2)	
STAGE III (DISTANT)	Involvement of lymphatic regions on **both sides** ofthe diaphragm, or Involvement of an **extranodal organ or site with** involvement of lymphatic regions on **opposite or both sides** of the diaphragm	
STAGE IV (DISTANT)	**Diffuse or disseminated involvement** of one or more metastatic sites with or without associated lymph node enlargment Bone Bone marrow Liver	Kidney Skin lesions or subcutaneous nodules Gastrointestinal tract Lung and/or pleura Brain Eye
SYSTEMIC SYMPTOMS:	Night sweats Unexplained fever	Pruritis Unexplained weight loss
** An alternative scheme for ONLY those hospitals wishing to stage lymphoma of extranodal sites.		

Appendix 4.2
Instructions for abstracting extent of disease and diagnostic procedures:
BRONCHUS AND LUNG

I. **History and physical examination**

Record significant findings from:

- Palpation of secondary masses
- Palpation of accessible lymph nodes

Record the presence of:

- Superior vena cava syndrome
- Horner's syndrome
- Recurrent laryngeal nerve paralysis (hoarseness)
- Pancoast syndrome

II. **X-rays, scans and other imaging techniques**

Record significant findings from:

- Chest x-ray
- Tomograms, planograms
- Bone survey
- Angiogram
- Brain scan
- Bone scan
- Liver/spleen scan

Significant findings of chest x-rays are:

- Hilar mass
- Mediastinal mass

Indicate whether masses are stated to be nodes or questionable nodes.

If no mention of a hilar or mediastinal mass or no information, record not specified (N/S)

Record other significant findings:

- Atelectasis
- Obstructive pneumonitis
- Pleural effusion

III. **Endoscopic and manipulative procedures**

Specifically identify:

- Bronchoscopy
- Laryngoscopy
- Mediastinoscopy (Note if hilar and/or mediastinal nodes are positive or negative)

IV. **Report highest class (I–V) from each source:**

- Sputum
- Pleural fluid (thoracentesis)
- Bronchial washings or brushings
- Ascitic fluid (paracentesis)

V. **Operative procedures**

A. Record information as to whether just the tumour was excised or the entire site, with details as to exactly what was removed.

Local tumour destruction:

- Cryosurgery
- Electrocautery
- Fulguration

Laser surgery – specify if the tumour is vaporized with no pathology specimen, or if there is a pathology specimen.

Local excision or limited resection:

- Wedge resection
- Segmental resection
- Lingulectomy
- Sleeve resection
- Partial lobectomy

Resection of primary site (specify type of resection)

- Lobectomy
- Bilobectomy

Radical Lobectomy
Partial pneumonectomy
Complete pneumonectomy
Total pneumonectomy
Standard pneumonectomy
Radical pneumonectomy
Extended radical pneumonectomy

B. Specifically identify organs and tissues removed to verify surgical procedure, i.e.:

Lung (specify side and portion)
Parietal pleural
Pericardium
Diaphragm
Chest wall
Rib

C. Indicate whether or not lymph nodes were removed and specify their location.

D. Indicate whether removal of rib was incidental.

VI. Pathology reports (including autopsy)

Record histology, multifocal tumours, size of primary tumour, direct extension of tumour, lymph nodes and distant sites.

Determine whether primary site is lung or main stem bronchus. If the primary is in the lung (or segmental bronchi), specify lobe(s) involved.

Record reports of bone marrow aspiration and/or biopsy.

VII. Site-specific details

A. Description of tumour in lung(s) and main stem bronchus:

1. Lobes involved; include mention of contiguous tumour where tumour crosses major fissure:
   - Right (specify if upper, middle or lower lobe)
   - Left (specify upper, lower lobe or lingula)
2. Main stem bronchus involved. Recorded relationship of tumour margin to carina (e.g. distance in cm.)
3. "Localized" or "hilar region of lung" without further details should be so recorded if this is the only information available.

B. Direct extension of tumour

Specifically identify:

- Pleura (specify visceral, parietal, NOS)
- Pericardium (specify visceral, parietal, NOS)
- Pulmonary ligament
- Atelectasis/obstructive pneumonitis (specify how much of lung is involved)
- Pleural effusion (specify with, without, or NOS)
- Major blood vessels (specify pulmonary artery or vein, superior vena cava or others)
- Nerves [specify recurrent laryngeal nerve, vagus, phrenic (fixed diaphragm), cervical sympathetic nerves]

If the only statement is extrapulmonary mediastinal involvement, record this.

Carina
Trachea
Oesophagus
Extrapulmonary mediastinum or NOS
Brachial plexus from superior sulcus or Pancoast tumour
Contralateral lung
Heart
Adjacent rib
Sternum
Chest (thoracic) wall
Skeletal muscle
Skin of chest
Superior sulcus (Pancoast) tumour
Brachial plexus
Vertebra
Diaphragm
Abdominal organs

Specify other organs or tissues involved by direct extension

C. Lymph nodes

1. Specifically identify:

Intrapulmonary
Intralobar
Hilar:
Bronchial
Parabronchial
Pulmonary root
Subcarinal, carinal
Extrapulmonary

Mediastinal:
Paratracheal
Paratracheobronchial
Paraoesophageal
Pericardial
Para–aortic

Other lymph nodes: (Distant lymph nodes)
Contralateralhilar or mediastinal (including bilateral)
Supraclavicular (transverse cervical)
Scalene
Cervical, NOS

2. Specify any other lymph nodes mentioned.

3. Record statements such as "Regional node(s)" or "Distant node(s)"

4. Specify if ipsilateral, contralateral or bilateral.

D. Metastasis (discontinuous involvement)

1. Specifically identify:

Implants in thoracic cavity; implants on pleura
Implants in contralateral lung
Liver
Adrenal gland(s)
Bone
Brain

2. Specify any other metastatic site(s).

3. Generalized metastases, carcinomatosis, or "distant metastasis" should be recorded if this is the only information available.

Instructions for abstracting extent of disease.

BREAST (Male and Female)

I. History and physical examination

Record description of palpation of:

- Both breasts and axilla
- Bilateral lymph nodes (specifically axillary, cervical and supraclavicular)

(see VII A and B for site-specific details)

II. X-rays, scans and other imaging techniques

Pertinent radiographic reports are:

- Mammography (both breasts)
- Xerography (both breasts)
- Thermography (both breasts)
- Chest x-ray
- Skull x-ray
- Bone survey
- Angiography
- Lymphography
- Bone scan
- Brain scan
- Liver/spleen scan

III. Endoscopic and manipulative procedures

For breast, these procedures would be done only for distant metastasis.

IV. Cytology reports

Record the highest class (I-V) from each source

- Ductal fluid
- Aspirated tumor cells
- Ulceration/inflammation of skin of breast, including areola
- Ascitic fluid (paracentesis)
- Pleural fluid (thoracentesis)

V. Operative reports

A. Record the information about exact-ly what was removed: was it only the tumour which was excised ? Was the entire primary site removed?

Less than total mastectomy (specify type of resection):

- Excisional biopsy
- Segmental resection
- Lumpectomy
- Quadrantectomy
- Tylectomy
- Wedge resection
- Nipple resection
- Partial mastectomy
- Excisional biopsy
- Subtotal mastectomy

Subcutaneous mastectomy or more (specify type of resection):

- Simple
- Total
- Modified radical
- Radical
- Extended radical

Specifically identify organs and tissues removed to verify the surgical procedure such as all or part of the pectoralis major muscle.

B. Indicate whether or not axillary and/or mammary lymph nodes were dissected, and specify their location.

C. Definitions:

Halsted: Developed radical mastectomy, i.e. en bloc dissection of entire breast and skin together with pectoralis major and minor muscles and contents of axilla.

Patey and Dyson: Modified radical mastectomy, i.e. removal of breast, pectoralis minor axillary contents, but leaving the pectoralis major intact.

Urban: Extended radical mastectomy, i.e. radical mastectomy plus excision of internal mammary nodes.

VI. Pathology reports (including autopsy)

Record histology, multiple tumours, size, location, direct extension of tumour, lymph nodes and distant sites.

Record reports of bone marrow aspiration and/or biopsy.

(See VII A and C for site–specific details)

VII. Detailed evaluation

A. Location

No primary found

Upper outer quadrant (UOQ), including axillary tail tumours

Upper inner quadrant (UIQ)

Lower outer quadrant (LOQ)

Lower inner quadrant (LIQ)

Upper half, upper midline

Lower half, inner midline

Outer (lateral) half, outer midline

Inner (medial) half, inner midline

Central (subareolar)

More than one tumour mass in the same breast

Diffuse

Laterality and location may be combined, i.e. RUIQ for right upper inner quadrant.

Location may also be described in "o'clock" terms, i.e. "2 o'clock", "5 o' clock", etc.

B. Size of Primary of Tumour

Record the size as stated in the pathological report. If none, check the operative report or, lastly, the physical examination.

If multiple masses are present, record the size of the largest.

C. Clinical evaluation of the primary tumour

1. Within the breast
   - Freely movable
   - Mobile
   - Nonfixed
   - Well circumscribed
   - Fixed within the breast

2. Nipple and areola
   - Attachment to nipple and/or areola
   - Induration of nipple
   - Retraction of nipple (not to be confused with inversion which is a congenital condition, usually bilateral)
   - Paget's disease of nipple

3. Overlying skin
   - Dimpling
   - Retraction of skin
   - Tethering
   - (these are considered to be due to shortening of Cooper's ligaments).
   - Adherence to skin
   - Attachment of skin
   - Induration or thickening of skin of breast
   - Fixation to skin (complete or incomplete)
   - (these imply direct extension to skin).
   - Specify presence and location of adjacent skin including satellite nodules in adjacent skin (e.g. over the sternum, upper abdomen or axilla).

4. Deeper structures
   - Fixation or attachment to pectoral muscleor fascia
   - Deep fixation to chest wall, intercostal muscles, serratus anterio muscle and/or ribs.

5. "Inflammatory carcinoma"
   - Not all breast cancers with inflammation are considered inflammatory. Only when a specific diagnosis of "inflammatory carcinoma" is made should it be so recorded.

6. Preoperative oedema of the ipsilateral arm is indicative of poor axillary lymph node drainage from possible involvement, and should be recorded.

D. Pathological evaluation

1. Depth of invasion:
   - In–situ only, intraductal, non–infiltrating
   - Infiltrating, invasive

2. Extension to tissue such as:
   - Nipple and/or areola
     (Record the presence of Paget's disease of the nipple and indicate whether or not there is associated cancer).
   - Skin of breast (dermal lymphatics)
   - Subcutaneous tissue
   - Adjacent skin (upper abdomen, axilla)
   - Pectoral fascia
   - Pectoral muscle
   - Chest wall
   - Intercostal muscles
   - Serratus anterior muscle
   - Ribs

3. Record metastatic nodule(s) within the breast. This is considered as localized spread by way of the lymphatic system.

E. Lymph nodes

1. Specifically identify:
   - Low axillary, including external mammary (adjacent to tail of breast)
   - Mid–axillary (including central, interpectoral, Rotter's node)
   - High axillary (including subclavicular and axillary vein nodes)
   - If terms such as "Level 1" or "level 3" are used, determine which corresponds to "low" or "high"
   - Internal mammary (parasternal)
   - Record "nodules(s) in axillary fat".
   - This is considered regional spread by way of the lymphatic system (probable lymph node(s) whose configuration has been obliterated by tumour.
   - "Axillary nodes" or "Regional nodes" should be so recorded if this is the only information available.
   - Supraclavicular (specify if homolateral or contralateral)
   - Infraclavicular (specify if homolateral or contralateral)
   - Cervical
   - Contralateral axillary
   - Contralateral internal mammary

2. Indicate if there is fixation of axillary nodes.
3. Record pretreatment oedema of the arm.
4. Specify any other lymph nodes mentioned
5. "Distant nodes" should be so recorded if this is the only information available.

F. Metastasis (discontinuous involvement)

1. Specifically look for:
   - Bone, other than adjacent rib
   - Opposite breast parenchyma
   - Lung: implants on pleura
   - Implants in thoracic cavity
   - Implants on peritoneum
   - Ovary
   - Adrenal
   - Liver
   - Brain
   - Skin including nodules (specify location)

2. Specify any other metastatic site(s).

3. Generalized metastasis, carcinomatosis, or "distant metastasis" should be so recorded if this is the only available information.

Instructions for abstracting extent of disease.

CERVIX UTERI

I. **History and physical examination**

Record significant findings from:

Pelvic examination, including bimanual examination of pelvic lymph nodes

Examination at dilatation and curettage (D & C)

Palpation of abdomen

Palpation of accessible lymph nodes

Palpation of secondary masses

If clinically there is no detectable cancer, state this.

Enlargement of the uterine cavity is measured with a sound from the external os. Record sounding in centimeters. If the exact size is not given, record any statement of enlarged uterine cavity.

II. **X-rays, scans, and other imaging techniques**

Record significant findings from:

Lymphangiogram

Hysterosalpingogram

Pelvic x-ray (scout film)

Pyelogram (intravenous or retrograde)

Chest x-ray

Bone survey

Bone scan

Liver/spleen scan

Brain scan

III. **Endoscopic and manipulative procedures**

Specifically identify:

Colposcopy

Culdoscopy

Cystoscopy

Hysteroscopy

Laparoscopy

Peritoneoscopy

Proctosigmoidoscopy

IV. **Cytology reports**

Report the highest class (I–V) from each source.

Cervical (Pap test, vibra, Gravelee jet washer)

Ascitic fluid (paracentesis)

Pleural fluid (thoracentesis)

V. **Operative procedures**

A. Record information as to whether just the tumour was excised or the entire primary site with details as to exactly what was removed.

Local tumour destruction:

Cryosurgery

Electrocautery

Fulguration

Laser surgery: specify if the tumour is vaporized with no pathology specimen, or if there is a pathology specimen.

Local excision:

Cervix uteri

Conization

Excisional biopsy

Trachelectomy

Amputation of cervix

Endocervical curettage (*in-situ* only)

Corpus uteri

D & C (in situ-only)

Polypectomy

Myomectomy

Simple excision

Resection of primary site (specify type of resection):

Simple hysterectomy

Panhystectomy

Total hysterectomy

Modified radical or extended hysterectomy
Radical hysterectomy
Wertheim (Cervix uteri)
Pelvic exenteration (specify anterior, posterior or total)

B. Specifically identify organs and tissues removed to verify surgical procedure such as :

Both corpus and cervix uteri
a. Without tubes and ovaries
b. With tubes and ovaries
Vaginal cuff (specify if just upper 1/3 or more is removed)
Parametrial/paravaginal tissues
Bladder
Distal ureters
Rectum and rectosigmoid
Appendix
Lymph nodes

C. Specify whether or not para-aortic and/or pelvic lymph nodes were removed.

D. Indicate whether removal of appendix was incidental or not.

E. Definitions:

Wertheim's operation: Radical abdominal hysterectomy for cancer of the cervix uteri in which there is as much of the parametrial tissue as possible and a wide margin of the vagina removed with the uterus

VI. Pathology reports (including autopsy)

Record histology, multifocal tumours, size of primary tumour, direct extension of tumour, lymph nodes, and distant sites.
Record reports of bone marrow aspiration and/or biopsy.
(See VII for site-specific details)

VII. Detailed evaluation

A. Direct extension of tumour:

1. Depth of invasion:
   In-situ: Intraepithelial
   noninvasive
   preinvasive
   minimal stromal invasion "microinvasion"
   Invasive cancer confined to cervix and/or endocervix.

2. Extension beyond the cervix to:
   Corpus uteri
   Body of uterus
   Vaginal wall (specify if tumour involves upper 2/3, lower 1/3 or if not specified)
   Fornices
   Anterior (vesicovaginal) and/or posterior (rectovaginal) septum
   Rectum (specify whether rectal wall or mucosa)
   Bladder (specify whether bladder wall or mucosa
   Parametrium (including uterosacral ligament and non-ovarian adnexae)
   Ligaments: broad, uterosacral, cardinal
   Pelvic wall(s)
   Ureter (specify whether intramural or extramural)
   Hydronephrosis or nonfunctioning kidney (except of other cause)
   Cul-de-sac (retrouterine pouch)
   Urethra
   Intestines (specify segment)
   Vulva
   Ovary and Fallopian tubes

3. If there is no information about extension beyond the cervix state this.

4. If the extension is described in terms of FIGO stages 0-IV, record this.

5. If there is evidence of "bullous oedema" of the bladder, this should be recorded.

6. If "frozen pelvis" is specified, state this.

B. Lymph nodes:

1. Specifically identify:
   Paracervical
   Parametrial

Pelvic, NOS
Iliac (specify common, internal, external, NOS)
Hypogastric
Obturator
Sacral (specify laterosacral, presacral,
Uterosacral or promontory (Gerota's)).
Aortic (specify pre–, para–. peri–aortic, or lumbar).
Retroperitoneal
Inguinal (specify superficial, deep, or NOS)
Supraclavicular, cervical, scalene

2. Specify any other lymph nodes mentioned.

3. Also record statements such as:
"Pelvic node(s)"
"Regional node(s)"
"Distant node(s)"

C. **Metastasis (discontinuous involvement)**

1. Specifically identify:
Metastasis in lung (specify whether solitary or multiple)
Implants on pleura and/or in thoracic cavity
Implant(s) in vagina
Ovary
Liver
Bone
Brain
Peritoneal involvement outside true pelvis

2. Specify any other metastatic site(s).

3. Generalized metastasis, carcinomatosis, or "distant metastasis" should be so recorded if this is the only information available.

Appendix 4.3

Definitions of anatomical sites according to the manual for staging of cancer of the American Joint Committee on Cancer Staging (AJCC, 1988)

Lip and oral cavity

The oral cavity extends from the skin-vermilion junction of the lips to the junction of the hard and soft palate above and to the line of the circumvallate papillae below and is divided into the following areas:

Lip C00 (140) The lip begins at the junction of the vermilion border with the skin and includes only that portion of the lip that comes into contact with the opposing lip (the vermilion surface). It is well defined into an upper and lower lip joined at the commissures of the mouth.

Buccal mucosa C06.0 (145.0) Includes all the membrane lining of the inner surface of the cheeks and lips from the line of contact of the opposing lips to the line of attachment of mucosa of the gingiva (upper and lower) and pterygomandibular raphe.

Lower gingiva (lower alveolar ridge) C03.1 (143.1) Includes the alveolar process of the mandible and its covering mucosa, which extends from the line of attachment of the mucosa in the buccal gutter to the line of free mucosa of the floor of the mouth. Posteriorly it extends to the ascending ramus of the mandible.

Upper gingiva (upper alveolar ridge) C03.0 (143.0) Includes the alveolar process of the maxilla and its covering mucosa, which extends from the line of attachment of the mucosa in the upper gingival buccal gutter to the junction of the hard palate. Its posterior margin is the upper end of the pterygopalatine arch.

Retromolar gingiva (retromolar trigone) C06.2 (145.6) Includes the attached mucosa overlying the ascending ramus of the mandible from the level of the posterior surface of the last molar tooth to the apex superiorly, adjacent to the tuberosity of the maxilla.

Floor of the mouth C04 (144) A semilunar space extending from the inner surface of the lower gingiva to the undersurface of the tongue. Its posterior boundary is the base of the anterior pillar of the tonsil. It is divided by the frenulum of the tongue into two sides and it contains the opening of the submaxillary and sublingual salivary glands.

Hard palate C05.0 (145.2) This is the semilunar area between the upper alveolar ridge and the mucous membrane covering the palatine process of the maxillary palatine bones. It extends from the inner surface of the superior alveolar ridge to the posterior edge of the palatine bone.

Anterior two thirds of the tongue (oral tongue) C02.0 – CO2.3 (141.1 – 141.4) The freely mobile portion of the tongue, extending anteriorly from the line of the circumvallate papillae to the undersurface of the tongue at the junction of the floor of the mouth.

Pharynx

The pharynx (including the base of the tongue, soft palate and uvula) is divided into three regions: oropharynx; nasopharynx; and hypopharynx. Each region is further divided into specific sites.

Oropharynx C10 (146) includes:

Base of the tongue C01.9 (141.0)

Soft palate CO5.1 (145.3)

Uvula C05.2 (145.4)

Tonsil C09.9 (146.0) tonsillar fossa C09.0 (146.1) and faucial pillars C09.1 (146.2) and vallecula C10.0 (146.3)

Anterior surface of epiglottis C10.1 (146.4)

Lateral wall of oropharynx C10.2 (146.6)

Posterior wall C10.3 (146.7)

Nasopharynx C11 (147)

Posterosuperior wall extends from the level of the junction of the hard and soft palates to the base of the skull C11.0 (147.0) and C11.1 (147.1).

Lateral wall, including the fossa of Rosenmüller C11.2 (147.2)

Inferior (anterior) wall which consists of the superior surface of the soft palate C11.3 (147.3)

Hypopharynx C13 (148)

Pharyngo-oesophageal junction (post-cricoid region) C13.0 (148.0) extends from the level of the arytenoid cartilages and connecting folds to the inferior border of the cricoid cartilage.

Pyriform sinus C12.9 (148.1) extends from the pharyngo-epi-glottic fold to the upper end of the oesophagus.

Posterior pharyngeal wall C13.2 (148.3) extends from the level of the floor of the vallecula to the level of the crico-arytenoid joints.

Larynx

The division of the larynx is summarized as follows:

Site	Subsite
Supraglottis C32.1 (161.1)	Ventricular bands (false cords)
	Arytenoids Epiglottis (both lingual and laryngeal aspects) Suprahyoid epiglottis Infrahyoid epiglottis Arytenoepiglottic folds
Glottis C32.0 (161.0)	True vocal cords including anterior and posterior commissures
Subglottis C32.2 (161.2)	Subglottis

Maxillary sinus C31.0 (160.2)

Cancer of the maxillary sinus is the most common of the paranasal sinus cancers; it is the only site to which the following classification applies. The ethmoid sinuses and nasal cavity may ultimately be defined similarly with further study. Tumours of the sphenoid and frontal sinuses are so rare as not to warrant staging.

Ohngren's line, a theoretic plane joining the medial canthus of the eye with the angle of the mandible, may be used to divide the maxillary antrum into the anteroinferior portion (the infrastructure) and the superoposterior portion (the suprastructure).

Salivary glands (including parotod, submaxillary, and sublingual)

The major salivary glands include the parotid CO7.9 (142.0), submaxillary CO8.0 (142.1), and sublingual CO8.1 (142.2) glands.

Thyroid Gland

The thyroid gland C73 (193) ordinarily is composed of a right and a left lobe lying adjacent and lateral to the upper trachea and oesophagus. An isthmus connects the two lobes and in some cases a pyramidal lobe is present extending upward anterior to the thyroid cartilage.

Oesophagus

For purposes of classification, staging and reporting of cancer, the oesophagus is divided into four regions:

Cervical oesophagus C15.0 (150.0)

The cervical oesophagus begins at the lower border of the cricoid cartilage and ends at the thoracic inlet (the suprasternal notch), approximately 18 cm from the upper incisor teeth.

Intrathoracic oesophagus C15.1–C15.5 (150.1–150.5)

The upper thoracic portion C15.3 (150.3) extends from the thoracic inlet to the level of the tracheal bifurcation, approximately 24 cm from the upper incisor teeth.

The mid-thoracic portion C15.4 (150.4) is the proximal half of the oesophagus between the tracheal bifurcation and the oesophago-gastric junction. The lower level is approximately 32 cm from the upper incisor teeth.

The lower thoracic portion C15.5 (150.5), 8 cm in length (includes the abdominal oesophagus C15.2 (150.2)), is the distal half of the oesophagus betweeen the tracheal bifurcation and the oesophago-gastric junction, approximately 40 cm from the upper incisor teeth.

Stomach

For staging purposes, the stomach is divided into three anatomical regions:

Upper third: includes the cardiac area C16.0 (151.0) and fundus C16.1 (151.3)

Middle third: includes the bulk of the corpus C16.2 (151.4)

Lower third: includes the antral area C16.3 (151.2) and pylorus C16.4 (151.1)

In order to delimit these regions, the lesser C16.5 (151.5) and greater C16.6 (151.6) curvatures are divided at two equidistant points and these are joined.

Colon and rectum

The colon extends from the terminal ileum to the anal canal, and is divided as follows:

Caecum C18.0 (153.4) and appendix C18.1 (153.5)

Ascending colon C18.2 (153.6)

Hepatic flexure C18.3 ((153.0)

Transverse colon C18.4 (153.1)

Splenic flexure C18.5 (153.7)

Descending colon C18.6 (153.2)

Sigmoid colon C18.7 (153.3)

Rectosigmoid C19.9 (154.0)

Rectum C20.9 (154.1)

Anal canal

The anal canal C21.1 (154.2) extends from the rectum to the perianal skin and is lined by the mucous membrane overlying the internal sphincter, including the transitional epithelium and dentate line, to the junction with the hair-bearing skin.

Liver (including intrahepatic bile ducts)

The liver C22.0 (155.0) is located in the right upper abdominal cavity below the right leaf of the diaphragm. It extends from the fifth rib and midclavicular line on the left side to the inferior costal margin and midaxillarry line on the right side, and is divided into right and left lobes. Two smaller lobes, the quadrate and the caudate, are subdivisions of the undersurface of the right lobe. Between the left and the right lobes is the porta hepatis through which pass the hepatic artery and its major branches, the portal vein, the extrahepatic bile ducts and lymphatic vessels.

Gallbladder

The gallbladder C23.9 (156.0) is a pear-shaped saccular organ located under the liver in the gallbladder fossa. It has three parts: a fundus, a body, and a neck that tapers into the cystic duct.

Extrahepatic bile ducts

Emerging from the transverse fissure of the liver are the right and left hepatic bile ducts C24.0 (156.1), which join to form the common hepatic duct. The cystic duct, which connects to the gallbladder, joins the common hepatic duct to form the common bile duct, which passes behind the first part of the duodenum and then traverses the head of the pancreas until it opens into the second part of the duodenum at the ampulla of Vater.

Ampulla of Vater

A small dilated duct, less than 1.5 cm in length, the ampulla C24.1 (156.2) is formed in most individuals by the union of the terminal segments of the pancreatic and common bile ducts. In 25% of individuals, the ampulla may be difficult to define or non-existent, being the termination of the common duct only, the panceatic duct having its own entrance into the duodenum, adjacent to the ampulla.

Exocrine pancreas

The exocrine pancreas (head C25.0 157-0; body C25.1 157.1; tail C25.2 157.2; duct C25.3 157.3; and pancreas C25.9, 157.9) is a long, coarsely lobulated gland that lies transversely in the long posterior abdomen. It is located retroperitoneally in the concavity of the duodenum on its right end and touching the spleen with its left end or tail.

Lung

The mucosa lining the bronchus is the usual site of origin for carcinoma of the lung (C34.0-C34.9, 162.2-162.9). The trachea, which lies in the anterior mediastinum, divides into the right and left bronchi, which extend into the right and left lungs, respectively, and then further subdivide into the lobar bronchi for the upper, middle, and lower lobes on the right and the upper and lower lobes on the left.

Bone

All bones [C40-41 (170)] of the skeleton.

Soft tissues

A variety of soft tissues can give rise to these sarcomas. The tissues include fibrous connective tissue, fat, smooth or striated muscle, vascular tissue, and peripheral neural tissue, as well as undifferentiated mesenchyme:

Connective, subcutaneous and other soft tissues (C47,C49; 171)

Retroperitoneum (C48.0 158.0)

Mediastinum (C38.1,38.2 164.2–3)

Carcinoma of the skin (excluding eyelid, vulva and penis)

The skin (C44.0, C44.2–42.9, C63.2; 173.0, 173.2–173.9, 187.7 [scrotum]) has two layers, an outer epidermis and the inner dermis. The epidermis consists predominantly of stratified squamous epithelium, the external layer of which is keratinized. The dermis contains dense connective tissue and elastic fibres. Immediately below the dermis is the subcutaneous tissue. The sebaceous and other glands of the skin are found in the dermis and adjacent subcutaneous tissue. All the components of the skin – epidermis, dermis and adnexal structures – can give rise to malignant neoplasms.

Melanoma of the skin (excluding eyelid)

The great majority of melanomas (skin C44, 173; vulva C51, 184.4; penis C60.9, 187.4; scrotum C63.2, 187.7) arise from the pigmented melanocytes located in the basal layer of the epidermis. The tumour often develops from a pre-existing pigmented lesion, although some arise from appparently normal skin.

Breast

The mammary gland (C50; 174,175), situated on the anterior chest wall, is composed of glandular tissue within a dense fibroareolar stroma. The glandular tissue consists of approximately 20 lobes, each of which terminates in a separate excretory duct in the nipple.

Cervix uteri

The cervix (C53, 180) is the lower third of the uterus. It is roughly cylindrical in shape, projects through the upper anterior vaginal wall, and communicates with the vagina through an orifice called the external os. Cancer of the cervix may originate on the vaginal surface or in the canal.

Corpus uteri

The upper two thirds of the uterus above the level of the internal cervical os is called the corpus (C54, 182). The fallopian tubes enter at the upper lateral corners of a pear-shaped body. The portion of the muscular organ that is above a line joining the tubo–uterine orifices is often referred to as the fundus.

Ovary

Ovaries (C56.9, 183.0) are a pair of solid bodies, flattened ovoids 2 to 4 cm in diameter, connected by a peritoneal fold to the broad ligament and by the infundibulopelvic ligament to the lateral wall of the pelvis.

Vagina

The vagina (C52.9, 184.0) extends from the vulva upward to the uterine cervix.

Vulva

The vulva (C51.8,51.9; 184.4) is the anatomical area immediately external to the vagina.

Prostate

Adenocarcinoma of the prostate (C61, 185) usually arises within the true gland and rarely seems to begin in the benign hyperplastic enlargement that occurs around the prostatic urethra in older men. Pathologically, this cancer tends to be multifocal in origin. It is more commonly found in the peripheral posterior portion of the gland and therefore is highly amenable to early detection by rectal examination.

Testis

The testes (C62, 186) are composed of convoluted seminiferous tubules with a stroma containing functional endocrine interstitial cells. Both are encased in a dense barrier capsule, the tunica albuginea, with fibrous septa extending into and separating the testes into lobules. The tubules converge and exit at the mediastinum of the testis into the rete testis and efferent ducts, which join a single duct. This duct, the epididymis, coils outside the upper and lower pole of the testicle, then joins a muscular conduit, the vas deferens, which accompanies the vessels and lymphatic channels of the spermatic cord.

Penis

The penis (prepuce, C60.0,187.1; glans, C60.1,187.2; skin C60.8,60.9;187.4) is composed of three cylindrical masses of cavernous tissue bound together by fibrous tissue. Two masses are lateral and are known as the corpora cavernosa penis. The corpus spongiosum penis is a median mass and contains the greater part of the urethra. The penis is attached to the front and the sides of the pubic arch. The skin covering the penis is thin and loosely connected with the deeper parts of the organ. The skin at the root of the penis is continuous with that over the scrotum and perineum. Distally, the skin becomes folded upon itself to form the prepuce or foreskin.

Urinary bladder

The urinary bladder (C67, 188) consists of three layers: the mucosal and submucosal subepithelial connective tissue, the muscularis, and the serosa (peritoneum covering the superior surface and upper part of the base). In the male, it adjoins the rectum and seminal vesicle posteriorly, the prostate inferiorly, and the pubis and peritoneum anteriorly. In the female, the vagina is located posteriorly and the uterus superiorly. The bladder is extraperitoneal in location.

Kidney

The kidney (C64.9, 189.0) is encased by a fibrous capsule and is surrounded by perirenal fat. The kidney is composed of the cortex (glomeruli, convoluted tubules) and the medulla (Henle's loops, pyramids of converging tubules). Each papilla opens into the minor calices; these in turn unite in the major calices and drain into the renal pelvis. At the hilus are the pelvis, ureter, and renal artery and vein. Gerota's fascia overlies the psoas and quadrants lumborum.

Renal pelvis and ureter

The renal pelvis (C65.9,189.1) and ureter (C66.9, 189.2) form a single unit. The ureteropelvic junction is variable in position and location, but serves as a "landmark" that separates the renal pelvis and the ureter. The renal pelvis and ureter are composed of the following layers: the mucusa, submucosa (lamina propria), and muscularis, which is continuous with a connective tissue adventitial layer. It is in this outer layer that the major blood supply and lymphatics are found.

Urethra

In the male, the urethra (C68.0, 189.3) is divided into anterior, penile (pendulous), and posterior (bulbomembranous and prostate). The urethra consists of mucosa, submucosal stroma, and the surrounding corpus spongiosum. Histologically, the meatal and parameatal urethra are lined by squamous epithelium, the penile and bulbomembranous urethra with pseudostratified or stratified columnar epithelium, and the prostatic utrethra with transitional cell epithelium. The corpora cavernosum is contiguous to the bulbous and penile urethra.

The female urethra is divided into proximal and distal sections. The mucosa is supported on a connective tissue submucosa. The periurethral glands of Skene are concentrated near the meatus but extend along the entire urethra. The urethra is surrounded by a longitudinal layer of smooth muscle that is continuous with the bladder. The distal third of the urethra is contiguous to the vaginal wall. The mucosa of the distal two thirds of the urethra is squamous epithelium; the proximal one third is transitional; and the periurethral glands are lined by pseudostratified and stratified columnar epithelium.

Carcinoma of the eyelid

The eyelid (C44.1, 173.1) is covered externally by epidermis and internally by conjunctiva, which becomes continuous with the conjunctiva that covers the eyeball. Basal cell carcinoma and squamous cell carcinoma arise from the epidermal surface. Sebaceous cell carcinoma arises from the meibomian glands in the tarsus, the glands of Zeis at the lid margin, and the sebaceous glands of the caruncle. Other adnexal carcinomas arise from the sweat glands of Moll and the hair follicles.

Melanoma of the eyelid

The eyelid (C44.1, 173.1) is covered externally by epidermis and internally by conjunctiva, which becomes continuous with the conjunctiva that covers the eyeball.

Carcinoma of the conjunctiva

The conjunctiva (C69.0, 190.3) consists of stratified epithelium that contains mucus-

secreting goblet cells; these cells are most numerous in the fornices. Palpebral conjunctiva lines the eyelid; bulbar conjunctiva covers the eyeball. Conjunctival epithelium merges with that of the cornea at the limbus. It is at this site, particularly at the temporal limbus, that carcinoma is most likely to arise. Conjunctival intraepithelial neoplasia (CIN) embraces all forms of intraepithelial dysplasia, including in situ carcinoma. Mucinous adenocarcinoma is a rare form of adenocarcinoma of the conjunctival goblet cells.

Melanoma of the conjunctiva

(C69.0, 190.3). In addition to mucus-secreting goblet cells within the stratified epithelium, melanocytic cells exist in the basal layer. These are of neuroectodermal origin, and melanocytic tumours may arise from these cells. Melanomas may arise from junctional and compound nevi, from primary acquired melanosis, or de novo. Tumours must be distinguished from non-tumorous pigmentation.

Melanoma of the conjunctiva

The uvea (uveal tract) (C69.4, 69.3; 190.0, 190.6) is the middle layer of the eyeball, situated between the cornea and sclera externally and the retina and its analogues internally. The uveal tract is divided into three regions: iris, ciliary body, and choroid.

Retinoblastoma

The retina (C69.2, 190.5) is composed of neurons and glial cells. The neurons give rise to retinoblastoma, whereas the glial cells give rise to astrocytomas, which in the retina are benign and extremely rare. The retina is limited internally by a membrane that separates it from the vitreous cavity. Externally it is limited by the retinal pigment epithelium and Bruch's membrane, which separate it from the choroid and act as natural barriers to extension of retinal tumours into the choroid. The continuation of the retina with the optic nerve allows direct extension of retinoblastomas into the optic nerve and then to the subarachnoid space. Since the retina has no lymphatics, spread of retinal tumours is either by direct extension into adjacent structures or by distant metastatis through hematogenous routes.

Sarcoma of the orbit

Sarcoma of the orbit (C69.6, 190.1) occurs in the soft tissues and bone of the orbital fossa.

Carcinoma of the lacrimal gland

The lacrimal gland (C69.5, 190.2) lies in a bony excavation that is covered by periosteum. It is located in the lateral orbital wall (the fossa of the lacrimal gland). The smaller palpebral portion projects into the lateral portion of the upper lid between the palpebral fascia and the conjunctiva.

Brain

A variety of tissues within the brain (C71, 191) can give rise to neoplasms. These include astrocytes and other glial cells, meninges (C70.0, 70.9; 192.1), blood vessels, pituitary and pineal cells, and neural elements proper. The major structural sites involved are the various lobes of the cerebral hemispheres; the midline structures, including midbrain, pons, and medulla; and the posterior fossa.

Hodgkin's disease

The major lymphatic structures include groups and chains of lymph nodes, the spleen, and the thymus gland. The digestive system is also an important lymphoid organ that has collections of lymphoid tissue known as Waldeyer's ring in the oropharynx, Peyer's patches in the ileum, and lymphoid nodules in the appendix. Hodgkin's disease can involve almost any organ or tissue, especially the liver, bone marrow, and spleen, in addition to the lymph nodes.

Non-Hodgkin's lymphoma

The major lymphatic structures include groups and chains of lymph nodes, the spleen, thymus, Waldeyer's ring, appendix, and Peyer's patches. Minor lymphoid collections are widely dispersed in other viscera and tissues, such as the bone marrow, liver, skin, bone, lung, pleura, and gonads. Involvement of extranodal sites is more commonly seen in the non-Hodgkin's lymphomas than in Hodgkin's disease.

Nephroblastoma (Wilms' tumour)

Nephroblastomas arise from the kidneys (C64.9, 189.0). These tumours may be bilateral and multiple.

Neuroblastoma

Neuroblastomas usually originate in the adrenal medulla (C74.0,74.1,74.9; 194.0). However, they may be found at any location along the course of the sympathetic chain, from the cervical region to the pelvis. These tumours may be multicentric in origin.

Soft-tissue sarcoma – paediatric

Soft-tissue sarcomas can involve nearly all anatomical sites. In children, these tumours may even affect unusual sites, such as the vagina or extrahepatic bile ducts, which are rarely involved in adults.

Connective, subcutaneous and other soft tissue	C47, C49; 171
Retroperitoneum	C48.0, 158.0
Mediastinum	C38.1,38.2; 164.2,164.3

The primary tumour site should be indicated according to the following notations:

ORB	Orbit
HEA	Head and neck
LIM	Limbs
PEL	Pelvis (including walls, genital tract, and viscera)
ABD	Abdomen (including walls and viscera)
THO	Thorax (including walls, diaphragm, and viscera)
OTH	Other

5
Input Procedures

The preceding chapters describe finding information on cancer cases in the registration area, recognizing and abstracting the relevant data and putting the information about the cancer diagnoses into coded form. This section looks at how the different documents which come to the registry can be managed, so that records relating to a patient from more than one source are linked to the same patient, ensuring that all the information necessary is present and avoiding duplicate registrations. Once documentation on each case is complete the data have also to be stored in such a way that they are available for consultation, updating and analysis.

The principles of the input operation are standard for all registries, although methods of processing the data will differ. Notifications have to be checked for completeness and accuracy, linked to the registry database so that it is possible to identify new cases versus new information on cases already registered, coded and added to the database or filed elsewhere. If the registry is computerized the process is simplified, but the steps to be followed are similar in both manual and computerized registries. It is assumed here that the majority of cancer registries are now working with computers, but reference is made to manual operations. Many computerized registries maintain some manual operations within a largely automated system.

Figures 1 and 2 provide illustrated examples of the flow of operations in two different registries, the first illustrating the treatment of hospital abstracts in the Rizal (Philippines) Cancer Registry and the next the procedures carried out for all notifications in the Danish Cancer Registry.

5.1 Receipt of notifications

Notifications on cancer patients will come in different formats, at different times and in different ways. Some registries receive routine notifications from hospitals, pathology laboratories and death records on a regular basis. In others the registry clerk(s) go to the various data sources to fill in the registry abstract forms. The registry may receive abstracts or notifications daily or in batches. The documents can be processed at varying intervals; for larger registries, for example, they may be dealt with in weekly batches (see Figure 2, which describes the processing of some 1000 forms weekly), and for smaller registries processing of data may be done by hospital and by year.

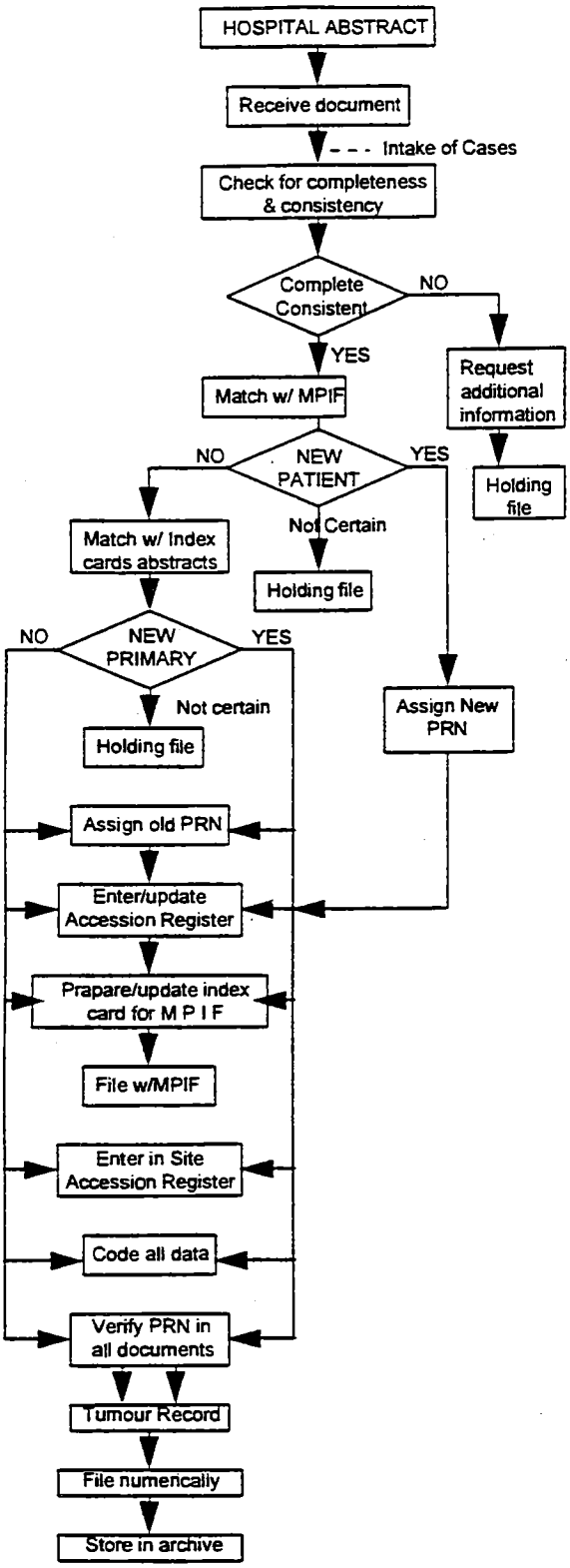
It is useful to maintain a record of the cases abstracted from each hospital in the area by year, to provide a summary record of the number of cases abstracted by hospital or hospital department, the distribution of cancer cases in each hospital by site and the workload of the registry personnel in the hospitals. In a computerized database this type of list is generated by using 'Source of information' to sort the records.

If the registry has access to death certificates, they may be sent automatically to the registry or it may be necessary to go to consult them in the government office responsible. When death certificate notifications are received it may be advisable to allow time for any hospital abstracts to be completed before undertaking the follow-back process (see below).

The registry should also establish a list of reasons why a notification should not be entered into the system in the standard way, such as:

- address not within the defined registration area: these cases should be manually filed separately or labelled as 'non-resident' in a computerized database. If they are resident in an area covered by another population-based registry the details should be transferred to that registry;

Figure 1. In-put procedures for hospital abstracts (Rizal Cancer Registry)



1. Receipt of Document

   Stamp with date when document received

   Check for completeness and consistency

   Suspense (Holding) File for incomplete or inconsistent abstracts

2. Record Linkage

   Match with:

   Master Patient Index File (MPIF)

   File of Prior to Reference Date Cases (FPRDC)

   Identification of Old and New Patients

   Identification of Old and New Primary Tumours

3. Registration of New Patients

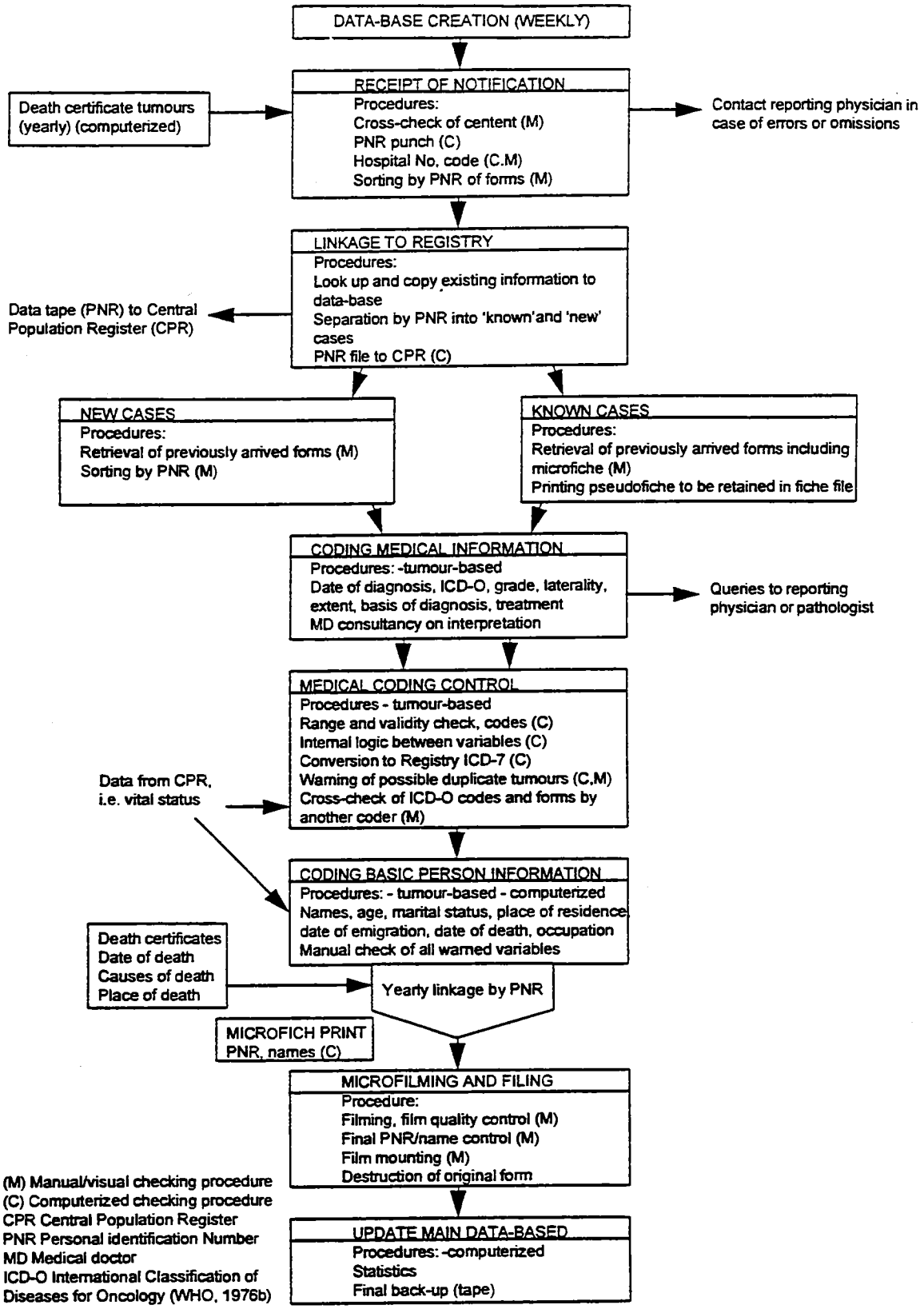
4. Registration of New Primary Tumours

5. Updating of Old Tumour Record

6. Filing the Tumour Records numerically, based on PRN (patient registry number)

7. Storage in archives

Figure 2. Flow diagram (Danish Cancer Registry)



- incidence date occurring earlier than the registry's reference date (the date from which the registry started registering cancer cases). These cases should be filed apart or labelled in the computer, and while they do not appear in the incidence data the information can be very useful, making it possible to check whether or not a case was diagnosed before the time the registry began operations. This is particularly true for registries which are just starting.

5.2 Checking for completeness and consistency

The validity of the data in the cancer registry should be looked at throughout the registration process. Chapter 6 describes some of the measures which can be used to assess the quality of the data in a cancer registry, both in relation to completeness of coverage (whether the registry is obtaining information on all the cases of cancer diagnosed in the registration area) and to the accuracy of the data.

The first stage in this continuing process of quality control is a visual check of the notification forms for content, and this should be done soon after receipt of any documents. If information necessary to register a case is missing, or if entries on the form are not logical, the information necessary to complete or clarify the form should be requested or looked for.

When information is being abstracted from hospital records or from any other source, if any data item is missing this should be noted on the form, e.g. NS (not specified) in the space for date of birth when date of birth is not given in the original records.

Computerized data checking may be done on-line (at the time of data entry) or as part of a batch operation. In on-line systems the data are put directly into the computer and errors or inconsistencies are automatically signalled by the system. In a batch operation the system will produce a listing of errors and queries on cases. Whether the data are checked on-line or in batch mode, the system should signal inconsistencies such as age not corresponding to date of birth, sex-specific tumours occurring in the wrong sex (prostate cancer in a woman), or date of death before incidence date or date of birth.

The degree of checking for inconsistencies and errors, as well as the extent to which a registry pursues missing information, will influence the quality of the data.

5.3 Missing or incorrect data

Abstracts on which essential data are missing or wrong should be kept in a temporary or holding file until the necessary information is obtained. In a manual registry this would be a physical file, but on a computer database such cases should be entered and labelled as 'suspense' cases.

Cases for which information is missing or notifications which need correcting should be followed back to the hospital sources so that the abstract form can be properly filled in. In the meantime the record can be labelled as a 'suspense' case or the abstract kept in the holding file. Similarly, for cases where the diagnosis remains doubtful, the details of the case should be abstracted but labelled 'suspense' or kept in the holding file.

5. 4 Coding of data

To enter information on paper into the computer, it is necessary to code a number of the data items. The topography and morphology are coded according to a recognized international classification, generally ICD-O (see Chapter 4). Additional dictionaries of codes can be created for many of the data items collected in a registry, such as basis of diagnosis, stage, ethnic group, hospital, area of residence. It is important to remember, when creating dictionaries, that an 'unknown' category is always required, e.g., for ethnic group:

1 Chinese
2 Malay
3 Indian
4 Other
9 Unknown

A computer can do the coding automatically, either working from a written description to find and allocate the appropriate code, or producing a written description when the code has been entered.

5.5 In-put

5.5.1 Linkage

The registry receives records relating to an individual patient from a variety of sources, such as different hospitals, pathology laboratories or offices of vital statistics. These records have to be linked together to complete all the information on each patient and to determine if the case (or cancer) is already registered or not. Remember that the registry is recording cancers, not individuals. If one person has two or three different cancers (according to the rules for defining multiple primaries given in Chapter 4) then two or three registrations are made – one for each cancer. It is, however, essential to avoid duplicate registrations, i.e. registering the same cancer more than once, and this is why this process of linkage of different documents is so important.

In countries where a unique personal identity number is used the linkage process is greatly facilitated. However, in countries which do not have such a number (the majority), matching the patient's name with the registry files is usually the only method. For names which are very common, the name alone is not sufficient for identification and other items such as date of birth and address are also necessary. When matching records, it must be borne in mind that data items may not be consistent between different documents. Names may be misspelled due to mishearing or to miscopying, or a patient may use different names in different institutions or on different admissions to a hospital. For example, a married woman may use her maiden name on one admission and her married name on another, so to the registry it appears that there are two diagnoses and a duplicate registration results. All known names for each patient should be recorded.

The information considered essential for registering a case is:

- name and address (or equivalent minimum identifying information, depending upon local circumstances);
- age or date of birth;
- sex;
- site;
- morphology (histology);
- basis of diagnosis;

Each document coming into the registry must be checked to see if it relates to a person already registered.

Manual linkage

In a manually operated registry incoming documents are checked with an index, generally on cards and arranged alphabetically by name. This file should include both living and dead cases, and each index card would contain information on the full name of the patient, the registration number, age, sex, address and other details such as source of information, hospital case number, incidence date, primary site, morphology and (if applicable) date of death. When matching by name, allowance must be made for errors in spelling (phonetic spelling of names or errors due to illegibility of hospital records). If there is a match in the name, then the age, sex, address and diagnosis are compared to make sure that the new information belongs to the previously registered patient.

If there is no match, then this is a new patient who should be registered. If it is uncertain whether the case is a new patient or not, the case may have to be followed back to the data source for additional information and in this instance the notification should be held in the holding file.

On-line record linkage

Some computer systems have sufficient flexibility to permit on-line searching for possible matches using identifying variables (for example name, date of birth and address). The principle is the same as in a manual registry, but instead of the index being stored on cards it is held on disk and the software takes the place of the human searcher. The index file is maintained by the computer, and when the operator types in the name, date of birth, address and other identifying

information the computer searches its files for cases with the same or similar details and displays possible matches on the screen. Based on this, the operator decides whether the case is known to the registry (patient already registered) or is a new patient. Such systems may have elaborate facilities for identifying possible matches using phonetic methods. As soon as a new patient is identified, the computer automatically sets up a new record. Changes can be made and additional information added to this record at any time. Incoming documents do not have to be arranged alphabetically or in any particular order for the record linkage.

Off-line (batch) record linkage

Off-line record linkage is done by creating a batch of completed records on disk or tape and comparing this with the existing records. A scoring system may be used to establish the degree of matching of each new record, so that an exact match achieves a higher score than a close or similar match, and the absence of a match results in a zero score. A weighted score is then computed and the score evaluated. Above a fixed level the match is presumed to be correct, and below another fixed level the absence of a match is assumed. Even with sophisticated computer systems this stage will probably be done by registry personnel. The computer produces a listing of possible matches, but the final judgement is left to the registrar. Matched records automatically update the existing records and unmatched records set up new registrations.

5.5.2 Registration of a new patient

When a new patient is identified (record linkage has shown no existing record for the patient), a registration number (also called accession number) is assigned and a new record created. This is done automatically in a computerized system. The number is a unique number which is used to identify the patient, and its composition will vary from one registry to another. The most common example is the use of the first two digits for year of diagnosis, followed by a number allocated serially as new cases are registered.

5.5.3 Identification of a new primary tumour

When there are several records for the same patient, the most appropriate primary site, histology and incidence date have to be determined. The site is selected from the most reliable source, i.e. a pathology report will be preferred to a clinical diagnosis. If more than one three-digit site code remains, the histology codes on each record are compared. If the histological diagnosis is different (see Chapter 4 for definitions of multiple primaries), a second primary tumour is identified and a new registration made.

In a manual system lists of all the cancer cases registered each year should be kept, one arranged by order of registration and one by site. The site list can help to check for duplicate registrations since cases with the same diagnosis will be grouped.

5.5.4 Second primary cancers

If a new primary tumour is identified in an individual who is already registered (multiple tumours), a new registration has to be created. In a sophisticated computerized system the same registration number can be used for one individual with two or more tumours, and the tumours are identified by a tumour number. In most systems, a new registration has to be created and it is advisable to have a separate field in which it is possible to identify multiple cancers.

5.5.5 Updating the records

Once the record linkage process has been carried out, new information linked to a case already registered should be used to update the existing record. The type of information which may be received includes:

- more precise identifying information such as middle or maiden name, date or place of birth, sex, civil status or a more complete address;
- a more accurate incidence date, a more valid basis of diagnosis, or a more definite primary site or histological type (e.g. as provided by autopsy findings);
- for patients who have died, the date, place and cause of death.

5.5.6 Death certificate notifications

The information on the death certificate is linked in the same way as that from a hospital abstract. If the case has been registered previously the record is updated with the date of death. If there is no registration for this case, the place of death is checked. If the patient died in a hospital, the case is followed back to the hospital and a hospital abstract is prepared. If the patient died at home, the case-finding lists from the different hospitals (see Chapter 3) may be used to check whether or not the patient was seen in a hospital. If yes, the case is followed back to the hospital.

If there has been no previous registration, and it proves impossible to trace any record of the case having been seen in hospital or by a physician, the case is registered as a new cancer and the Basis of diagnosis is 'Death Certificate Only' (DCO), while the Source of information will be 'death certificate'. Figure 3 illustrates the process of registering a death certificate notification.

5.6 Record maintenance

5.6.1 Editing

All documents are checked for completeness and consistency as soon as they reach the registry. However, further omissions or inaccuracies may be found later, either due to errors in data entry or coding or because additional information has been received. The data in the cancer registry can be edited (added to or corrected) before, during and after entry.

5.6.2 Retrospective checking for duplicates

In spite of repeated checks, some duplication of registration may occur in the following circumstances:

- the same patient may use different names, e.g. maiden name in one hospital and married name in another;
- some patients use nicknames or aliases;
- errors in the spelling of the patient's name may not have been noticed during the linkage process;
- inaccurate information on, for example, the date or place of birth may have led to registration of two patients when there was only one.

When duplicate registrations are discovered, all existing records must be drawn together to update one record and cancel the other(s).

5.7 Queries and follow-up

5.7.1 Looking for information

It is often necessary for the registry to make enquiries about missing data or information which is obviously inconsistent. In the manual registry, either standard letters giving the known details about the patient and describing the problem are sent out or the registry clerk visits the hospital(s) to try and find the information. The same procedure is used in a computerized registry, but it is possible to develop a system which will detect missing or inconsistent data and generate a query automatically.

5.7.2 Follow-up

If the registry practices active follow-up enquiries are made at regular intervals, usually once a year on the anniversary date of the patient's diagnosis, about each patient not known to be dead. In a manual system, index cards for all patients to be followed-up should be kept grouped by the month when follow-up is due. When the date of follow-up arrives a form is sent to the hospital or general practitioner treating the patient. If a notification of death is received the card concerning the individual should be removed from the follow-up files.

The procedure is the same in a computerized system, but the computer can automatically generate the follow-up requests.

A passive follow-up system relies on receiving notifications of deaths of registered cases, and it is not necessary to generate routine enquiries.

5.8 Storage

Documents on paper must be filed using the registry filing system (usually numerically by patient accession number) and stored in a room which is secure and inaccessible to

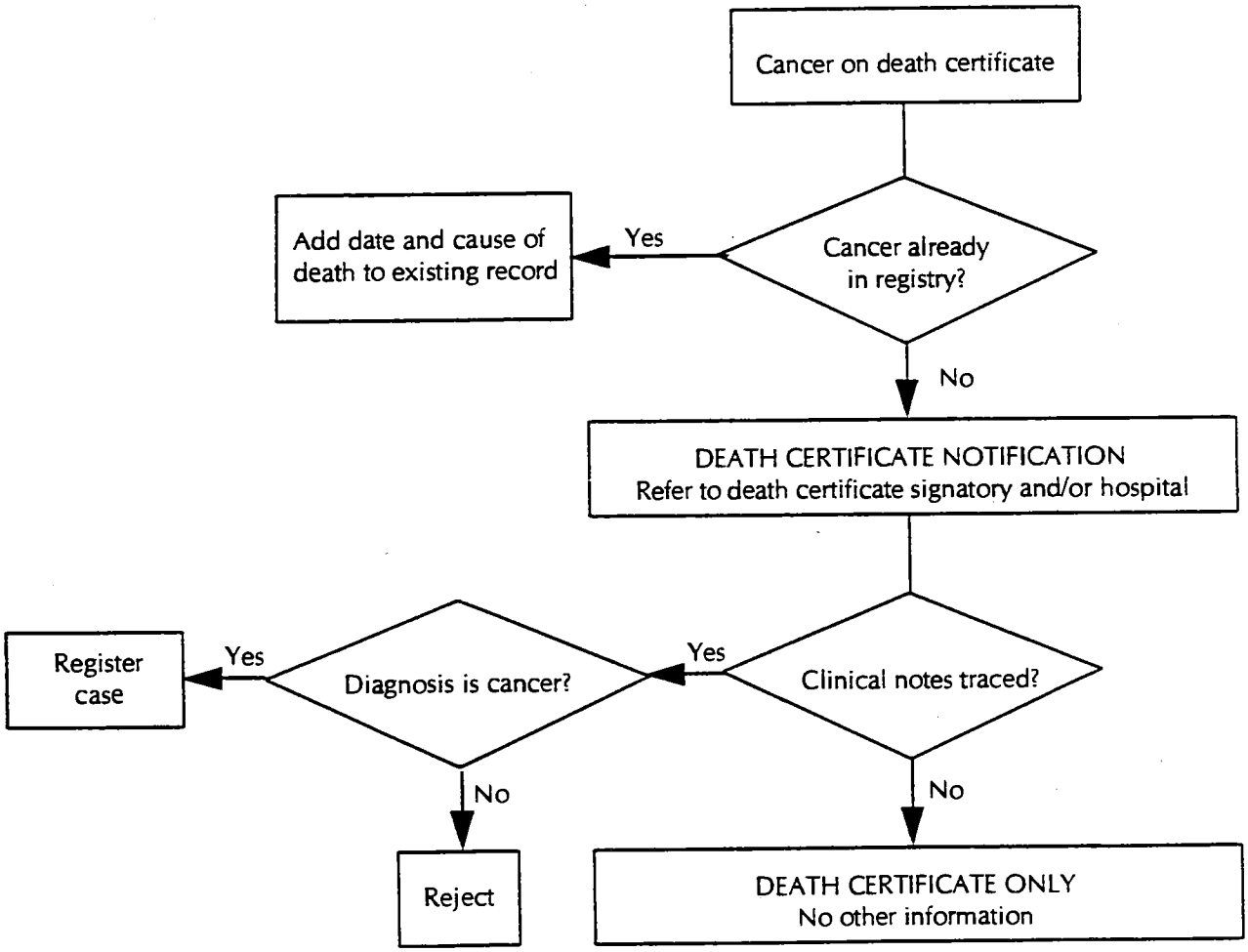
unauthorized persons. They should be protected against loss or damage from fire, floods or interference. If index cards are used they should be kept in filing cabinets for index cards.
Computerized data are stored on magnetic tapes or diskette. The cancer registry database exists on hard disk, so that it is possible to process records in any order, and working on-line, to alter one record without disturbing the others. Records can be accessed randomly or in various index sequences (numerical, alphabetical, by primary site, etc.). Several software packages exist to maintain these databases, but some training and experience is needed to be able to use them

Magnetic tape files consist of a series of records, with each cancer usually occupying one record. The records are read in the order they are held on the tape. There is no limit to the size of the file and magnetic tape is an economic and efficient way of backing up the cancer registry data, so ideal for storage.

Diskettes In a registry which only has access to Pcs, the data should be backed up on diskette. Data held on diskette have the same advantages as those on the disk – they are easy to work with, and records can be accessed in the same way. The disadvantage when compared with magnetic tape is that they hold much less data.

Computer files, both programs and data, should always be kept in at least two different places to guard against damage or theft. Back-up (on tape or diskette) of data should be done regularly so that data can be recovered in cases of hardware failure or accidental deletion. If there are a lot of records a full back-up can be done at regular intervals, say at the end of each month, and an incremental back-up of just the records entered or amended since the last full back-up can then be done each day. If all the data are lost, they can be restored using first the last full back-up and then the incremental back-up.

Figure 3. Flow chart for death notifications



6
Quality Control

The primary goal of a population-based cancer registry is to determine the incidence of cancer within its geographical population. It is therefore of the utmost importance that the registry data be reliable and of good quality. Coverage of the population should be as complete as possible and information gathered, especially on essential items, should be complete, consistent and accurate.

Quality control is the mechanism by which the quality of data can be assessed. This may be either a formal on-going programme incorporated in the standard operating procedures of the registry or it may be an ad hoc survey to assess completeness and consistency of casefinding, abstracting and coding, as well as the accuracy of reporting. Quality control programmes can show the level of errors, and can also include feedback mechanisms to improve accuracy and consistency. Less formal quality control involves the critical scrutiny of the data as they are used. To some, this is the best form of quality control.

This chapter presents various methods for monitoring the quality of data in the cancer registry. More detailed information can be found in the IARC/IACR Technical Report *Comparability and Quality Control in Cancer Registration* (Parkin et al., 1994).

1. *Completeness of cover*

The population-based registry aims to record all cancer cases occurring within its defined geographical area. It is therefore essential that all the data sources for the registry be covered completely. That is, casefinding and abstracting should include all hospitals within the catchment area of the registry. All data sources within these hospitals should likewise be covered in order to avoid under-reporting.

On the other hand, each abstract must be carefully checked soon after it arrives in the registry to determine if the case is eligible for registration:

- Is the diagnosis included in the registry's reportable list?
- If the registered cases are limited to residents of the catchment area, is the patient's residence inside the boundaries of this area?
- Is the incidence date on or after the reference date (the date from which cases are recorded) of the registry?
- Are the essential items of information in the registry abstract complete?

The registry must also endeavour to avoid duplication of patients or multiple registrations as these will artificially inflate the incidence rates. The items of identifying information must be sufficient to ensure that a patient who has been registered previously can be recognized as the same person, should he be reported again to the registry. Multiple primaries occurring in the same patient, either at the same time or at different times, should also be identified. A case with more than one primary can be identified by, for example, a primary registration with a sequence number of 2 or more (see section 4.2.7 (10), sequence number).

How to assess completeness of cover

The use of death certificates as a source of information provides a very useful method of evaluating completeness.

(a) The proportion of cases which come to the attention of the registry for the first time through a death certificate (death certificate notification – DCN) should be monitored. This type of case may be easily identified if 'Method of detection' (see section 3.3.4) or a similar variable is recorded by the registry. The registry should allow a defined time period (which would vary according to how frequently the registry has access to the death certificates) to elapse before matching death certificates against

the file of registered cases. If many cases are being found via death certificates, it is certain that registration is incomplete. For every cancer patient who dies before being discovered by the registry, there is probably one who does not die, and is thus never identified. If a high proportion of cases is identified by death certificates, the registry should determine the reasons for this and implement measures to improve completeness. The cases should be carefully followed back to the hospitals where they died or they may be traceable through the physician who signed the death certificate. In this way it should be possible to establish where in the hospital (or other medical resources in the community) the registry is failing to find cases.

A distinction must be made between a DCN and a Death Certificate Only (DCO) case. Only the DCN cases which cannot be traced or followed back to hospital or the certifying physician are registered as 'Death Certificate Only' (DCO) cases (see section 3.3.3). A registration which is made on the basis of a death certificate alone, with no other documentation, is likely to be less accurate than a diagnosis supported by histological, or at least clinical, confirmation.

(b) Monitor the incidence of each site annually and compare the latest year of incidence with previous years. Any marked change should be investigated. Under-reporting may be site-specific, e.g., in hospitals where research on a particular cancer is being carried out the medical records on patients involved in the study may be taken out by the researcher so that they cannot be located by registry staff.

(c) Whenever possible, monitor the difference in incidence rates for the subdivisions of the registry's geographical area. For example, note the difference in incidence rates by municipality within a province. The change in incidence rates in a particular area is usually slow. Any marked change should be investigated to identify areas of under-reporting which may need action.

(d) Another method to assess completeness of cover would be to sample patient attendance at a specialized clinic and later check if they are included in the registry. Sometimes case series of cancers have been collected by doctors for research purposes. The registry should use these independent lists to check what proportion of the cases had been found.

Assessment of completeness of cover should be carried out constantly.

2. Completeness and accuracy of details

All incoming reports or registry abstracts should be checked rapidly upon arrival to ensure that at least all the essential items of information are complete. In this way, errors can be corrected while the hospital records are still available. Errors in detail may arise while abstracting or during transcription, coding or key punching.

How to assess accuracy

(a) The best method of assessing completeness and accuracy of detail in a record is by 'blind' re-abstraction and recoding without reference to the original registration. The initial and the reprocessed registrations are later compared to determine the error rates for each item. Since accuracy is a matter of degree, a 'scale of error' for each item may have to be established. Ideally this quality control programme should be built into the registry system, with a percentage of registrations re-abstracted and re-coded.

Duplicate coding of essential items, such as diagnosis (primary site and histology) and most valid basis of diagnosis, ensures consistency between coders.

It is preferable that all the members of the registry staff share in the responsibility for quality control, since this increases their awareness of the need for high quality data. However, if the registry is under-staffed and in need of funds, *ad hoc* exercises would be more practical.

(b) In computerized registries data quality can be checked using automated routines:

(i) Validation checks: these checks are carried out on each data item to ensure that there are no invalid codes fed into the data base. All computerized registries should have computer files containing the valid codes for each item (coding control files). Every incoming code is checked against the control file and if this is invalid, the code will be rejected.

(ii) Consistency checks: these checks compare the concordance of specified data items against other recorded items, for example.

- check for cancer of the cervix uteri in males or prostatic cancer in females.
- the sequence of dates should be checked so that the sequence of date of birth, date of diagnosis and date of death is preserved (a patient's incidence date cannot be earlier than his date of birth nor later than his date of death).
- check that certain site-specific morphology terms have the correct topography codes assigned (e.g., nephroblastoma which arises from the kidney should have a topography code of C64.9 (189.0), and hepatoblastoma which arises from the liver should have a topography code of C22.0 (155.0).

In certain instances, attention may be drawn to possible errors and warnings issued. Cases of rectal carcinoma or chronic myelogenous leukaemia in children can be signalled, not because they are necessarily wrong but because these cases do not usually occur in children. A review of the case is warranted to rule out any error.

Computer checks may either be done at the time the data are being entered (on-line) or as a part of a batch operation (off-line). A 'scale of errors' may be set up in the system such that major errors result in complete rejection of a registration, while less serious ones may be recorded and added to the database. The latter cases should be flagged to indicate that they contain an error. The most serious errors should be corrected first.

The IARC-CHECK Program (available with the publication *Comparability and Quality Control in Cancer Registration* (Parkin *et al.*, 1994)) checks data for validity and for consistency. The data items checked by the program are:

- registration number
- date of incidence
- age (or date of birth)
- sex
- site
- histology
- basis of diagnosis

3. *Pre-requisites for quality control*

(a) Rules and documentation

The registry should have a set of rules covering its different functions and activities, with a rigid definition of the data items to be collected and other associated terms. These rules and definitions should be written down and kept on file as a ready reference for the registry personnel. They may be kept in the form of a procedural manual which should be applied consistently over time as changes occur in the registry. If there are any changes in the rules or definitions, these should be documented for accurate usage and interpretation. In certain cases where subjective judgement is necessary, the senior members of staff should be consulted and the reasons for the decision should be documented as a guide to solving similar situations in the future.

(b) Good coding systems

In a good coding system, only one code is allocated for each appropriate term. If there is any change in the coding system, there should be documented rules as to the time period under which a given set of codes operates.

(c) Standards

The registry should have standards under which to operate. Maximum tolerable error rates should be set for major data items (for example 5% for the three-digit level of the ICD-O, or 0.5% for sex). If these rates are exceeded, corrective action should be taken to reduce the errors to acceptable standards.

7
Data Presentation

Evelyn Shambaugh

7.1 Selecting, assembling and presenting data

The first step in preparing a statistical report is to define the problem. What information does the user want? What information is available in the registry? The objectives and scope of the report must be defined at the outset. The request may be answered from the routine data collected in the registry. On the other hand, it may require the collection of additional data for a special study. If it is an annual report, define what types of information are to be included from the available information, such as years of diagnosis, tumour sites, age and sex distributions, and treatment and stage distributions.

Once the objectives of the report and the items of information are clearly identified, determine the cases to be included. For a count of all cancers seen at a hospital for a given year, include both alive and dead patients, including cases identified at autopsy only. For a count of all cancers in a population-based registry, count all residents of that population diagnosed with cancer during the period under study from whatever sources, including cases diagnosed on death certificate only. If planning a survival analysis, exclude those patients with cancers identified at autopsy or identified by death certificate only. For example, the population may be all patients under 15 years of age who had acute lymphocytic leukaemia diagnosed between 1 January 1990 through 31 December 1991.

For some studies it is desirable to select a random sample of cases. The most common aid to selecting a random sample is a table of random numbers (see any statistical textbook). A popular practical equivalent of random selection is systematic selection, i.e., taking every fifth patient on a list. When a systematic selection is used, make sure that the number of items between successive selections does not correspond to some recurring cycle of cases.

The presentation of the data will depend on the purpose of the study. If the purpose requires only counts or cross tabulations of the characteristics in the patient record, the data may be presented in the form of a table or a graph.

Tables versus graphs: advantages and disadvantages:

Ever since records were first kept, there has been the problem of interpretation of numerical data. Statistical tables were a big step forward for summarizing data, but graphs went even further by presenting data in visual form.

Too often data are presented in an awkward or confusing format. By following certain simple rules described in section 7.2 for tables and in section 7.3 for graphs, it should be possible to present the data with maximum effectiveness.

The question of whether to present data in the form of a table or a graph depends on the purpose. Tables have the following advantages over graphs:

- more information may be presented;
- exact values can be read from a table to retain precision;
- less work and less cost are required in the preparation;
- flexibility is maintained without distortion of data.

On the other hand, graphs have the advantage of:

- attracting attention more readily;
- showing trends or comparisons more vividly;
- being a simple and efficient method of showing observations in the past, present and future;
- providing results that are more easily remembered.

In short, one picture (graph) is worth a thousand words. However, in some studies it may be advantageous to give both the detailed table and a simple summary graph. Graphs can bring out hidden facts and relationships which stimulate analytical thinking, but tables provide the supportive details. Together they present a better balanced understanding of a study.

7.2 Preparing tables

A table is an orderly classification of facts arranged in vertical columns and horizontal rows which groups related numbers into classes. Each variable such as sex, race, age, treatment and stage of disease has a system of classification. Sex has two classes while age can have any number depending on age groupings.

Title: The title must tell as simply as possible what is in the table. It should answer the questions:

- **Who?**
  White females with breast cancer,black males with lung cancer.
- **What** are the data?
  Counts, percentage distributions, rates.
- **Where** are the data from?
  One hospital, or the entire population covered by your registry.
- **When** ?
  A particular year, time period.

Boxhead: The boxhead contains the captions or column headings. The heading of each column should contain as few words as possible, yet explain exactly what the data in the columns represent.

Stub: The row captions are known as the stub. Items in the stub should be grouped to facilitate interpretation of the data. For example, group ages into 10-year age-groups.

Footnotes: Anything in a table which cannot be understood by the reader from the title, boxhead, or stub should be explained by footnotes. The footnotes contain information on missing numbers, preliminary or revised numbers, or explanations for any unusual numbers. Definitions, abbreviations, and/or qualifications for captions or cell names, and all pertinent information should be footnoted. A footnote usually applies to a specific cell(s) within the table and a symbol, such as '*' or '#', is used to key the cell to the footnote. If several footnotes are required, it is better to use small letters rather than numbers. Footnote numbers might be confused with the numbers within the table.

Source: If data from a source outside the registry are used, the exact reference to the source should be given. For example, if comparing the registry's patient survival with the survival data from the USA SEER Program, reference the SEER data, e.g.,
Source: Axtell, L.M., Asire, A.J. & Myers, M.H.: Cancer Patient Survival, Report Number 5. DHEW Publication No. (NIH) 77-992
Denoting the source lends authenticity to the numbers and enables the reader to locate the source if further information is desired.

Tables usually are arranged so the length exceeds the width; it is generally better to use the longer wording in the stub. Important numbers to be compared should be placed in adjoining columns or rows. Time series are listed in chronological order, beginning usually with the earliest time period. Traditional listings are usually listed in that order, e.g., anatomical sites are listed in ICD-O order. For emphasis, the order may be changed to another order, such as the relative frequency of occurrence. Classifications of size are usually listed from smallest to largest.

Cross-classified tables must always account completely for the data being classified. For this reason, unimportant classes are put in a composite class labelled 'Other'. The 'Other' categories are placed to the right of the bottom of the rows or columns, respectively.

Many analytical tables contain both numbers of cases and percentage distributions. Numbers provide information on magnitude; percentage data facilitate comparisons.

Check the table to be sure that:

- it is a logical unit (separate problems call for separate tables);
- it is self-explanatory (can it stand alone if removed from its context?);
- all sources and units are specified.

Construction of tables:

In table construction, good judgement is more important than blind following of rules. Present the data to answer a definite question or phase of a question. The simplest table is a one-way classification in which one variable, for example, sex, is presented either in terms of numbers of cases or a percentage distribution or both. Table 1c below has both.

If a classification is desired according to two characteristics simultaneously, they are cross-classified in a 'two-way' table. One classification will appear horizontally and the other vertically as shown in Table 2a below:

Table 1a. Form for a ONE-way classification: Numbers of cases:

Distribution by sex of children with acute leukaemia Community hospital, 1991		
	Sex	Number of cases
	Total	50
Stub—	Male	30
	Female	20

— Title
— Box-

Table 1b. Form for a ONE-way classification: Percentage distribution

Distribution by sex of children with acute leukaemia Community hospital, 1991	
Sex	Percent
Total	100
Male	60
Female	40

Table 1c. Form for a ONE-way classification with both numbers of cases and a percentage distribution

Distribution by sex of children with acute leukaemia Community hospital, 1991		
Sex	Number of cases	Percent
Total	50	100
Male	30	60
Female	20	40

Table 2a. Form for a two-way classification

Age distribution of lung cancer patients by sex, 1980-1993			
Age	Total	Male	Female
All ages ——————————Row——————————			
<45	Cell	C	
45-54	Cell	o	
55-64	Cell	l	
65-74	Cell	u	
75 and over	Cell	m	
		n	

— Title
— Boxhead
Stub —

Footnote
Source

In this case sex is listed horizontally in the BOXHEAD and age is listed vertically in the STUB. The individual entries which are classified according to the row and column are called CELLS. Often it is desirable to include summary information in a table. For example, in Table 2a the ratio of males to females might be pertinent to the discussion and could be added to the caption entries as fol lows:

Table 2b. Age distribution of lung cancer patients by sex, 1980-1993

Age	Total	Male	Female	M/F ratio
All ages				
<45				
45–54				
55–64				
65-74				
75 & over				

When three or more classifications of the data are desired, the problem becomes more difficult. This multi-dimensional relationship must be shown on a two-dimensional sheet of paper. This can be done by subdividing each class of one or both classifications. Table 3 illustrates a 'three-way' classification.

Table 3. Form for a three-way classification

Age and sex distribution of white and black lung cancer patients for cases diagnosed in 1991				
Race and age	Total	Male	Female	M/F ratio
White:				
All ages:				
Under 45				
45-54				
55-64				
65-74				
75 & over				
Black:				
All ages:				
Under 45				
45-54				
55-64				
65-74				
75 & over				

Table 4 illustrates a 'four-way' classification

Whenever further subdivision of data leads to tables which are too complex to be read easily, it is preferable to increase the number of tables.

Table 4: Form for a four-way classification

Age and sex distribution of white and black lung cancer patients for cases diagnosed 1980-86 and 1987-93								
Race and age	Total		Male		Female		M/F Ratio	
	1980–1986	1987–1993	1980–1986	1987–1993	1980–1986	1987–1993	1980–1986	1987–1993
White:								
All ages:								
Under 45								
45-54								
55-64								
65-74								
75 & over								
Black:								
All ages:								
Under 45								
45-54								
55-64								
65-74								
75 & over								

Mutually exclusive categories:

In defining classifications, the classes should be mutually exclusive so that the limits do not overlap

In general, it is advisable to divide detailed data into a reasonable number of arbitrary classes. If the number of classes is too few, important characteristics may be concealed. If there are too many classes, there may be a confusing variation of frequencies and some classes may contain no values. A proper balance must be struck so that one neither overlooks a relationship nor creates the effect of one by chance.

The location of classes must be stated precisely to avoid ambiguity. Any of several methods of designating classes may be used depending in part on the nature of the data. The table below demonstrates four methods of designating classes of tumour size for breast cancer patients. Of the four methods, the one in Column A is the poorest, for it is ambiguous: it is not clear where a tumour of 2 cm should be counted. Column B clearly states the midpoint of each interval, but it is not clear what the limits of each class are. The class limits in Column C are appropriate for discrete data, that is, data that are recorded as whole numbers. The class limits in Column D are the most suitable for continuous data when some values could include decimal values.

Table 5: Examples of classification

Classification for tumour size (in cm)			
A	B	C	D
0–2	1	0-1	Less than 2.0
2–4	3	2-3	2.0-3.9
4–6	5	4-5	4.0-5.9
6–8	7	6-7	6.0-7.9
8–10	9	8-9	8.0-9.9
10 & over	11	10 &over	10 & over

It is highly desirable that all class intervals have the same width because equal intervals are easier to interpret. For some types of data, however, unequal intervals must be used. For example, in the classification above for the relationship between tumour size and prognosis, it is more important to have smaller interval sizes for small tumours and larger interval sizes for the larger tumours, such as:

Under 0.5 cm
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-9.9
10.0 & over

It often happens that what is needed is not so much the absolute number of patients which fall in each class but rather the relative number. Then, the total number of patients is 100% and the percent is the number of patients in each class divided by the total. This is known as a percentage distribution. It is illustrated in Table 6.

Table 6. Example of percentage distribution

Age distribution of acute lymphocytic leukaemia Patients: 1985–94		
Age	Male	Female
Number of cases	617	449
	Percent	
Total	100	100
0–9	55.2	53.4
10–19	14.5	13.1
20–29	4.9	4.0
30–39	4.4	4.8
40–49	2.0	3.6
50–59	5.1	5.2
60–69	5.4	7.0
70–79	6.0	6.3
80+	2.5	2.6

Source: Cancer Patient Survival, Report No. 5, 1977

7.3 Graphs: form and construction

A graph is the best medium for presenting data for quick visualization of relationships between various factors. Graphs effectively emphasize the main points in an analysis and clarify relationships which might otherwise remain elusive.

Form of graphs:

There are many types of graphs: picture graphs, maps using dots or shading, pie charts, bar graphs, and line graphs plotted

on a variety of scales. The type of graph used will depend on the data. There are four different kinds of data; their scales of measurement vary from the simple nominal to the more complex ratio scale of measurement:

(1) **Nominal** (named) data require unordered categories for such data as sex, race and blood groups, but ordered categories for data such as stage of disease where there is a logical order based on disease prognosis. Either numbers of cases or a percentage distribution is presented.

(2) **Ordinal** (ordered) data, as the name implies, require that the categories be ordered in a definite way. Examples are rating scales and performance status scales. For rating scales the data are ordered from least satisfactory to most satisfactory. For performance status scales, the physical ability of the patient is ordered from normal to decreasing ability from 100 to 0 in the Karnofsky scale.

(3) **Interval** data require equal units along the scale as, for example, temperature, but the zero point may be a different value depending on the scale. If the temperature is 50 degrees, the next question is:

'What is the scale - centigrade or Fahrenheit?'

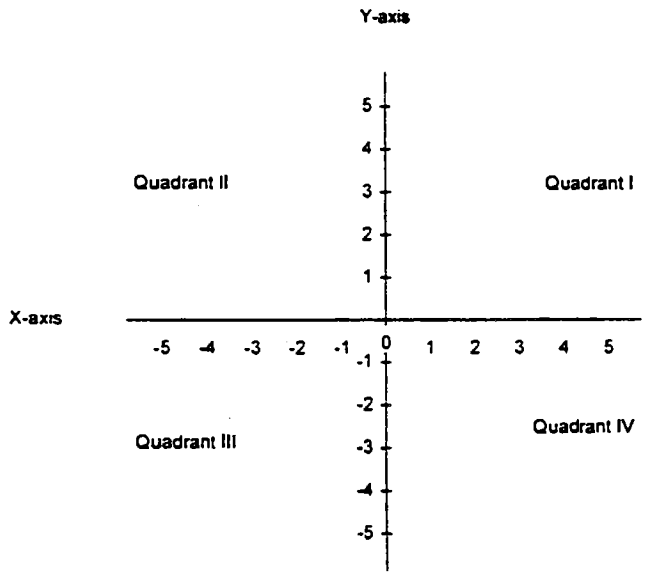
(4) Ratio data must have numerical values for computing ratios. A ratio scale has not only *equal units*, but also a *zero point* which is absolute in the sense that zero represents a complete lack of the value being measured. It allows comparisons such as, 'If A is age 20 and B is age 40, then B is twice as old as A.'

Constructing graphs:

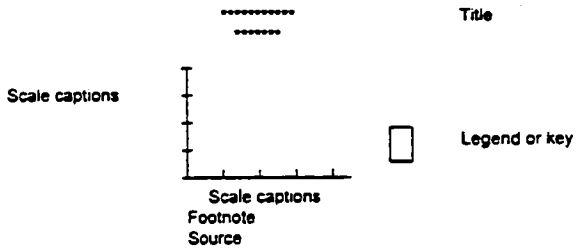
The basic form of a graph is derived by plotting numbers in relation to two axes. A scale is arranged in both directions from a zero point at the intersection of the axes. A comparison of data is shown by variation in the slopes of lines, the heights of bars, or the sizes of areas. Most graphs use positive values only, thus only the upper right-hand part of the grid (Quandrant I) is usually known. 'Tic' marks are used to indicate the grid lines in the example below. The axes are marked off in equal units and may be extended as far as necessary in any direction.

The scale of values for the X-axis is placed along the bottom of the graph from the lowest value on the left to the highest value on the right. The scale of values for the Y-axis is placed at the left of the graph from the lowest value at the bottom to the highest value at the top of the graph.

Choose the largest scale that will fit the paper and allow the graph to be centrally located on the page. Clearly label each scale and indicate the units.



Graph 1



Graph 2

TITLE: The title must tell as simply as possible what the graph shows. It should answer the same questions as the title for a table.

- **Who?**
  White females with breast cancer; black males with lung cancer.
- **What** are the data?
  Counts; percentage distributions; rates.
- **Where** are the data from?
  One hospital; the entire state.
- **When?**
  A particular year; a time period.

Legend or key: When several variables are included on the same graph, it is necessary to identify each by using a key or legend. The legend should be placed in a clear space on the face of the graph and each line identified on the graph as in the example below.

White males .....
Black males ---------
White females ...-...-...-...-
Black females —.—.—.—.

Scale captions: Scale captions are placed on both axes to identify the scale values clearly. It is essential that both the subject and the units used be identified. The caption for the horizontal scale is generally centred under the X-axis. The caption for the vertical axis is placed either at the top left of the Y-axis or along the Y-axis, whichever is the easier to read.

Footnotes: If the title, scale labels, and legend cannot explain everything in the graph, then footnotes should be used as in tables.

Source: The exact reference to the source should be given just as for tables. For example, when comparing a registry's patient load with the incidence data from the USA SEER Program, reference the SEER data as follows:

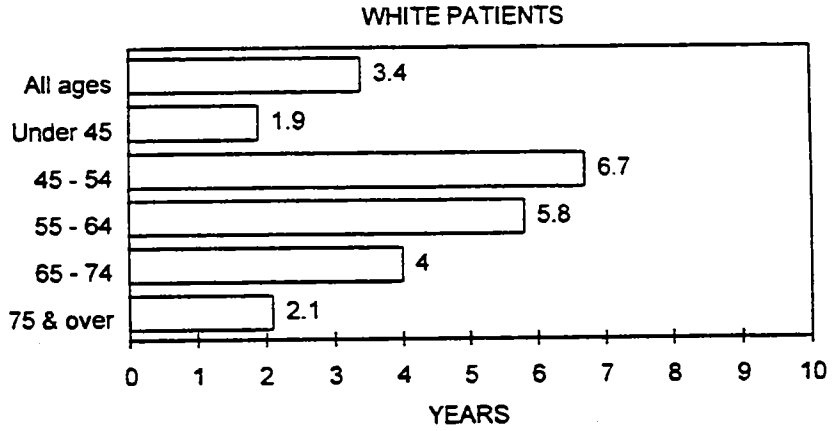
Source: Young, J.L., Percy, C.L. & Asire, A.J. Surveillance, Epidemiology, and End Results: Incidence and Mortality Data, 1973-77, NCI Monograph 57, NIH Publication No. 81-233

Remember that a graph is useless unless it is read. It has to be interesting and attractive if it is to be read.It may be advisable to include a table with each graph so that the reader may see the actual numbers on which the graph is based.

7.3.1 Bar graphs

Bar graphs are commonly used for frequencies, proportions and percentages of nominal and ordinal data. They are easy toconstruct and can be readily interpreted. Bars emphasize individual amounts in contrast to lines which emphasize general trends. Bars are effective for showing the component parts of a whole and for making comparisons between groups such as breast cancer patients by race and stage of disease. The bars may be either horizontal or vertical and may be filled in with stripes, cross-hatching, or shading to make them stand out. Because the bars represent magnitudes by their lengths, a zero line must be shown and the arithmetic scale must be used. In a simplebar graph, the spaces between the bars are usually about half of the width of each bar.

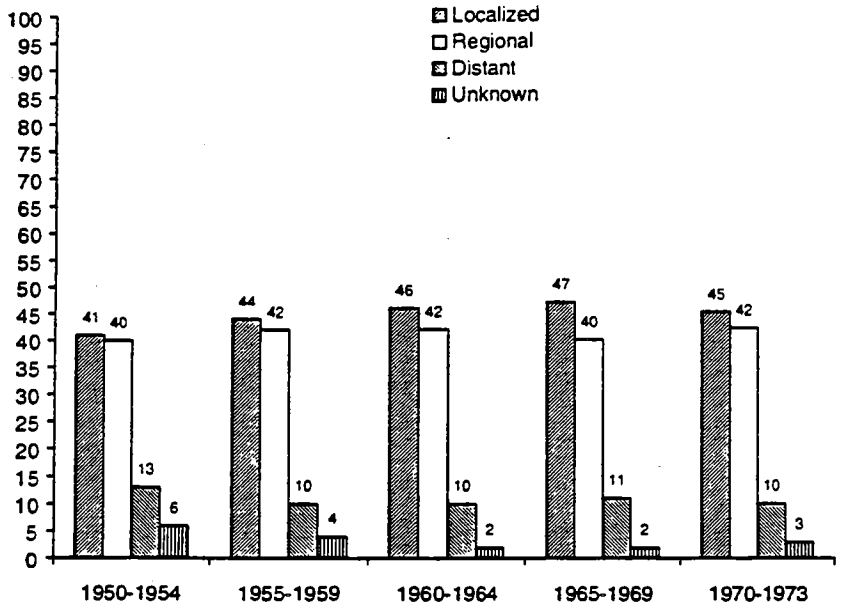
Figure 1. Observed median survival time by age for white males with cancer of the prostate diagnosed 1960-73



Source: End Results in Cancer. Report No. 5, 1977

The width of the bar for 'all ages' is the same as that for each of the specific age-groups in this graph. The values for each age-group are independent of the values for the other age-groups. In this graph, the values have been written in the bars for ease in reading.Bars may be grouped without spaces between bars to show subdivisions within several groups where the subdivisions are the same for each group. Each bar within a group is distinguished by a different texture and the same shading is used for each group. This is illustrated in Figure 2 in which trends among white female breast cancer patients are illustrated for stage of disease, i.e., localized, regional, distant and unknown, within each of five time periods.The major groups, which are separated by a space, are the five time periods 1950-54, 1955-59, 1960-64, 1965-69 and 1970-73. Stage of disease is the subdivision within each time period with no spaces between localized, regional, distant and unknown. This graph clearly indicates the percent of cases in each stage category for each time period.

Figure 2: Trends among white female breast cancer patients by stage of disease, 1950-1973, SEER Program



Example for trend data
Percent treated by

Year of diagnosis	Surgery only	Radiation only
1950–54	30	23
1955–59	22	40
1960–64	19	42
1965–70	12	54
1970–73	14	57

The graph for the trend data in the preceding table is illustrated below in Figure 3. This bar graph uses vertical bars to contrast differences in treatment over time. Again the bars can be of equal width since the percentage for each time period is independent of the percentages for the other time periods. The bars representing the two different types of treatment are of different textures so they can be readily distinguished.

7.3.2 Histogram

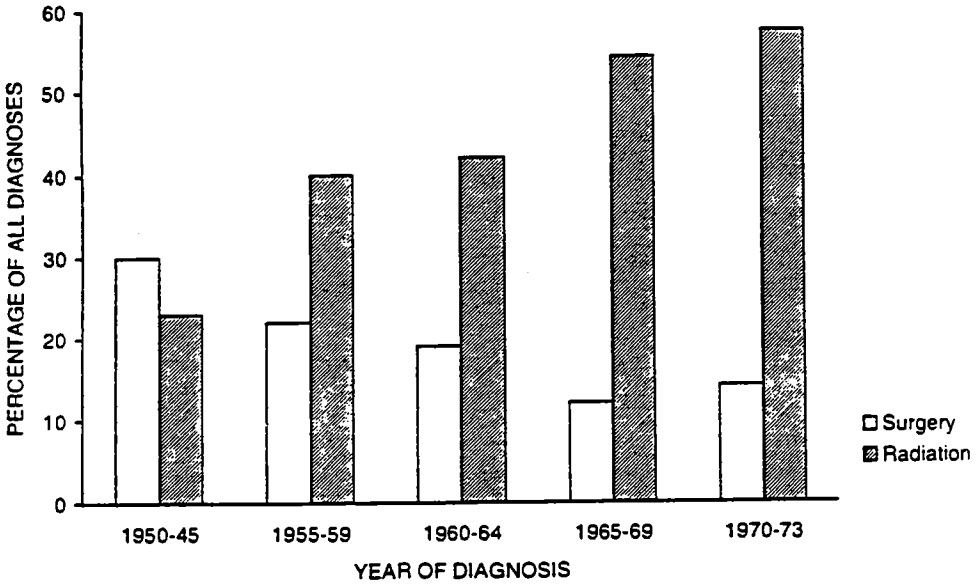
A histogram is usually the best type of graph to use when only one distribution is being represented. It is a distribution expressed either in terms of numbers or percentages. A histogram consists of a series of columns each having as its base one class interval and as its height the number of cases as the distribution in that class. In this type of graph there are no spaces between the columns. The sum of the heights of the columns represents the total number or 100% of the cases. A histogram should be

used only when the data on the horizontal or X-axis are measured on an interval or ratio scale.

In order to avoid having the figure too flat or too steep, it is usually good to arrange the scales so the width of the histogram itself is about one and two-thirds times its height (a ratio of 3:5). A column is centred around the midpoint of the class interval (see Figure 4 below).

Histograms are easy to understand. They are useful for showing differences in age distributions, as in Figure 5 which indicates that brain cancers occur with the highest frequency between 50-59 years of age. This distribution is bimodal; that is, it has two age-groups which have a higher frequency than the adjacent age-groups. The age-group with the highest frequency (50-59) is called the MODE. To obtain the percentage of cases diagnosed between two ages, e.g., between 40-79, it is necessary to add the values of the bars, including the values between these ages, i.e., 19% + 25% + 18% + 5% = 67%.

Figure 3. Trends in percentage of white oesophageal cancer patients treated by surgery only and by radiation only, 1950–1973



Source: Cancer Patient Survival, Report No. 5, 1977

Figure 4: Cases of rash illness, elementary school, Sample City, 22-23 March, 1990

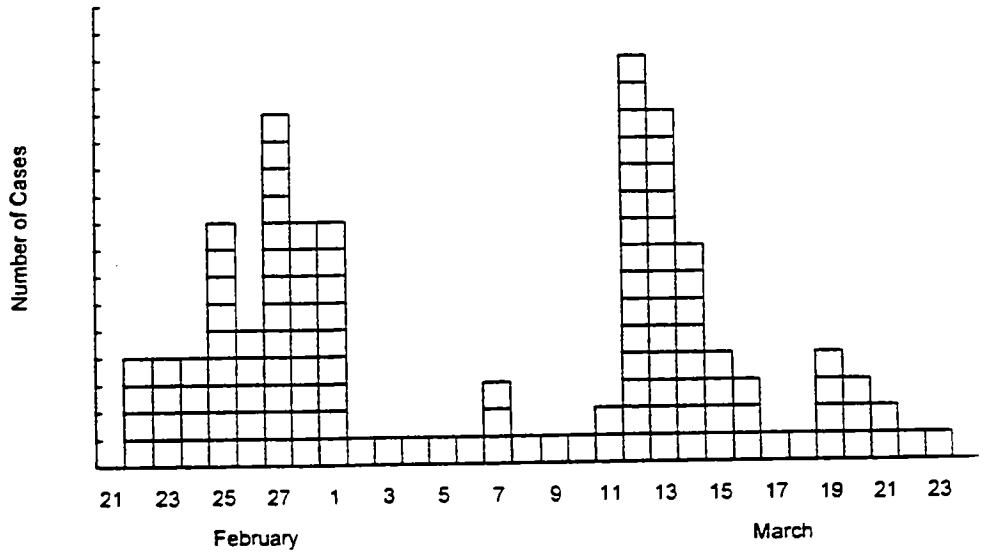
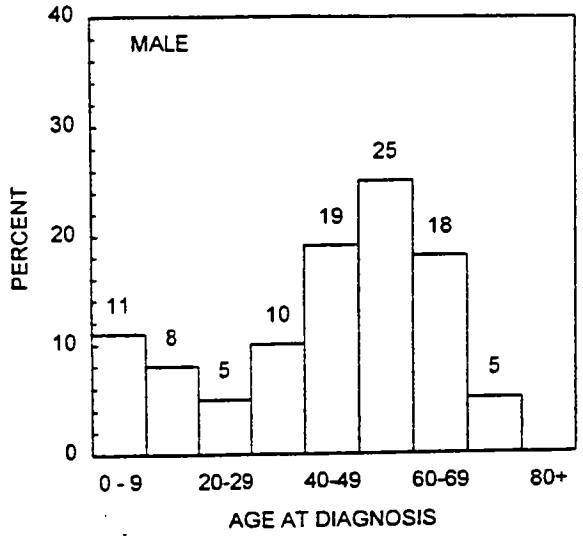


Figure 5: Age distribution of male brain cancer patients diagnosed 1955-64



Source: End Results in Cancer, Report No. 3, 1968

Width of intervals: In working with histograms it is a good idea, if possible, to use intervals of the same width, e.g., all five-pound weight intervals or all 10-year age-groups. If the intervals are not equal, but have varied interval sizes, the frequency value on the vertical scale should be adjusted for differences in interval width. It is area which represents frequency, not height of a column. Each column MUST represent the same size group since the total area represents relative differences in the frequency distribution. If all the intervals were for five years except one that was 10 years, the 10-year interval would have to be converted by dividing its percentage in half.

7.3.3 Frequency polygon

A frequency polygon may be used as an alternative to the histogram just described. Simply join the midpoints at the top of each bar in the histogram as shown in the figure below. The advantage of the frequency polygon over the histogram is that several frequency polygons can easily be plotted on the same graph for purposes of comparison. It is also easy to interpret (see Figure 6 overleaf).

As with all work with graphs, two axes (X and Y) are used. In constructing the graph of the frequency polygon, the X-axis is longer than the Y-axis; a ratio of 3 to 2 or 4 to 3 will result in a good graph. The frequency values are always placed on the Y-axis and the scores on the X-axis. Frequency values are plotted at the midpoint of each class interval as a rule.

If the numbers in different groups vary widely, it may be impractical to put them on the same graph, e.g., the distribution of patient ages in one hospital versus another. In that case convert each frequency into a percentage and plot it. The percentages are plotted in the same manner as the numbers. When comparing items of data, each line should be constructed using different types of lines of different colours. A legend should be included identifying the different lines.

7.3.4. Cumulative frequency polygon

As a further step in the analysis of the frequency distribution, the value in a series may be cumulated. The cumulative frequency for any interval is the total of the frequencies for that interval and for all lower intervals. The cumulative relative frequency is the cumulative frequency divided by the total number of observations. It is used to find percentiles of a distribution, i.e., the percent or proportion of observations less than a given value. Always plot the cumulative frequency or cumulative relative frequency against the true upper limit of each interval.

Figure 6: Number of cases of influenza-like illness by week, Sample City, 1970

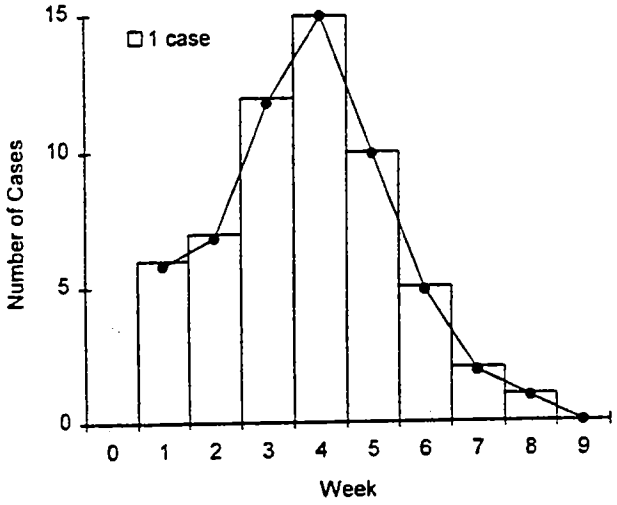
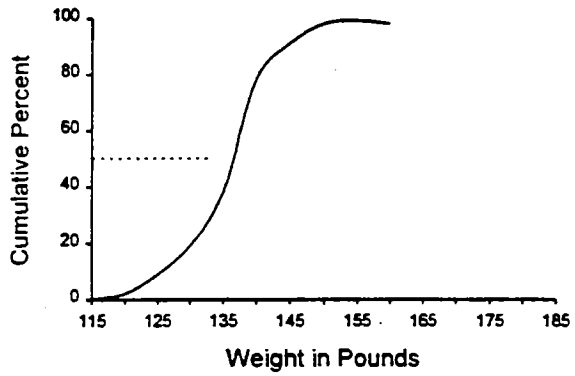


Figure 7 Female patients in a weight study at memorial hospital, 1990



In the example in Figure 7 note that, at the midpoint of the cumulative percentage curve (50th percentile) where 50% of the cases lie above the midpoint and 50% below the midpoint, the median weight is 135 lbs. The 10th percentile is seen to equal 117.5 pounds.

7.3.5. Component band graph

The component band graph is used to compare the various components of independent groups. Like a bar graph, it analyses nominal and ordinal data, but instead of bars it has bands. It can be either vertical or horizontal, whichever is easier to read.

Figure 8 illustrates how this type of graph can be used. In constructing it the length of each band is the same and each band represents 100% of the cases of a particular group.

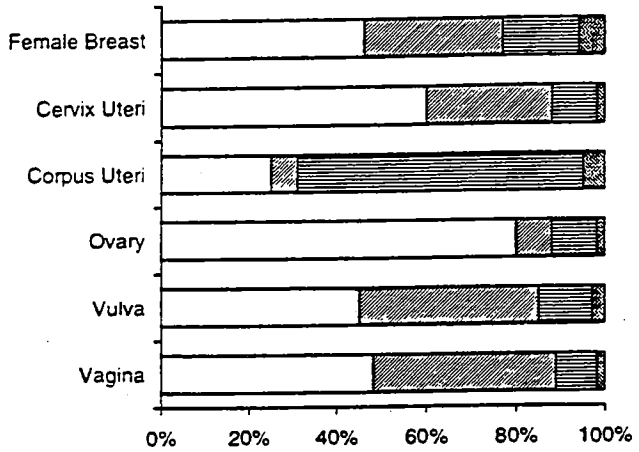
The segments in each band represent the different components of the total and are arranged in the same order in all groups. The three summary stages are arranged in the conventional order, and the length of each segment is determined according to the scale shown on the X-axis. For this graph 'localized' stage is the most important stage and, therefore, is shaded the darkest for greater emphasis. The space between the bands is usually one-half the width of the bands.

The graph for the component band graph is illustrated in Figure 8 overleaf.

Sample data for component band graph

	Localized		Regional		Distant		Unknown	
Female breast	48	+	41	+	9		2	= 100
Cervix	45	+	40	+	12	+	3	= 100
Corpus	80	+	8	+	10	+	2	= 100
Ovary	25	+	6	+	64	+	5	= 100
Vulva	60	+	28	+	10	+	2	= 100
Vagina	46	+	31	+	17	+	6	= 100

Figure 8 Stage distribution for female reproductive organs for patients diagnosed 1970-73



Source: Cancer Patient Survival, Report No. 5, 1977

7.3.6 Line graphs

There are two kinds of line graphs, arithmetical and semilogarithmic. The arithmetical measures absolute differences. It is like an automobile odometer in that it measures 'how far'. The semilogarithmic, on the other hand, measures the rate of change. Like a speedometer, it measures 'how fast'.

(1) Arithmetical line graph

An arithmetical line graph consists of a line connecting a series of points on an arithmetical scale. It should be designed toachieve simplicity without too much information on any one graph. The selection of proper scales and complete and accurate titles and legends is important. If a graph is too long and narrow, either vertically or horizontally, it has an awkward appearance and unduly exaggerates one aspect of the data. The most attractive ratio between the width and the length as a whole is between 3 to 4 and 4 to 7.

The line graph is used when there are considerable numbers of values to be plotted. It is also used when presenting continuous data. Conventionally for a time series, the horizontal scale shows the time units from left to right, while the vertical scale measures the value of the factor being shown, e.g., percent of cases classified as localized. If the coordinate lines are used to represent the time interval, the value is plotted on the coordinate line itself. If the space between any two of the coordinates represents the time period, the value is plotted at the centre of the space allotted itself. If the space between any two of the coordinates represents the time period, the value is plotted at the centre of the space allotted itself. If the space between any two of the coordinates represents the time period, the value is plotted at the centre of the space allotted.

When a frequency distribution is graphed, the coordinate lines are used to indicate the group limits. The value is plotted at a point halfway between the two coordinates at the place indicated by theappropriate value on the vertical (Y-axis) scale.

If there are several variables on the same graph, different types of lines should be used for each of the lines in order to distinguish them. This is especially important if any of the lines cross or almost touch each other. Each of these lines must be identified in the key or legend.

White males .....
Black males - - - - - - - -
White females ...-...-...-...
Black females —.—.—.—

There are two kinds of time-trend data:

- point data which are taken at a specified instant of time; and
- period data which cover an average or total over a specified period of time, such as, a year of a five-year time interval.

The vertical ticks mark instances of times and the spaces between the ticks represent periods of time. The following examples illustrate these two kinds of plotting.

When plotting the percent of the patients surviving to the end of each interval, plot the values and then connect each point plotted by a straight line. In this example the value at diagnosis (year = 0) is understood to be 100%. All three sets of values are placed on one graph in order to compare the absolute differences in survival.

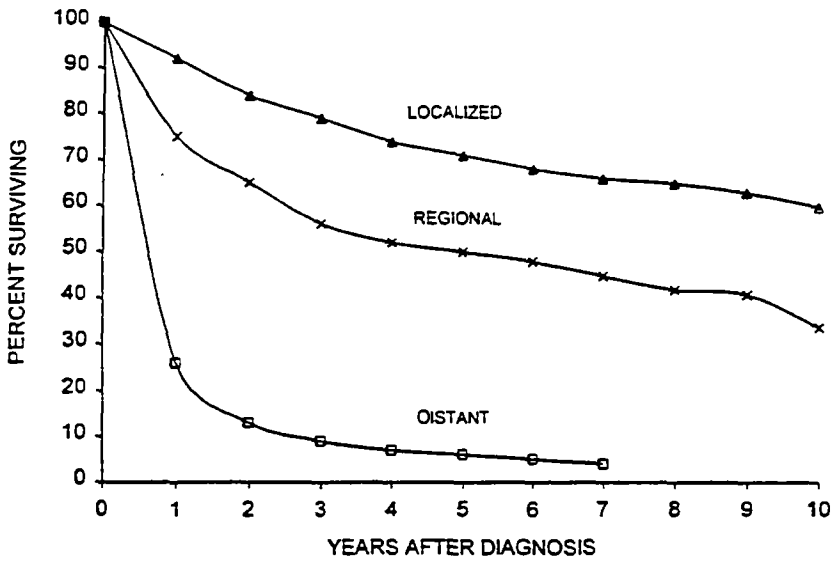
The graph for the point data in the preceding table is illustrated in Figure 9 below.

Example for point data: Relative survival rates for white patients with kidney cancer diagnosed 1960-73 by stage

Years after diagnosis	Percent surviving to end of interval		
	Localized	Regional	Distant
1	92	75	26
2	84	65	13
3	79	56	9
4	74	52	7
5	71	50	6
6	68	48	5
7	66	45	4
8	65	42	*
9	63	41	*
10	60	34	

*Too few cases to show survival rate

Figure 9 Observed survival for white kidney cancer patients 35-64 years of age, diagnosed 1960-1973



When plotting a summary statistic such as one-year and five-year survival rates for several time periods, plot the values at the mid-point value of the time periods. Example for period data.

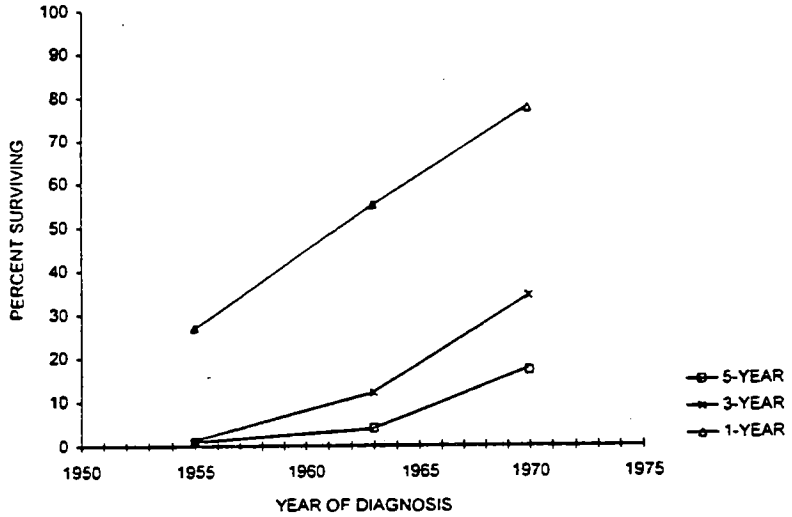
The graph for the PERIOD data in the preceding table is illustrated in Figure 10 below. Since this is plotted on an arithmetic scale, the lines represent absolute changes in the survival values.

1-year, 3-year and 5-year survival rates for children under 15 with acute lymphocytic leukaemia: 1950-59, 1960-66 and 1967-73

		Survival rate		
Year of diagnosis	Mid-point of interval	1-year	3-year	5-year
1950-59	1955	2	1	1
1960-66	1963.5	55	12	4
1967-73	1970.5	77	34	17

Source: Cancer Patient Survival, Report No. 5, 1977

Figure 10 Survival for children under 15. Acute lymphatic leukaemia



(2) Semilogarithmic line graph

Lines plotted on semilogarithmic (or semi-log) graph paper show the relative changes (rate of change) by the slope of the lines. The X-axis usually shows time and is plotted on the usual arithmetic scale. The values of the variable, usually survival rates, measured at each interval of time, are plotted on the Y-axis, which is a logarithmic scale. Logarithmic scales are scales in which the spaces between division marks are not constant but vary according to the logarithms of the numbers that are represented on the scales (instead of the numbers themselves). The steeper the line, the greater the rate of change. When values of the variable range in value between 1 and 10, a single-cycle log scale is used. For values ranging from 1 to 100, a two-cycle scale is used.

The logarithm of zero is minus infinity and, therefore, cannot be located on the scale. Each cycle begins with a power of 10, i.e., 0.1, 1, 10, 100, 1000. Distances between 2 and 4, 4 and 8, 8 and 16 (100% increases) will be the same, and distances between 2 and 3, 8 and 12, 16 and 24 (50% increases) will also be constant.

The example used in the arithmetic plot as point data would require two-cycle semilog paper since survival values range from 4% to 92% (see Figure 15 below). The values for each rate would be plotted on the vertical lines as before. The plot on the arithmetic paper

shows the absolute difference in survival for the three stage groups. For example, the absolute differences in the rates for regional and distant cases after the three years is between 41% and 45% and the lines have about the same slope. On the semilog plot the slopes for the regional and distant stages are much farther apart and the slope is much steeper for the distant cases. The steeper slope indicates that the distant cases are experiencing a higher annual mortality rate.

The slope of the line on a ratio graph indicates the percentage change between two points in time. The steeper the slope, the greater the percentage change.

A rate of change which is constant over all years of observation would plot as a straight line. In the figure for each of the stages for the first three years, the slope of the line becomes less steep indicating that the mortality rate is decreasing each year after diagnosis. From the third through the ninth year the line for regional cases is straight which indicates a constant mortality.

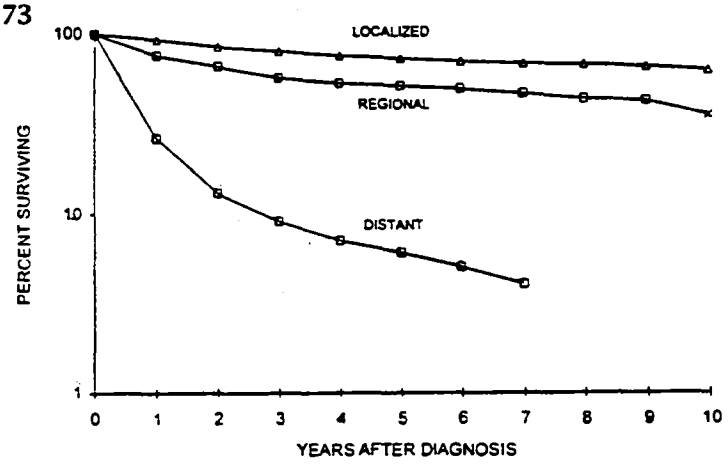
Graphs plotted on semilog scale are useful for plotting survival curves since they show rates of change. When plotting factors for which the absolute values are important, the arithmetical scale should be used.

In Figure 11, observed survival rates for kidney are shown. Compare these rates done on semilog scale with those shown in Figure 9 which are done on an arithmetic scale.

7.3.7 Geographical coordinates

A map of an area is used as a reference, and certain statistical information is superimposed upon it. Two commonly used graphs of this type are dot maps and shaded maps.

Figure 11 Observed survival for white kidney cancer patients 35-64 years of age, diagnosed 1960-1973



(1) Dot maps

Dots or coloured pins are placed in their proper locations on a map to indicate the occurrence of a particular observation at that location and, thus, give the general effect of density. Each dot represents a certain number of cases. In some areas the dot may be too close to be counted, but an impression of density can be clearly brought out. The dots may represent the number of cases for a geographical area. A better value would be the number of cases per 100 000 population. Such maps would be useful in pinpointing areas of excessive incidence which need to be investigated.

For example, influenza epidemics are plotted routinely every week by the Public Health Service in the USA. This method has been useful in pinpointing epidemics as they travel geographically.

Variations in quantities may be indicated also by varying the size, shape, and/or colour of the dot or pin. The construction of dot maps can be difficult because of the care which must be exercised in selection of the size of the dot and the quantity it is to represent. On the other hand, the pin map is flexible and quick and easy to change.

(2) Shaded maps

These maps are most often used, instead of dots, for incidence or mortality rates. In

designing a shaded map, the lightest shading should indicate the lowest rate, and the shading should increase with the darkest shading indicating the highest rate (see Figure 12).

7.3.8. Pie charts

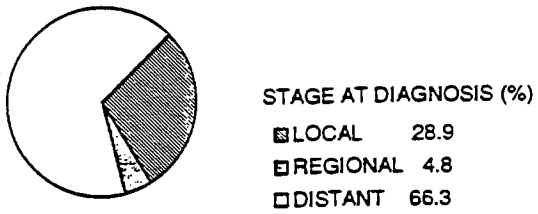
Another method of showing the component parts of the whole is to plot them on a circle (360°) called a pie chart. Each part is expressed as a percent of the total and is plotted with a protractor (1% = 3.6°) as a sector around a circle whose total circumference represents the whole of 100%.

Pie charts are constructed as follows:

- convert percents to degrees (1% = 3.6°),
- start at the 12 o'clock point, and
- plot clockwise either in order of magnitude (size) or in conventional order;
- all printing should be in a horizontal plane for ease of reading (either within the circle or outside).

Never use two pie charts to compare distributions. Pie charts are not as appropriate as are component band charts for such comparisons. A pie chart should only be used to illustrate how the whole is divided into segments; for example, stage of disease for a particular site is divided into in situ, localized, regional and distant. Extent of disease is also an example where logical or conventional order is preferred to magnitude. Start with the best prognosis and end with the worst – in situ, localized, regional and distant.

Figure 13 Stage distribution for ovarian cancer patients diagnosed 1970-7



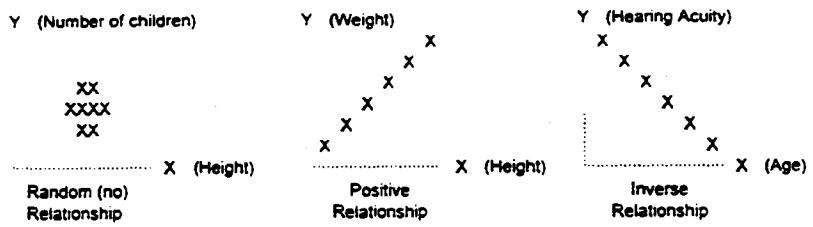
Source: Cancer Patient Survival, Report No. 5, 1977

7.3.9 Scatter diagrams

A scatter diagram is a means of presenting relationships between two variables. For example, generally one thinks of the characteristics of weight and height as being rather closely related in adults. As one increases, the other increases; the two variables are positively related. Variables can be inversely related also, for example, the older one is, the worse is one's hearing acuity.

7.3.10 Picture graphs

Identical numbers (symbols) are used to stand for a certain total number. Then the number of these numbers indicates the size of the number being illustrated. It is easy to understand, and is a fair picture as long as each figure is the same size; it is not acceptable to use different sized numbers in the same graph.



Scatter diagrams

Picture graphs

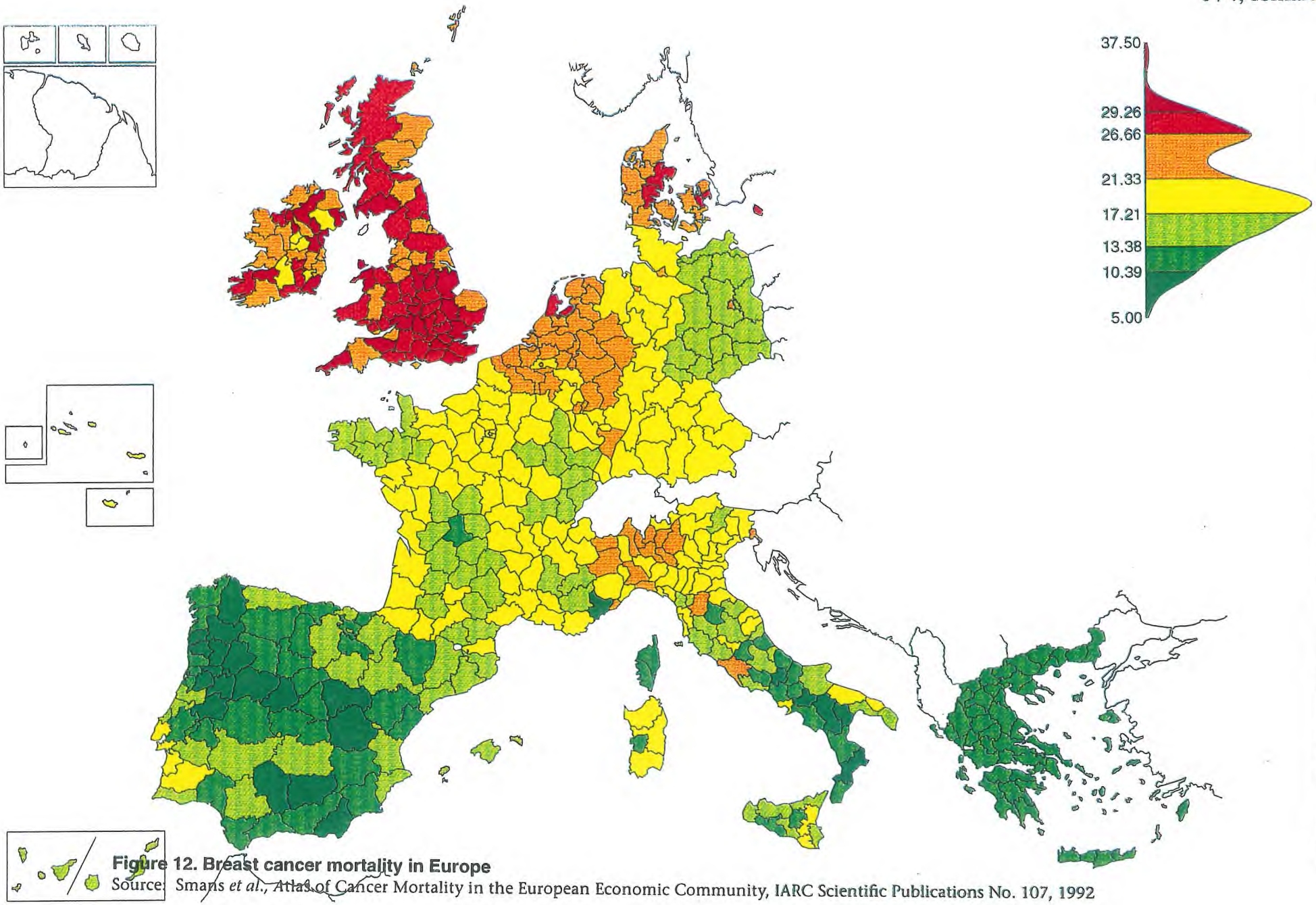


Figure 12. Breast cancer mortality in Europe
Source: Smans *et al.*, Atlas of Cancer Mortality in the European Economic Community, IARC Scientific Publications No. 107, 1992

EXERCISES ON DATA PRESENTATION

TABLES AND GRAPHS

1. Using the data in Table 1 (overleaf), make a table depicting the incidence rate of , mortality rate from and the incidence-mortality ratio of the 10 most frequently occurring cancers in the San Francisco-Oakland SMSA during 1976 (Note: the incidence-mortality ratios will have to be calculated.)
2. Using the data in Study 2, make a bar chart showing the distribution of lung cancer cases in Hawaii 1975-77 by race and sex.
3. Plot the age-specific mortality rate from lung cancer among males in the United States, 1975 (data from Study 3 below).
4. Plot the age-adjusted lung cancer mortality rates both for males and for females for the time period 1950-75 (Study 3). Repeat using a log scale for the rates.
5. Of the 610 lung cancer cases diagnosed in males in Hawaii 1975-77 (Study 2), 101 (16.6%) were localized, 149 (24.4%) were regional, 307 (50.3%) were distant and 53 (8.7%) were unstaged. Illustrate this information with a pie chart.

Study 2. A three year lung cancer study (1975 through 1977), Hawaii residents

There were 870 lung cancer cases diagnosed between 1975 and 1977. This study was done by sex, age, race, stage by sex, histology, treatment and survival by status of the disease. There were 610 males and 260 females.

Ages by sex		
Males	Age	Females
0	20-24	1
3	30-34	0
7	35-39	6
15	40-44	9
52	45-49	19
58	50-54	35
112	55-59	42
92	60-64	32
98	65-69	42
63	70-74	33
59	75-79	18
22	80-84	11
18	85-89	8
11	90+	4

Table 1. Number and age-adjusted (1970 US standard) incidence and mortality rates per 100 000 population by site, year and all races, San Francisco-Oakland SMSA (Alameda, Contra Costa, Marin, San Mateo and San Fransisco Counties), 1973–1976

	Incidence[a]						Mortality[b]					
	Both sexes		Male		Female		Both sexes		Male		Female	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
All sites												
1973	11 314	350.2	5333	386.9	5981	335.5	5476	170.0	2825	208.2	2651	145.8
1974	12 004	366.7	5618	401.3	6386	353.8	5476	176.5	3011	219.1	2745	149.0
1975	12 050	363.9	5503	389.9	6547	358.3	5857	177.0	3082	221.3	2775	147.9
1976	11 777	351.2	5571	390.1	6206	334.3	5790	172.2	3009	214.1	2781	145.1
1973–1976	47 145	358.0	22 025	392.0	25 120	345.5	22 879	173.9	11 927	215.7	10 952	147.0
Stomach												
1973	370	11.6*	221	16.9*	149	8.0*	283	8.8*	166	12.8*	117	6.1*
1974	358	10.9*	219	15.8*	139	7.1*	267	8.2*	156	11.6*	111	5.7*
1975	359	10.8*	211	15.2*	148	7.7*	280	8.4*	165	11.9*	115	5.9*
1976	358	10.6*	211	14.9*	147	7.2*	252	7.4*	154	11.2*	98	4.8‖
1973–1976	1445	11.0	862	15.7	583	7.5	1082	8.2	641	11.8	441	5.6
Colon												
1973	1097	34.2	505	38.1	592	32.0	564	17.5	263	20.1*	301	16.1*
1974	1114	34.1	541	39.8	573	30.4	601	18.3	287	21.5*	314	16.1*
1975	1160	35.0	515	37.6	645	33.4	611	18.3	289	21.1*	322	16.1*
1976	1189	35.3	552	39.5	637	32.5	606	17.9	286	20.8*	320	16.0*
1973–1976	4560	34.6	2113	38.7	2447	32.1	2382	18.0	1125	20.9	1257	16.2
Rectum												
1973	455	14.2	241	17.5*	214	11.6*	161	5.0*	90	6.8*	71	3.8‖
1974	472	14.4	261	18.7*	211	11.4*	159	4.9*	84	6.3*	75	3.9‖
1975	490	14.8	261	19.0*	229	11.9*	144	4.3*	68	5.1*	76	3.9‖
1976	537	16.0	305	21.4*	232	11.9*	146	4.2*	76	5.6*	70	3.3‖
1973–1976	1954	14.9	1068	19.2	886	11.7	610	4.6	318	6.0	292	3.7*
Pancreas												
1973	331	10.3*	177	12.9*	154	8.4*	317	9.9*	148	10.9*	169	9.2*
1974	360	11.0*	178	12.9*	182	9.9*	334	10.3*	166	12.0*	168	9.1*
1975	381	11.6*	206	14.6*	175	9.2*	371	11.2*	192	13.7*	179	9.4*
19763	322	9.6*	162	11.4*	160	8.1*	337	10.1*	186	13.1*	151	7.6*
1973–1976	1394	10.6	723	12.9	671	8.9	1359	10.4	692	12.4	667	8.8
Lung & bronchus												
1973	1548	48.1	1114	79.2	434	24.6	1124	35.0	819	58.7	305	17.2*
1974	1735	53.4	1224	86.1	511	28.7	1301	40.0	925	65.7	376	20.9*
1975	1695	51.5	1128	78.9	567	31.2	1283	39.0	917	64.8	366	20.0*
1976	1717	51.7	1156	80.5	561	30.7	1322	39.7	891	62.4	431	23.2
1973–1976	6695	51.2	4622	81.2	2073	28.8	5030	38.4	3552	62.9	1478	20.4
Melanoma												
1973	255	7.6*	122	8.0*	133	7.5*	67	2.0‖	37	2.6‖	30	1.7‖
1974	273	8.1*	133	8.6*	140	7.8*	49	1.5‖	27	1.8‖	22	1.2‖
1975	290	8.4*	141	8.9*	149	8.1*	54	1.6‖	29	2.0‖	25	1.4‖
1976	271	7.7*	126	7.8*	145	7.8*	55	1.6‖	35	2.4‖	20	1.0‖
1973–1976	1089	8.0	522	8.3	567	7.8	225	1.7*	128	2.2*	97	1.3‖
Breast												
1973	1641	50.4	18	1.3‖	1623	92.1	505	15.6	3	0.2‖	502	28.2
1974	1915	58.3	24	1.7‖	1891	106.1	588	17.8	3	0.2‖	585	32.2
1975	1762	53.3	7	0.5‖	1755	98.0	556	16.8	5	0.4‖	551	30.2
1976	1636	48.9	12	0.9‖	1624	89.3	515	15.3	5	0.4‖	510	27.6
1973–1976	6954	52.7	61	1.1‖	6893	96.4	2164	16.4	16	0.3‖	2148	29.5

Cervix												
1973	266	7.9*	–	–	266	14.9*	66	2.0‖	–	–	66	3.7‖
1974	215	6.4*	–	–	215	12.1*	81	2.5‖	–	–	81	4.5‖
1975	255	7.4*	–	–	255	14.0*	56	1.7‖	–	–	56	3.1‖
1976	227	6.6*	–	–	227	12.6*	68	2.0‖	–	–	68	3.7‖
1973–1976	936	7.1	–	–	963	13.4	271	2.0*	–	–	271	3.7*
Corpus												
1973	705	21.6	–	–	705	40.1	40	1.2‖	–	–	40	2.2‖
1974	729	22.1	–	–	729	41.0	36	1.1‖	–	–	36	1.9‖
1975	802	24.3	–	–	802	45.0	38	1.2‖	–	–	38	2.0‖
1976	741	22.1	–	–	741	41.0	39	1.1	–	–	39	2.0‖
1973–1976	2977	22.5	–	–	2977	41.8	153	1.2	–	–	153	2.0*
Ovary												
1973	279	8.5*	–	–	279	15.8*	161	5.0	–	–	161	9.0*
1974	298	9.1*	–	–	298	16.8*	181	5.6*	–	–	181	10.1*
1975	306	9.3*	–	–	306	17.1*	173	5.3*	–	–	173	9.5*
1976	254	7.6*	–	–	254	14.1*	193	5.7*	–	–	193	10.3*
1973–1976	1137	8.6	–	–	1137	16.0	708	5.4	–	–	708	9.7
Prostate												
1973	889	27.9	889	69.0	–	–	245	7.6*	245	19.7*	–	–
1974	938	28.8	938	71.8	–	–	272	8.3*	272	21.5*	–	–
1975	927	28.2	927	69.6	–	–	277	8.3*	277	21.4*	–	–
1976	931	27.6	931	68.9	–	–	291	8.5*	291	22.3*	–	–
1973–1976	3685	28.1	3685	69.8	–	–	1085	8.2	1085	21.2	–	–
Bladder												
1973	431	13.4	329	24.5*	102	5.5*	159	4.9*	109	8.6*	50	2.5*
1974	478	14.6	332	24.1*	146	7.7*	131	4.0*	89	6.8*	42	2.1‖
1975	560	16.9	405	29.3*	155	8.1*	156	4.6*	102	7.7*	54	2.6‖
1976	503	14.9	365	26.3*	138	7.0*	155	4.6*	106	7.9*	49	2.4‖
1973–1976	1972	15.0	1431	26.1	541	7.1	601	4.5	406	7.7	195	2.4*
Kidney												
1973	187	5.8*	121	8.5*	66	3.8‖	80	2.5‖	53	3.8‖	27	1.5‖
1974	207	6.4*	133	9.2*	74	4.1‖	97	3.0‖	65	4.7‖	32	1.7‖
1975	162	5.0*	116	7.9*	46	2.5‖	83	2.5‖	52	3.6‖	31	1.6‖
1976	222	6.8*	141	9.7*	81	4.6‖	84	2.5‖	56	3.8‖	28	1.4‖
1973–1976	778	6.0	511	8.8	267	3.8*	344	2.6*	226	4.0*	118	1.6*
Lymphomas												
1973	399	12.2*	210	14.1*	189	10.6*	215	6.6*	120	8.4*	95	5.2‖
1974	414	12.6	229	15.5*	185	10.3*	215	6.5*	118	8.2*	97	5.4‖
1975	451	13.5	241	15.8*	210	11.4*	217	6.5*	121	8.3*	96	5.0‖
1976	408	12.1	226	14.7*	182	9.7*	217	6.4*	120	8.3*	97	5.1‖
1973–1976	1672	12.6	906	15.0	766	10.5	864	6.5	479	8.3	385	5.2*
Leukaemias												
1973	305	9.8*	170	12.3*	135	7.9*	211	6.6*	116	8.6*	95	5.1‖
1974	297	9.4*	161	12.0*	136	7.6*	200	6.4*	114	8.6*	86	4.9‖
1975	283	8.8*	137	9.9*	146	8.1*	227	6.9*	116	8.3*	111	6.1*
1976	273	8.4*	155	11.3*	118	6.4*	225	6.7*	122	8.9*	103	5.4‖
1973–1976	1158	9.1	623	11.4	535	7.5	863	6.6	468	8.6	395	5.4*

a/b Source: SEER Program. Data for 1976 are provisional.
b Source: Number of deaths from National Center for Health Statistics

* Standard error of the rate is between 5 and 10
‖ Standard error of the rate is 10% or greater

Race by sex		
Males	Race	Females
219	Caucasian	95
162	Japanese	64
115	Hawaiin/Part Hawaiian	49
59	Filipino	22
34	Chinese	18
7	Korean	4
4	Puerto Rican	2
6	Others/Mixed races	4
4	No record of race	2

Stage at diagnosis by sex		
Males	Stage at diagnosis	Females
101	Local	56
	Regional:	
59	Lymph nodes	26
33	Direct extension	23
20	Both L.N. & extension	8
37	Regional NOS	15
307	Distant	115
53	Unstaged	17

Histologies

Cases	Histology
233	Squamous cell carcinomas
188	Adenocarcinomas NOS
110	Oat cell carcinoma
103	Carcinomas NOS
66	Bronchoalveolar carcinoma
55	Undifferentiated/anaplastic carcinoma
44	Large cell carcinoma
23	Adenosquamous carcinoma
13	Giant cell carcinoma
8	Mucinous adenocarcinoma
7	Papillary adenocarcinoma
6	Malignancy NOS
4	Malignant carcinoids
2	Fibrosarcomas
2	Leiomyosarcomas
1	Embryonal rhabdomyosarcoma
1	Mucoepidermoid cancer
1	Transitional cell carcinoma
1	Adenoid cystic carcinoma
1	Clear cell carcinoma
1	Papillary carcinoma NOS

First course treatment

12 cases wedge restrictions
7 cases wedge restrictions plus radiation
2 cases wedge restrictions plus radiation and chemotherapy
134 cases lobectomies
28 cases lobectomy plus radiation
3 cases lobectomy plus chemotherapy
6 cases lobectomy plus radiation and chemotherapy
4 cases lobectomy plus radiation and immunotherapy
24 cases more than 1 lobe removed
5 cases more than 1 lobe removed plus radiation
27 cases pneumonectomy
15 cases pneumonectomy plus radiation
1 case pneumonectomy plus chemotherapy
266 cases radiation only (primary or metastatic lesion)
36 cases chemotherapy only
110 cases radiation and chemotherapy
150 cases no treatment - reason:
- 99 patients expired before treatment began
- 38 patients no treatment because of age and condition
- 13 patients refused treatment
18 cases unknown if treatment done (no record of treatment or death in Hawaii)

22 cases autopsy diagnosis only

Survival by stage

Of the 870 patients diagnosed in the three year period, over one half, 422, had distant metastases at diagnosis and 287 expired with metastases within six months of diagnosis.

Stage at diagnosis:
expired patients' survival time

Local stage: *expired with metastases or recurrent carcinoma with exception of 4 cases who died post operatively.*
13 patients expired within 6 months
10 patients lived 7-12 months
12 patients lived 13-24 months
7 patients lived 25-36 months
2 patients lived 37-48 months
1 patient expired - status of disease unknown
6 patients expired - diagnosed at autopsy

Regional stage:
63 patients expired within 6 months
59 patients expired in 7-12 months
40 patients expired in 13-14 month
9 patients expired in 25-36 months
1 patient expired in 37-48 months
1 patient expired – unknown if from cancer
5 patients expired – autopsy diagnosis

Distant stage:

287 patients expired within 6 months
80 patients expired in 7-12 months
37 patients expired in 13-24 months
5 patients expired in 25-36 months
11 patients expired - diagnosed at autopsy

Unknown stage:

47 patients expired within 6 months
16 patients expired in 7-12 months
3 patients expired in 13-24 months
1 patient expired - cancer status unknown

There were 8 patients who expired with no cancer.

Status of patients alive without cancer: months of survival by stage at diagnosis

Local stage:

1 case	7-12 months
26 cases	13-24 months
28 cases	25-36 months
10 cases	37-48 months

Regional:

1 case	7-12 months
18 cases	13-24 months
11 cases	25-36 months
3 cases	37-48 months

Distant:

2 cases	13-24 months
1 case	25-36 months

Patients lost to follow-up by stage at diagnosis:

30 patients with localized disease
6 patients with regional disease
5 patients with distant disease
3 patients with unstaged disease

Study 3 Age-specific and age-adjusted lung cancer mortality rates per 100 000 population, females, United States, 1950-1975

Age	1950	1955	1960	1965	1970	1975
0-4	0.1	0.1	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	-
10-14	0.1	0.0	0.1	-	0.0	0.0
15-19	0.1	0.1	-	0.1	0.0	0.0
20-24	0.1	0.2	0.0	0.1	0.1	0.1
25-29	0.2	0.4	0.2	0.2	0.2	0.2
30-34	0.7	0.6	0.8	0.9	0.9	0.8
35-39	1.2	1.7	1.9	2.7	4.0	3.5
40-44	2.7	3.1	4.6	6.4	8.1	10.2
45-49	4.5	5.2	7.8	11.4	16.1	20.5
50-54	7.3	8.1	10.7	16.6	26.2	32.5
55-59	10.9	11.6	13.4	20.5	34.9	49.9
60-64	16.9	16.2	17.6	23.5	38.9	63.1
65-69	20.0	22.1	22.0	28.3	42.0	64.3
70-74	27.1	26.3	27.6	34.5	44.4	65.6
75-79	32.0	33.8	29.1	36.5	51.6	66.5
80-84	34.0	34.4	39.6	38.2	53.7	68.6
85+	28.0	30.0	38.8	39.0	50.0	66.9
1950 age-adj.	4.4	4.6	5.2	6.9	10.3	14.3

Age-specific and age-adjusted lung cancer mortality rates per 100 000 population, males, United States, 1950-1975

Age	1950	1955	1960	1965	1970	1975
0-4	0.0	0.0	0.0	0.1	0.1	-
5-9	0.1	0.0	0.0	0.0	0.0	-
10-14	0.1	0.1	0.0	0.0	0.0	-
15-19	0.2	0.1	0.1	0.1	0.1	0.0
20-24	0.2	0.2	0.1	0.2	0.3	0.1
25-29	0.4	0.7	0.7	0.4	0.6	0.4
30-34	1.8	1.8	2.2	1.9	2.2	1.9
35-39	4.2	5.1	6.1	7.8	7.9	6.9
40-44	10.6	12.1	15.3	19.8	7.9	6.9
45-49	25.1	30.9	33.3	40.2	47.3	51.6
50-54	47.3	58.7	70.2	79.4	89.6	96.2
55-59	75.0	95.0	115.1	132.9	156.4	158.1
60-64	98.6	133.2	168.5	190.9	229.1	252.7
65-69	99.0	152.1	200.1	249.0	303.7	330.9
70-74	99.4	143.7	209.9	284.0	343.8	414.8
75-79	88.8	133.3	174.9	255.1	350.6	432.3
80-84	72.6	113.1	151.3	206.8	295.5	392.3
85+	63.1	73.0	107.7	136.4	194.0	266.9
1950 age-adj.	29.5	27.8	35.3	43.4	52.8	58.8

ANSWERS TO THE EXERCISES

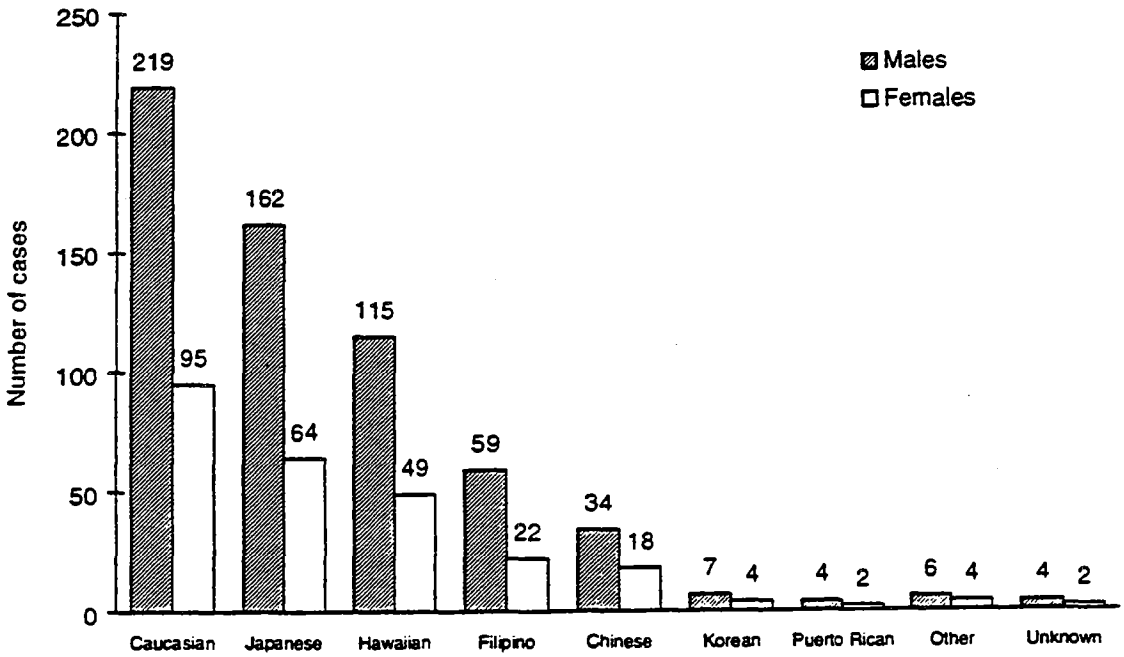
1. Age-adjusted (1970 standard) incidence and mortality rates per 100 000 population for the 10 most common sites in San Francisco - Oakland SMSA*, 1976

SITE	Incidence	Mortality	Mortality/incidence ratio
Lung and bronchus	51.7	39.7	1.30
Breast	48.9	15.3	3.20
Colon	35.3	17.9	1.97
Prostate	27.6	8.5	3.25
Corpus	22.1	1.1	20.09
Rectum	16.0	4.2	3.81
Bladder	14.9	4.6	3.24
Lymphoma	12.1	6.4	1.89
Stomach	10.6	7.4	1.43
Pancreas	9.6	10.1	0.95

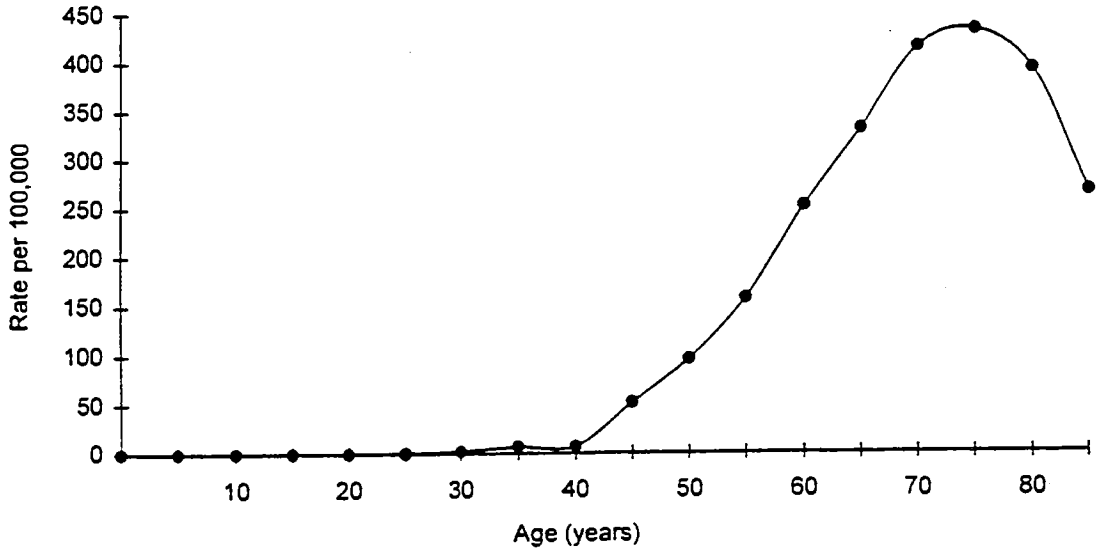
Source: Cancer Incidence and Mortality in the United States, SEER, 1973-1976. DHEW Publication (NIH) 78-1837, US Department of Health, Education, and Welfare, Public Health Service, National Institutes of Health

*SMSA: Standard Metropolitan Statistical Area

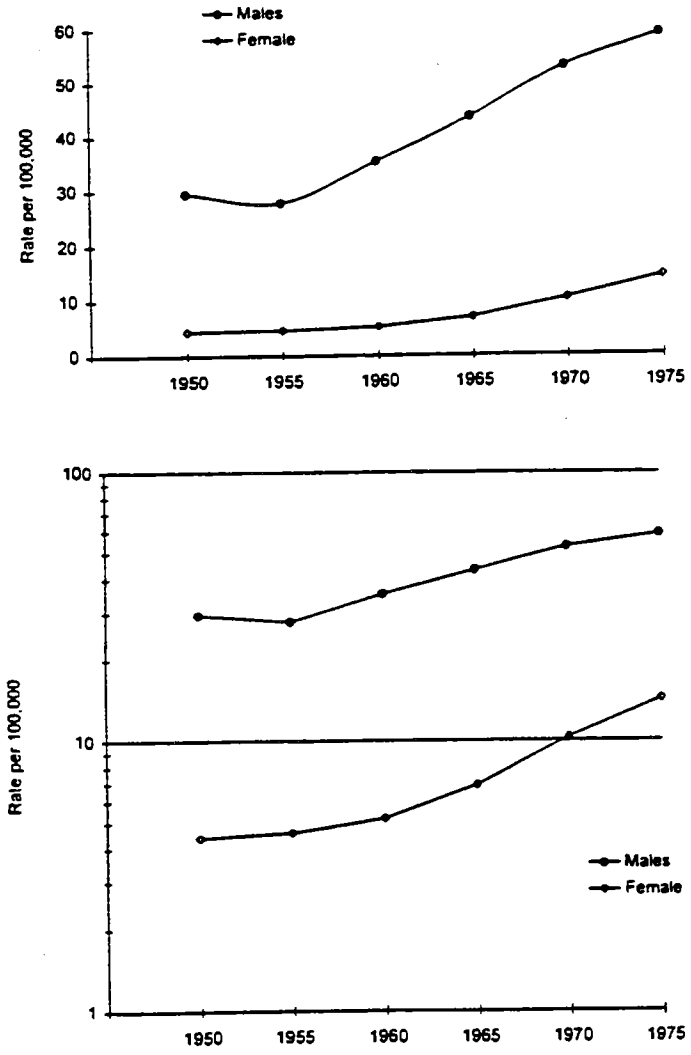
2. **Distribution of lung cancer cases in Hawaii 1975-1977, by race and sex**



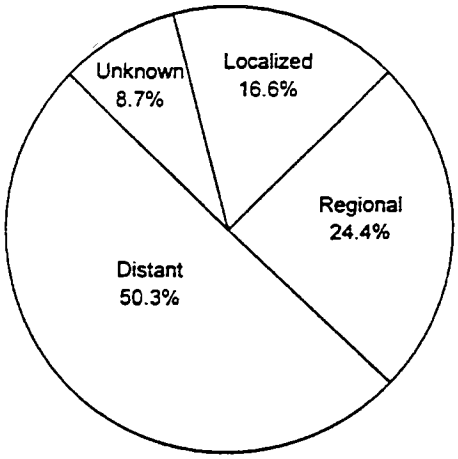
3. Age-specific lung cancer mortality rates per 100 000, males, US, 1975



4. Age-adjusted lung cancer mortality rates per 100 000, males and females, 1950-1975, US



5. Stage at diagnosis for males diagnosed with lung cancer, 1975-1977, in Hawaii



8
Confidentiality of medical records

The primary goal of a population-based cancer registry is to collect data which are as complete,accurate and reliable as possible. To be able to achieve this, the registry needs the cooperation of health professionals and the general public, who would like to be assured that the information being gathered is necessary to meet the objectives of the registry and will be safeguarded against unauthorized access and misuse.

With the public's growing concern for individual privacy and medical confidentiality, safe keeping of medical information has become increasingly important. Unless measures are taken by the registry to ensure the preservation of medical confidentiality, problems will be encountered in cancer registration, especially by population-based registries. The aim of establishing these measures is to ensure that information on the cases reported to the registry is not divulged to unauthorized individuals or organizations

Medical confidentiality is not limited to medical information on cancer patients held by physicians and medical institutions. It also includes data on other individuals, such as members of cohorts on whom data are stored in the registry, as well as information gathered from death certificates.

The preservation of confidentiality concerns all members of the registry staff. It is recommended that, at the time of employment, every member should sign a special undertaking to preserve the anonymity of the registry data and not to divulge any information, even after employment ceases. Disciplinary action should be considered if the rules are broken.

Each cancer registry should have its own set of rules and regulations of confidentiality, applicable to its own setting. A copy of the rules should be given to all staff on arrival, and also be posted within the registry premises as a constant reminder.

Practical aspects of confidentiality in cancer registration

Measures to ensure confidentiality can be implemented in the different operations of the registry, i.e. data collection, data transmission, in-put procedures, storage, and preparation of reports:

1. Data collection

Information on cancer patients may be gathered actively, or notifications may be sent to the registry by the different data sources in the hospital(s) and by the vital statistics bureau. The contents of these reports should not be disclosed to other parties than the data source and the registry. If the data are collected actively, it is the responsibility of the registry staff to preserve the confidentiality of information on cancer cases or anything of a personal or confidential nature seen or heard at the source. It is highly recommended that the data collected be kept under lock and key, preferably in a lockable case, until they reach the registry. The data should not be left in a place where an unauthorized person might have access, e.g., in a car.

2. Data transmission

Transmission of information may be accomplished by several methods. Different security measures may be considered for each mode of transmission:

(a) Mail:

When sending information through the mail staff may:

(i) use registered mail;

(ii) send the medical information separately from the list of names, with a 'key', so they can be put back together;

(iii) use double envelopes: the exterior one gives a general address and the interior envelope is marked "to be opened by X only".

Confidential data should never be sent by fax.

(b) Magnetic media:

When information is sent on magnetic tape or diskette, it is important to take measures to ensure that these will not go astray, will not be easily read by other parties, and do not leave the registry premises without authority.

The following precautions may be taken:

(i) encrypting of names at various levels of complexity so that they cannot be read easily by other parties;

(ii) preparation of separate tapes, or diskettes, one with the names and addresses and another with the tumour-related data, incorporating a common link number.

(iii) keeping a record of all magnetic tapes, diskettes or other magnetic media sent and received by the registry.

(c) Telecommunications:

Particular care should be taken when transmitting data by internet. If it is absolutely necessary to use names these must be encrypted.

(d) Computer:

If a registry stores its information on a computer, user identification and passwords (which preferably should not appear on the VDU screen when entered) should be used. Passwords should be changed regularly. Identifying information must not be included when data are transferred from the computer.

(e) Telephone:

Confidential information should not be given over the telephone, nor should enquiries from collaborators concerning confidential data be answered over the phone (e.g., danger of crossed wires). If the telephone is used by staff to complete missing information in the registry, this may be given only if the caller is an authorized recipient and can give proof of identity. The registry staff should not give confidential information over the telephone as this would constitute a breach of confidentiality.

3. Access to and storage of data

(a) Registry:

The registry director should establish a written list of persons who currently have access to the registry, indicating the levels of access authorized. All registry records should be stored in a room which can be locked and access to which is limited only to authorized persons.

(b) Computer:

In a computerized registry, part of the information is kept in the computer, and access to the data is protected by the use of a password. Other security measures to be considered are to:

(i) use a name file which is separate from the other information;

(ii) encrypt the names at various levels of complexity;

(iii) prepare a list of staff with access to the data including the level of access for the registry director;

(iv) put electronic data processing material, e.g. back-up and other tapes, in a locked, fire-proof safe at the end of the working day.

(c) Paper files:

Since these files could be read easily by an outsider, additional security measures to ensure their confidentiality should be considered:

(i) defining who should have access to the registry premises;

(ii) defining who should have access to the room where the records are stored;

(iii) providing a lockable cabinet to keep all records, including back-up copies, at the end of the working day;

(iv) confidential waste paper should be shredded in order to prevent unauthorized staff (e.g., cleaning personnel) from scrutinizing the records.

(d) Dead files:

Paper files containing the names of persons who have died from cancer may be kept in the registry for about two years and then put on microfilms (if resources allow) which

are stored indefinitely. The original files are destroyed either by shredding or burning.

(e) Cessation of activity:

It is recommended that if and when the registry ceases its activities, all records in the registry should be microfilmed and kept for a minimum of 35 years by an appropriate body, which should observe the same rules of confidentiality as the cancer registry when it was still in operation.

4. Use and release of data

Confidential data may be provided by the registry only upon written request, which should include the exact purpose for which the data will be used, the information required, the name(s) of the person(s) responsible for keeping the confidential information, and the time period for which the data are needed.

Before any confidential data are released, the registry should make sure that those receiving the data:

(i) are bound by the same rules of confidentiality observed by the registry staff;

(ii) will use the data only for the purpose agreed upon at the time of provision, and will not make them accessible to other parties;

(iii) will return or destroy the data when they are no longer needed for the said purpose; and

(iv) will not contact a patient or members of his/her family unless authorization is granted by the attending physician.

No information should be provided to insurance companies, medical funds, pension schemes, employers, the police, the authorities, etc., nor to a physician having to examine an individual for such purposes.

(a) Aggregate data:

One of the most important activities of the registry is the preparation of incidence data by age, sex, site, and urban/rural distribution, as well as time trends. Usually this does not pose any problems in confidentiality, except when there are very small numbers in a cell. Thus, in the preparation of reports, care should be taken not to go into very minute details sufficient to identify individuals in any cell of the tabulation.

(b) Individual data:

Cancer registries contribute to investigations on the causes of cancer and the registry may frequently be asked to provide the names of patients with a given cancer so that they can be included in, for example, a case-control study. Patients' names must not be disclosed unless the attending physician of each patient gives his/her consent. Names may be disclosed to bonafide researchers with the agreement that the patient or members of the patient's family must not be approached unless the attending physician or the hospital department permits them to do so. The published results of any study must not identify any individual, or include any detailed information which permits such identification.

(c) International release:

Data sent abroad should be in a form which does not permit individual identification, or a code number (e.g., patient registry number) should be used, which would not permit identification of the individual in the cancer registry of origin. In a study on migrants, where individual data have to be sent to other countries, these data should be subject to the rules of confidentiality of the providing nation.

(d) Record linkages:

Registry files may be linked with external files for research purposes. Security measures must be taken to protect all identifying information.

If on matching with other files a registry suspects the existence of an unregistered case, the registry should approach the organization responsible for the data file to obtain further information.

(e) Dissemination of data in periodic reports, to official bodies, the press and the general public:

Annual or periodic reports should be presented in tabular form or in graphs or histograms, making individual identification impossible.

Someone in the registry, usually the director, should be specifically assigned to answer enquiries from the press on various topics regarding the registry.

Exercises:

QUESTIONS: True or false?

1. Confidentiality measures in the registry ensure the preservation of the anonymity of individuals reported to the registry.
2. Medical confidentiality is limited to medical information on cancer patients held by physicians or hospitals.
3. The maintenance of strict medical confidentiality in the registry is the responsibility of the registry director.
4. Preservation of confidentiality in the registry is the concern of all the members of the staff.
5. Every registry worker should sign a special declaration or "oath of secrecy" to the effect that he/she will preserve the anonymity of the data in the registry, and this is operational even after employment ceases.
6. Data gathered actively from data sources should be safeguarded in transit, e.g., in a lockable attaché case until they reach the registry.
7. Release of registry information to a physician examining a patient for health insurance purposes constitutes breach of confidentiality.
8. Release of information via the telephone should be avoided as this can give rise to breach of confidentiality.
9. As a measure of confidentiality in the registry, there should be limited and well-defined access to the registry.
10. Confidential data should be released by the registry only on written request, after having confirmed that the recipient of the information is bound by the same principles of confidentiality as the registry staff, and that the use of the data is restricted only to those purposes which were agreed upon at the time of provision.
11. When transmitting information on magnetic tapes or diskettes, it is recommended that separate tapes or disks be used for name and address and for the tumour-related information, observing maximum security measures on the tape/disk containing the names.
12. The right to match the registry files with other external files should be limited.

ANSWERS:

1. TRUE
2. FALSE
3. TRUE
4. TRUE
5. TRUE
6. TRUE
7. TRUE
8. TRUE
9. TRUE
10. TRUE
11. TRUE
12. TRUE

Medical Terminology Course

Margaret Boyd*

This section comprises the edited notes for a course in medical terminology given at the Dr. W.W. Cross Cancer Institute, Edmonton, Canada.

The glossary and assignment exercises will be found in subsections 18 and 19 respectively.

Acknowledgements

The writer thanks the Administration of the Provincial Cancer Hospitals Board, Edmonton, Alberta, Canada, for their cooperation in allowing time off for the staff to attend the initial courses, as well as for the clerical assistance, especially in the preparation of the revised series. The clerical work was carried out by Ms. Linda Cousins.

The revision of a series of lecture notes, used some years previously, necessitated the search of many well-known reference books to determine the source of material, and where possible, authors were given credit.

The work was organized from existing sources and from the writer's personal experience. Many medical works have been consulted and heavy reliance has been placed on Dorland's Illustrated Medical Dictionary and Taber's Cyclopedic Medical Dictionary. Other books which have been consulted rather extensively are The Standard Nomenclature of Diseases and Operations, published by the American Medical Association, and Essentials of Pathology by Dr. H.J. Van Peenen. All reference material is listed in the bibliography and in footnotes.

The writer, Margaret L. Boyd, Reg. N., B.Sc.N., M.H.S.A., was the first Director of Nursing for the Provincial Cancer Hospitals Board, including the Dr. W.W. Cross Cancer Institute, from the years 1968-1972. Leaving to complete her post-graduate education, she subsequently was employed by the Misericordia Hospital, Edmonton, Alberta as the Assistant Executive Director, Patient Care Services. Retirement from that position in March, 1975 made possible the completion of this revised material.

MEDICAL TERMINOLOGY COURSE

Introduction

There are important rules which govern the formulation of most medical terms. In this course, medical terms commonly in use in cancer centres will be introduced.

Many medical terms are derived from other languages and everyday English does not always apply. Thus it is important to recognize word elements and their meanings.

In this course, for ease in pronunciation, principal accents are written in capital letters and slashes are used to divide syllables, e.g. co/LOS/to/my.

Some words are pronounced differently in different countries. Some examples are the differing pronunciations of a few rather common words:

abdomen	AB/do/men ab/DO/men
migraine	MI/graine ME/graine
neurasthaenia	NEUR/as/then/ia NEUR/as/thenia

1. WORD ELEMENTS

To make medical terminology simpler, terms may be broken down into several smaller words or word elements. The three primary word elements are prefixes, roots and suffixes. Roots, also known as stems, are usually the main parts of the word. Prefixes are word elements which, when combined with a root, alter or augment the meaning. Prefixes precede the root. Suffixes also alter or augment the meaning of a root element and follow the root or stem.

Examples:

Root:	content	
New Words:	discontent discontented	prefix = dis suffix = ed
Root:	kind	
New Words:	kindness unkind	suffix = ness prefix = un

The main difference in medical terminology is that most word elements are derived from Latin (L) or Greek (Gr).

1.1 Combined Word Elements

Not all word elements are required to complete medical terms. For example, the word *oliguria* is made up of a prefix and a suffix, olig originating from the Greek meaning *few* or *small* and *uria* also Greek pertaining to *urine* (ur), thus oliguria means that a scanty or small amount of urine is being produced.

Some medical terms combine a prefix and a root: endoderm, pronounced EN/do/derm, derived from the Greek root *derm* meaning *skin*, thus, the inside skin layer.

At times the same root may be combined with a suffix: dermalgia, pronounced DERM/al/gia, combines *derm* with a Latin suffix *algia* meaning *pain*, thus dermalgia means painful skin.

Bronchoscopy, pronounced BRONCH/o/scopy, combines the Greek *bronchos* meaning *windpipe* with the Greek *scop* which means to *look at* or *observe*, hence the meaning is to look at the windpipe.

Sometimes two roots are combined to describe a disease or treatment with more accuracy. For example osteoncus - (OS/te/oncus). The Greek *osteo* meaning *bone* combines with the Greek root *oncos* meaning *mass* or *tumour*. This word is synonymous with a more common term osteoma (OS/te/oma) however *oma* is a Greek suffix pertaining to *tumour*

A more common example of a term with two roots is bronchopneumonitis BRON/cho/pneumon/itis where the Greek root *bronchos* combines with the Greek root *pneumo* meaning *lung*, however a Greek suffix defines the word even further by the addition of *itis*, which means *inflammation of*, thus a word meaning inflammation of the windpipe and lungs.

Note that the adjective *inflamed* – has only one m but the term inflammation, derived from the Latin *inflammere* which means to *flame within* has two m's.

1.2 Word variations

Words formed from several different word elements may add, change or omit certain letters to conform with rules of spelling and pronunciation, for example derm (at), broncho (s), oste (o).

Table 1. Summary of new terms

Word	Pronunciation	Prefixes	Roots	Suffixes
oliguria	O/lig/ur/ia	olig		uria
endoderm	EN/do/derm	end(o)	derm	
dermalgia	DERM/al/gia		derm	algia
bronchoscopy	BRONCH/o/scopy		broncho(s)	scopy
osteoncus	OS/te/oncus		oste(o) +	oncus
osteoma	OS/te/oma		oste(o)	oma
broncho-	BRON/cho/		broncho(s) +	itis
pneumonitis	pneumon/itis		pneumon	

Table 2. Elements of similar spelling or sound

Element	Meaning	Origin	Example	Meaning of Word
ante	before	L.	antepyretic	*before* patient becomes febrile
anti	against	Gr.	antipyretic	used *against* fever
a	negative prefix	L.	adipsia	*absence* of thirst
ad	towards	L.	adrenal	*near* the kidney
a, an	negative	L.	anoxaemia	*absence* of oxygen in blood
ano	anus	L.	Anorectal	pertaining *to anus* and rectum
ad	towards	L.	Adnexa	appendages or *adjunct parts*
aden(o)	gland	Gr.	Adenoma	*glandular* tumour
cyto	cell	Gr.	Cytolymph	hyalin substance in a *cell*
cysto	bladder	Gr.	Cystolith	*bladder* stone
di	two	L.	Diamine	containing *two* amino groups
dia	through	Gr.	Diathermy	heat treatments *through* the tissues
dis	away from	L.	dislocation	*displacement* of a part, especially a bone
dys	bad or improper	Gr.	dyslochia	disordered lochial discharge
en	in	Gr.	encranial	located *in* the cranium
entero	intestines	Gr.	enterology	study of *intestines*
gram	record	Gr.	electroencephalogram	*record* of brain waves
graph	machine	Gr.	electroencephalograph	*instrument* used to make record
graphy	process	Gr.	electroencephaloraphy	*process* of making records
haem(at)	blood	Gr.	hemangioma	tumour consisting of *blood* vessels
hemi	half	Gr.	hemiglossal	involving *half* the tongue
haemo	blood	Gr.	haemoglobin	oxygen pigment carrying red *blood* cells
hyper	above	Gr.	hyperchro-matosis	*increased* staining capacity

Table 2. Elements of similar spelling or sound

hypo	below	Gr.	hypochro- mato-sis	*fading or disappearance* of chromatin from a cell
ile(o)	ileum	L.	ileocaecal	pertaining to the *ileum* and caecum
ilio	hip bone	L.	iliosacrum	pertaining to the *ilium* and sacrum
inter	between	L.	intervertebral	*between* two contiguous vertebrae
intra	inside	L.	intravenous	*within* the vein
macr(o)	large	Gr.	macrodontia	*large* teeth
micro	small or minute	Gr.	microdontia	abnormal *smallness* of teeth
my(o)	muscle	Gr.	myocyte	a cell of the *muscle* tissue
myel(o)	marrow	Gr.	myelocyte	bone *marrow* cell
necr(o)	corpse	Gr.	necrotic	state of tissue *death*
nephr(o)	kidney	Gr.	nephrotic	*kidney* condition caused by nephrosis
neur(o)	nerve	Gr.	neurotic	*nervous* condition
or(al)	mouth	Gr.	oropharyngeal	pertaining to the *mouth* and pharynx
aur(al)	ear	L.	auralgia	*ear* pain
ost(eo)	bone	Gr.	osteosclerosis	abnormal hardening of *bone*
ot(o)	ear	Gr.	otosclerosis	formation of spongy bone in the middle *ear*
per	through	L.	percutaneous	*through* the skin
peri	around	Gr.	periglottis	*around* the tongue
pre	before	L.	precordium	region in *front* of the heart
py(o)	pus	Gr.	pyogenesis	formation of *pus*
pyr(o)	fire	Gr.	pyrogen	*fever* producing substance
(ec)tomy	to remove	Gr.	cystectomy	surgical *removal* of bladder
(os)tomy	to make a mouth	L.& Gr.	cystostomy	surgical *opening* into bladder
(o)tomy	to incise or open	Gr.	cystotomy	surgical *incision* into bladder

Also, many word elements with which you must be familiar are similar in sound or even spelling but have very different meanings (Table 2).
For example, a patient who has advanced carcinoma of the bladder may require a *cystectomy,* however sometimes when temporary drainage of the bladder is required, a *cystostomy* is performed. However, the surgeon who only incises the bladder, for example to remove a stone, and sutures it prior to ending surgery, has *performed a cystotomy.*

2. BASIC ANATOMY AND PHYSIOLOGY

2.1 Definitions

Anatomy – the science which deals with the structure of the body

Physiology – the science dealing with body functions

2.2 Plan of the human body

The *head* contains the cranial cavity which is formed by the skull and encloses the brain.
The *trunk* is composed of the thoracic, abdominal and pelvic cavities.
The *thoracic cavity* is formed by sternum, ribs and thoracic vertebrae. The floor is formed by the diaphragm. The organs or viscera in the thoracic cavity are the heart, lungs, trachea and oesophagus.
The *abdominal cavity* is formed by the vertebral column, and layers of muscle which support the viscera. The viscera in the abdominal cavity are the stomach, small and large intestines, liver, gallbladder, spleen, pancreas, and kidneys.
The *pelvic cavity* is enclosed by the bony pelvis. The viscera in the pelvic cavity are the urinary bladder, organs of reproduction, sigmoid colon and rectum.
The *spinal canal* is continuous with the cranial cavity and lies within the backbone. It encloses the spinal cord.

2.3 Anatomical position

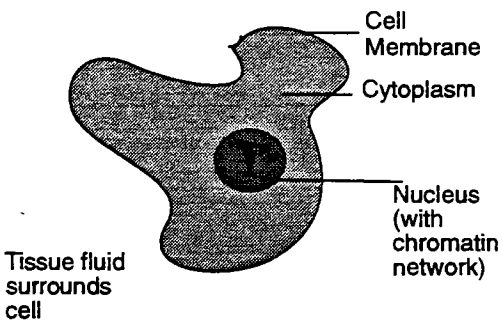
The individual is considered to be in the anatomical position when standing erect with arms at the side and palms turned forward.

Apex – top or upper part
Distal – farthest away from the body
Proximal – nearest to the body
Dorsal – back or posterior part of the body
Ventral – front or anterior part of the body
Inferior – lower or under
Superior – upper or higher
Antero (anterior) – in front of
Postero (posterior) – behind
Dextro – to the right of
Levo — to the left of
Latero – to the side of
Mes – medi – in the middle of
Opisth — backward

2.4 Cell structure

Tissue fluid surrounds cell and all cells are composed of protoplasm.

Diagram 1. Cell structure



(1) General properties of cell membrane:

(a) Osmosis

materials in solution on one side of a semipermeable cell membrane attract fluid from the other side.

(b) Selective permeability

the ability to pass through, e.g. the kidney units (glomeruli) retain certain substances and let others filter through.

(c) Diffusion of a gas or liquid

until evenly distributed on both sides of a membrane, e.g. oxygen diffuses from the lung alveoli into the blood and in the tissues from the blood into the cells.

(2) *Process of living cells*

Metabolism – the sum of all physical and chemical changes that take place within an organism.

(a) Catabolism – breaking up

(b) Anabolism – building up

(3) *Functions of specialized body cells*

(a) Secretion

the production of substances from materials in the blood, e.g. glandular cells in the stomach secrete digestive enzymes.

(c) Contractility

changing in response to nervous stimulation, e.g. muscle cells contract and relax.

(c) Conduction

transfer of an impulse, e.g. nerve cells. The *all or none law.* A stimulus to a nerve or muscle causes it to respond to its greatest extent or not at all. Impulses all travel at the same rate but nerves only respond to a *threshold stimulus.*

2.5 Water

Approximately 66% of the body is water, which is contained:

(1) within the cells
(2) surrounding the cells (tissue fluid)
(3) in blood vessels (principal component of blood).

Water has several functions in the body. It is used:

(1) as a solvent
(2) for ionisation of acids, bases and salts
(3) to absorb heat and therefore to regulate temperature
(4) as a vehicle; permitting exchange, excretion, and secretion through cell membranes.

2.6 Electrolytes

Electrolytes are chemicals which carry electrical impulses. Water and electrolyte balance is important. For example, on a hot day we perspire and deplete the salts in our body. The water depletion causes us to feel thirsty, but if we fail to replace the salt also, in severe circumstances, illness (heat stroke) due to salt loss may occur.

2.7 Tissues

When groups of cells (cyto) become specialized in the work they perform in the body, they are called tissues.

There are five main types of tissue:

(1) *Epithelial tissue* covers the surface of the body and lines cavities. Examples are the skin and lining of the thoracic and abdominal cavities, the pleura and peritoneum. Epithelial cells are packed closely together with little space between.

(2) *Connective tissue* supports, anchors and holds other tissues together. Examples are ligaments, tendons, cartilage, bone and fat.

(3) *Muscular tissue* possesses the ability to contract.

There are three types of muscle tissue:

(a) skeletal (voluntary)
(b) smooth (involuntary)
(c) cardiac (heart)

(4) *Nerve tissue* receives and carries sensations to and from the brain and spinal cord from various parts of the body.

(5) *Vascular tissue* carries food and oxygen to cells, removes waste, and fights infection. Blood and lymph make up vascular tissues.

Fat, known as adipose tissue, is a connective tissue which:

(1) serves as a covering under the skin, cushioning and protecting parts exposed to pressure.
(2) being a non-conductor of heat, prevents too rapid heat loss through the skin.
(3) supports and protects various organs, for example, the eyes and kidneys.
(4) fills up space in the tissues affording support to delicate structures such as blood vessels and nerves.
(5) constitutes an important reserve of food when needed by the body. Bears hibernating can survive only if they have a sufficient fat reserve to last through the period of hibernation.

2.8 Organs

Different kinds of tissue form organs (viscera). For example, the stomach is an organ composed of epithelial, connective, muscular, nerve and vascular tissues. Every organ has some special function to perform, working in co-ordination with other organs.
Groups of organs which act together are called *systems*. There are **nine** primary body systems: integumentary, endocrine, musculo-skeletal, respiratory, circulatory, digestive, nervous, urinary, and reproductive.

3. INTEGUMENTARY SYSTEM

The integumentary system consists of the skin and mucous membranes. The word integumentary is derived from a prefix and a root. The prefix "in" means just that, and the root from the Latin word tegere means to cover.

3.1 Epidermis

The epidermis is the thin outer protective layer, however on the soles of the feet or the palms of the hands, the epidermis is thick. The epidermis can be divided into four layers. The *stratum corneum* is composed of keratinized cells with no visible nucleus. The *stratum lucidum* is composed of flattened cells and nuclei are not visible. Where hair is present, there is a thin stratum corneum and the stratum lucidum is usually absent.
In the third layer, or *stratum granulosum*, granules and nuclei can be seen in the cytoplasm.
The innermost layer, known as the *stratum germinativum* or Malphigian layer is the part of the skin where new cells are germinated. Young cells which are pigmented contain melanin which protects the underlying tissues.

3.2 Dermis

The dermis beneath the epidermis is made up of dense, irregular connective tissue, with dense bundles of fibrous tissue between the cells. In the dermis are found sweat glands, blood and lymph vessels, nerves and nerve endings, hair follicles and sebaceous (sebum = tallow) glands. (Diagram 2).

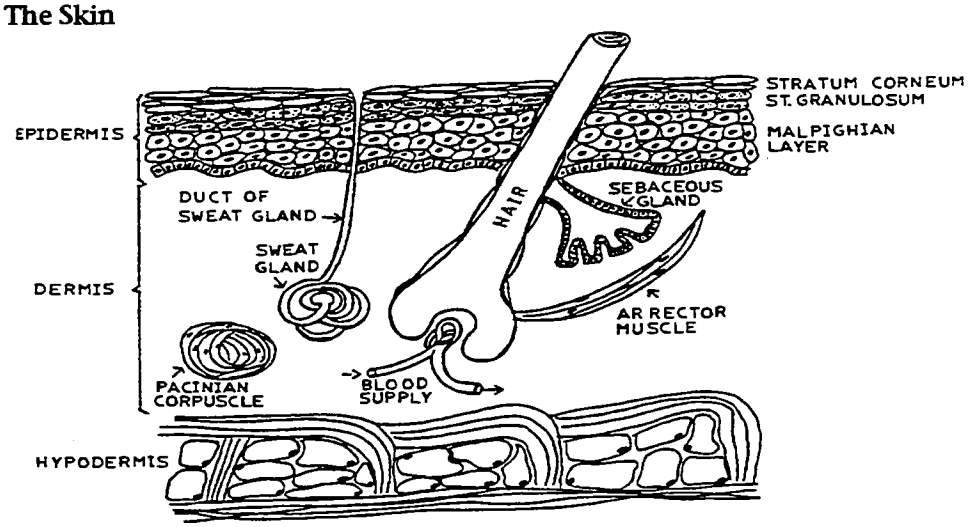
3.3 Sweat glands

Sweat glands are small tubes that run spirally to the surface of the skin from a coiled end deep in the dermis. The opening on the skin is called a pore. Surrounding the end are capillaries from which the gland removes water and waste products. These are forced out on the surface of the skin to form perspiration (L. per = through + spirare, to breathe). Normally the amount perspired in twenty-four hours is approximately one litre.
The sweat glands help to regulate body temperature. When the water on the skin evaporates, heat is lost from the body.

3.4 Hair

Hair is distributed over most of the body with the exception of the palms of the hands and the soles of the feet. Hairs have their roots in hair follicles. These follicles widen at the base to enclose a capillary tuft which provides nourishment for the growth of hair. If the follicle is damaged, the patient may suffer from alopecia, AL/o/pe/shia (Gr.) or a loss of hair; this may be generalized following some cancer chemotherapy or localized following radiotherapy.
The hair follicle is placed obliquely to the skin and a small muscle (the arrector muscle) is

Diagram 2. The Skin



fastened to the side causing it to stand up in cold or fright. The portion of the hair extending above the skin surface is called the shaft.

3.5 Sebaceous glands

The oil or sebaceous glands are small sacs with ducts which usually empty into the hair follicles, although some open directly on the skin surface. The sebaceous glands secrete an oil which lubricates the skin and keeps it soft and pliable and makes the hair glossy.

3.6 Nails

Nails are tightly packed cells of the epidermis that protect the finger and toe tips and help in handling and picking up objects.

3.7 Functions of skin

(1) Forms a protective covering over the body.

(2) Eliminates waste products from the body in the form of perspiration.

(3) Helps to regulate body temperature (the evaporation of perspiration) while layers of fat serve as insulation

(4) Provides us with the sensation of touch because of the nerve endings in the dermis.

3.8 Signs, symptoms and diseases of the integumentary system

Acne vulgaris

simple acne (vulgaris = simple).

Carbuncle

(L. Carbunculus = little coal) painful local inflammation of the skin with formation of pus.

Cicatrix

scar left by healed wound.

Contact dermatitis

inflammation of the skin caused by external irritants such as poison ivy, cosmetics, detergents, sprays, etc.

Decubitus ulcers

(decumbero = to lie down) ulcers due to poor circulation

Dermatophytosis

athlete's foot (tinea pedis), a fungus infection.

Dermoid cysts

benign tissue in a cyst in the skin.

Eczema

irregular, dry, itchy and scaly patches of the skin.

Erosion

dead epidermis (e = out) (rodere = to gnaw)

Erysipelas

(erythro = red) (pella = skin), infection within the skin.

Excoriation

(ex = out) (corium = skin) the skin breaks out in a rash.

Fissure

(L. fissura) ulcer or crack-like sore.

Furuncle

(L. furunculus) a boil.

Gangrene

death of tissue caused by interference with blood supply. Associated with diabetes and circulatory disorders.

Macule

(L. macula = spot)

Mycosis

(mykes = fungus) (osis = condition of) fungal infection of skin or other tissues.

Papule

elevated spot (from L. papula = pimple).

Paronychia

(Gr. para = beside) (Gr. onyx = claw) infection of marginal structures about the nail.

Pediculosis

caused by animal parasites called pediculi or lice in the hair, body or pubic region. Their eggs or nits appear as white specs on hairs.

Pruritis

(L. prurire = to itch) (itching) a symptom of some general disease conditions.

Psoriasis

(Gr.) a chronic disease characterized by eruptions in circular patches covered with dry, silvery scales.

Scabies

(L. scabere = to scratch) due to microscopic parasites (*Acarus scabei*) that burrow under the outer layer of the skin.

Steatoma

(Gr. steat = fat + oma = tumour) "wen" or sebaceous cyst.

Urticaria

(L. urtica = nettles) hives, oedematous raised pinkish areas that itch.

Varicella

chicken pox (L. varicella = a tiny spot).

Variola

smallpox (L. variola = a small spot).

Vesicle

elevated lesion with fluid (L. vesica = a bladder).

4. THE SKELETAL SYSTEM

The skeleton consists of a number of bones, held together by bands or ligaments to form joints, which allow movement between them.

4.1 Structure of bones

The periosteum is a membrane that covers every bone. It contains blood vessels which carry nutrients to the bone cells. In the long bones of the extremities the shaft or diaphysis is the hard compact portion, the epiphysis or end is spongelike and covered by a shell or harder bone and the metaphysis or growing portion lies between them. The diaphysis and epiphysis do not fuse until growth has ceased. Bone cells multiply rapidly in early years but later on only dead cells are replaced or injured ones are repaired. Bones get harder and more brittle with age. Bones differ in size and shape. Long bones give support, flat bones provide protection for delicate organs and irregular bones allow for more motion. The outer portion of bones is hard, however the hollow inner part is filled with soft marrow (Gr. myelo = marrow). Yellow marrow is found in long bones, whereas red marrow is found in the end of long bones as well as in ribs and bodies of the vertebrae. The latter is responsible for the manufacture of red blood cells, some of the white blood cells and platelets.

4.2 Functions of the bones or skeleton

The skeleton:

(1) gives general shape and proportion to the body;

(2) provides attachment for muscles and forms levers on which the muscles act to move the body;

(3) forms cavities for the protection of vital organs.

Bones are not always hard. Some originate as cartilage and then become hard. Bones are usually completely hardened by about twenty years of age through the deposit of calcium and phosphorus from food. Some remain as cartilage, however, for example, the end of the nose, the ears and the anterior part of the ribs attached to the sternum.

4.3 Joints

Where two bones glide over one another in semi-attachment, *joints* (arthro) are formed. Where the surfaces of the ends of the bones come together they are covered with a thin layer of cartilage. Between them layers of fibrous tissue called *ligaments* are formed. Inside, the cells of the lining of the joint give out a small amount of slippery fluid (synovial fluid) which keeps them lubricated and allows free movement. Joints have:

(1) no movement, for example, the flat bones of the skull;

(2) slight movement, for example, the bodies of the vertebrae;

(3) free movement, for example, the joints at the shoulder and hip.

Types of freely movable joints

(1) *Ball and socket*

A joint in which a rounded head is received into a cup-like socket, for example, the shoulder joint, formed by the head of the humerus and the glenoid cavity of the scapula.

(2) *Hinge*

Movement is permitted in one plane only, for example, the knee or elbow joints.

(3) *Pivot*

One bone rotates around another which remains stationary, for example, the first cervical vertebra pivots on the second.

(4) *Gliding*

The articulating surface of one bone slides on that of another to a limited extent, for example, joints between the carpal and tarsal bones.

4.4 Kinds of movement

(1) *Flexion*

A limb is flexed when it is bent, for example, bending the arm at the elbow.

(2) *Extension*

A limb is extended when it is straightened out, for example straightening the arm at the elbow.

(3) *Abduction*

Movement away from the midline, for example, raising the arm from the side.

(4) *Adduction*

Movement toward the midline, for example, lowering the raised arm to the side.

(5) *Circumduction*

Circular movement in which the bone outlines a cone, for example, swinging the arms.

(6) *Rotation*

The turning of bones on their axes, for example, rotation of the atlas (1st vertebra) on the axis (2nd vertebra) to turn the head.

(7) *Supination*

Moving to the supine position with the arms hanging down and the palms facing forward.

(8) *Pronation*

Moving to the prone position with the arms hanging down and the palms facing backwards.

(9) *Eversion*

The sole of the foot faces outward.

4.5 The skull

The skull consists of the bones of the *cranium* and of the *face*. They fit together to form a cavity for the protection of the brain. The skull is made up of twenty-two bones closely fitted together without movable joints, with the exception of the lower jaw or *mandible*. This is attached to the skull by a hinge joint on either side that permits movement of the mandible up and down. The upper jaw is called the *maxilla*. It is firmly attached and does not move. The facial bones form the eye sockets and the nasal and oral cavities.

Bones of the cranium

Two parietal bones, one occipital bone, and one frontal bone form a covering for the brain. Two temporal bones contain the ear cavities, the organs of balance, and the mastoid cells. One sphenoid bone is located in the centre and forms the base of the skull. One ethmoid bone is found in the roof of the nasal cavity.

Bones of the face

Two nasal bones form the upper part of the bridge of the nose. One vomer bone divides the nasal cavity. Two inferior turbinate bones in the nostrils form the outer walls of the nasal cavity. Two lacrimal bones form a small part of the medial wall of the eye orbit. Two zygomatic or malar bones form the prominence of the cheek. Two palatine bones form the roof of the mouth. Two maxillae form the upper jaws and one mandible forms the lower jaw.

Sinuses

Four pairs of cavities in the cranial bones make the skull lighter and return the sound of the voice. Named after the bones in which they lie, there are 2 frontal sinuses, 2 maxillary sinuses, 2 ethmoid sinuses, and 2 sphenoid sinuses.

Sinusitis

The effect of swollen epithelial tissue which blocks drainage channels and thereby prevents normal secretions in the sinuses

4.6 Vertebral or spinal column

The thirty-three bones comprising the spinal column are called vertebrae. These are divided into five groups according to their distinguishing characteristics.

(1) *Cervical vertebrae* (7 in number)

The first, called the *atlas*, forms a joint with the base of the skull and permits the nodding movement; the second called the *axis* permits the side to side movement of the head.

(2) *Thoracic vertebrae* (12 in number)

The twelve pairs of ribs are attached to these.

(3) *Lumbar vertebrae* (5 in number)

These are large vertebrae that allow free movement to the spinal column.

(4) *The sacrum*

The sacrum is a single wedge-shaped bone consisting of *five vertebrae* fused together. It is situated between the two pelvic bones and forms part of the pelvic girdle.

(5) *The coccyx*

Situated below the sacrum consists of four small bones fused together.

Functions of the spine:

- forms the central support for the body.
- ensures flexibility of the trunk,
- protects the spinal cord,
- absorbs shock,
- provides attachment for the ribs,
- supports the weight of the trunk and transmits it to the lower limbs,
- forms a strong posterior boundary for the thorax and abdomen and helps to maintain erect posture.

The spine normally curves anteriorly and posteriorly. (Diagram 3).

Diagram 3. Curves of the spine

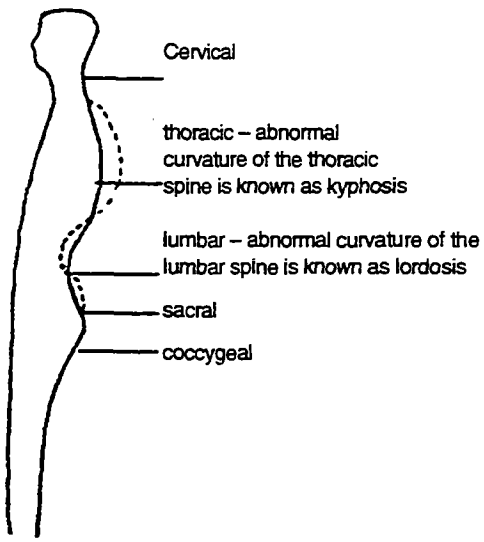
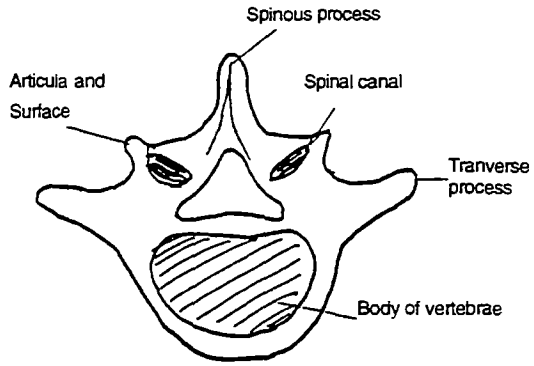


Diagram 4. Vertebra



The flat part of the body of the vertebra bears most of the weight. An arch is formed, providing an opening or spinal canal throughwhich the spinal cord passes (Diag. 4).
Fingerlike extensions called transverse process serve to anchor tendons and ligaments.
Intervertebral discs are plates of cartilage between the vertebrae which make the joints flexible and help to break the shock of any sudden force.

4.7 Ribs and Sternum

There are twelve ribs on each side connected in pairs to the thoracic vertebrae behind and, with the exception of the last two pairs, to the sternum (breast bone) in front. The ribs are not bony throughout their entire length, but at a short distance from the front, cartilage takes the place of bone. The upper seven pairs are called true ribs and are attached by their cartilage directly to the sternum. The lower five pairs are called false ribs. The upper three pairs of false ribs are attached by their cartilage to the rib directly above and thence to the sternum. The last two pairs are unattached to the sternum and are called floating ribs.
The sternum is a long, flat, dagger-shaped bone with the point downwards. Three parts make up the sternum, known as the manubrium, body and xiphoid process.

4.8 Bones

(1) Bones of the upper extremities

The *scapulae* or shoulder blades are two large flat, triangular bones lying upon the ribs posteriorly. A prominent ridge or spine at the back forms an attachment for back and arm muscles. At the outer and upper part the glenoid cavity receives the rounded head of the humerus.

The *clavicles* are two slender bones which extend horizontally across the upper part of the thorax above the first ribs. They articulate with the scapulae and sternum.

The *humerus* is the bone of the upper arm. It consists of a shaft and two enlarged ends. The proximal end is the smooth rounded head which fits into the glenoid cavity of the scapula. The distal end has bone surface which articulates with the ulna to form the elbow joint.

The *radius and ulna* are parallel bones located in the forearm. The radius extends from the elbow to the wrist on the lateral side. The ulna extends from the elbow to the wrist on the medial side. The radius articulates with the ulna just below the elbow.

The *carpal* bones comprise the wrist, made up of eight bones arranged in two rows of four.

The *phalanges* are the finger bones. Three phalanges comprise the fingers, and two the thumbs.

(2) Bones of the lower extremities

The pelvis is formed by six bones, two ilia, two ischia and two pubic. One of each form two large flat irregular bones (the innominate) that become one when adulthood is reached which, together with the sacrum, constitute the pelvic girdle.

There is a hollow on the outer side of each innominate bone which forms the *acetabulum*, a socket to articulate with the upper end of the femur.

The *femur* is the bone of the thigh. It extends from the acetabulum to the knee. It is the longest and strongest bone of the body. Proximally the smooth rounded head fits into the acetabulum. The neck of the femur is a weak point. It joins the head to the shaft. The distal end of the femur has two bony masses by means of which it articulates with the tibia and patella and forms the knee joint.

The *patella* is a small flat triangular bone placed in front of the knee joint which it serves to protect.

The *tibia and fibula* are parallel bones of the lower leg. The *tibia* or shin bone extends from the knee to the ankle medially. The *fibula* extends from the knee to the ankle laterally.

The seven *tarsal* bones comprise the ankle and are united by ligaments. They are larger and more irregular than the carpal bones. The largest is the heel bone or *calcaneus*.

The *metatarsals* are five long bones that comprise the foot.

The *tarsals* join the metatarsals to form two arches – *longitudinal* and *metatarsal*.

The *phalanges* in the toes resemble those in the hand both in number and general arrangement.

5. MUSCULAR SYSTEM

5.1 Introduction

The appearance of human muscular tissue is roughly comparable to the lean of butcher's meat. Muscle cells are arranged in fine elastic threads or fibres, wrapped together in bundles. Several bundles make a muscle. Every muscle is covered by a sheath, the ends of which form *tendons* attached to bones.

Muscles are attached to bones at the point that will give best leverage. Muscles tend to work in pairs; for some movements groups of muscles are used. Each muscle is connected to the central nervous system by a *motor nerve* which carries messages from the brain, causing the muscle to contract.

Bursae are small sacs lined with synovial membrane and are found wherever pressure is exerted by ligaments over moving parts (singular noun – bursa).

5.2 Functions of muscles

(1) The maintenance of erect posture and holding the head, body and extremities in a variety of positions.

(2) Movements and locomotion, to secure food and shelter and communicate by speech.

(3) An elastic support for certain organs, for example, the floor of the pelvis is support for the pelvic contents.

5.3 Kinds of muscles

(1) *Voluntary* muscles are under the control of the will and are capable of rapid and complicated movements; for example, walking, talking, or swallowing.

(2) *Sphincters* are special voluntary muscles which guard body openings.

(3) *Involuntary* muscles are not under the control of will and are capable of slow and mechanical movement only. They are found in the walls of blood vessels and in most of the internal organs. Cardiac muscle is found only in the heart and is a special form of involuntary muscle. The working of the involuntary muscles is controlled by a special set of nerves known as the *autonomic nervous system.*

5.4 Some important muscles

There are 325 muscles in the body – we will consider only a few groups.

(1) The *diaphragm* lies between abdominal and chest cavities. Contraction and relaxation is part of the respiratory mechanism.

(2) The *intercostal* muscles are found between the ribs. They assist the respiratory process.

(3) The *abdominal* muscles are flat bands which stretch from rib to pelvis and support the abdominal organs. There are four sets of abdominal muscles:

(a) the internal oblique muscle – ascending;

(b) the external oblique muscle – descending;

(c) the transversus abdominus – across the abdomen;

(d) the rectus abdominus muscle – vertically.

A *hernia* is a protrusion of a portion of the contents of a body cavity. There are weak places where herniae may occur. These are places where blood vessels and other structures normally extend through the muscles.

The *inguinal ring, femoral ring,* and *umbilicus* are common sites.

(4) The *pectoralis* muscles, major and minor are large anterior chest muscles (L. pectus = breast). The pectoralis major is a large triangular muscle extending to the humerus which draws the arm forward and downward. The pectoralis minor, beneath the pectoralis major extends to the scapula, lowers it, and depresses the shoulder.

Both of these muscles are removed during a radical mastectomy. The mastectomy patient must learn exercises to accommodate the loss of the pectoral muscles.

(5) The *serratus anterior* (L. serratus = toothed) are the anterior chest muscles arising from the ribs by separate slips. Inserting into the scapula, the muscles elevate the ribs and assist in breathing. The serratus anterior also rotates the scapula.

(6) The large muscles of the shoulder, posterior chest and back are the *trapezius* and the *latissimus dorsi*. When the trapezius contracts, the head is drawn back and to the side and the scapula is rotated. The latissimus dorsi originating in the thoracic, lumbar and sacral vertebrae and the iliac crest insert into the groove below the biceps on the humerus for adduction and rotation of the arm.

(7) The paired *gluteal* muscles form the buttocks (Gr. gloutos = buttock) and are called the gluteus maximus, medius and minimus. These muscles insert into the greater trochanter of the femur permitting thigh movement.

(8) Major muscles associated with the anterior aspect of the thigh are the *quadriceps femoris* (L. quadri = four + ceps from caput = head, thus a four headed muscle) originating in the ischial tuberosity on the pelvis and inserting into the femur. The quadriceps causes extension of the leg.

(9) In the posterior part of the thigh are the hamstring muscles, including the *gracilis, sartorius, biceps femoris,* and *semitendinous* muscles which cause flexion of the thigh.

When the sartorius contracts it allows the legs to flex and cross. It is thus named the tailor's muscle (L. sartor =

tailor). The sartorius is the longest muscle in the body.

The gracilis flexes and adducts the leg and adducts the thigh. Originating on the pelvis, it inserts into the medial surface of the shaft of the tibia.

(10) Large muscles of the lower leg and foot

The *tibialis anterior* elevates and flexes the foot. Originating in the upper tibia, it inserts in the ankle and foot bones.

The calf of the leg contains the *gastrocnemius,* the largest muscle which extends the foot and helps to flex the knee or the thigh. Originating on the femur, this muscle inserts by the Achilles tendon into the calcaneus.

Other muscles in the calf of the leg are the *soleus* and *peroneus longus*. The soleus (L. solea = sole of foot) extends and rotates the foot. It inserts along with the gastrocnemius into the Achilles tendon. The peroneus longus extends, abducts and everts the foot.

(11) Large muscles of the shoulder and arm

The deltoid muscle (shaped like the Greek letter *delta*) which moves the upper arm outwards from the body, raising and rotating the arm has its origin in the clavicle and scapula. It is inserted into the shaft of the humerus.

The biceps flexes and supinates the arm. It has two sources of origin, the short head rising from the coracoid process of the scapula and the long head from the scapula above the glenoid fossa. Insertion is into the radius (bi-ceps = two heads).

The triceps muscle acts in opposition to the biceps. It also originates on the scapula but also has two heads coming from the humerus. Inserted into the ulna, it extends the forearm and arm (tri-ceps = three heads).

(12) Muscles in the forearm are used to allow action in the wrist, hand and fingers. For example, the flexor pollicis longus, which allows us to flex our thumb, originates in the radius and inserts into the terminal phalanx of the thumb.

5.5 Signs, symptoms and diseases of the musculoskeletal system

Definition: orthopaedics is the special branch of medicine concerned with the preservation and restoration of the functions of the skeletal system.

The following list includes some of the more commonly used terms related to diseases of muscles and bones.

Achondroplasia

is a congenital anomaly resulting in dwarfism due to abnormally short long bones.

Dislocation

the ligaments at the joint give away completely and the bone is displaced from its socket.

Fibrositis

inflammation of fascia and muscle sheaths.

Fractures

a fracture is a break in a bone. It may be complete or partial. The types of fractures are:

(1) *Simple fracture,* a crack or clean break occurs.

(2) *Compound fracture,* the skin is broken and the bone protrudes through.

(3) *Comminuted fracture,* the bone is broken into several pieces.

(4) *Greenstick fracture,* a bending and cracking of the bone without a complete break, occurs in immature bones of childhood.

Torticollis or stiff neck

in which the neck muscles are affected. (Tortus = twisted. Collum = neck).

Kyphosis

is an abnormal curvature of the thoracic spine convexly and posteriorly.

Legg-Calve Perthes disease

is osteochondritis of the head of the femur.

Lordosis

abnormal curvature of the lumbar spine convexly and anteriorly.

Myasthenia gravis

is exhibited by rapid fatigue of muscles without pain.

Myositis

is inflammation of muscles.

Osteitis deformans

(Paget's disease) the enlargement and distortion of bones in older age.

Osteitis fibrosa cystica

(von Recklinghausen's disease) – bony manifestation caused by hyperparathyroidism.

Osteoarthritis

Hypertropic or degenerative arthritis. A disease of older people resulting in gradual wearing out of the joint.

Osteochondritis

inflammation of bones and cartilage.

Osteomalacia

softening of the bones.

Osteomyelitis

inflammation of bone caused by a pyogenic (pusforming) organism. It is most common among children.

Paralysis

the control of muscles by the nervous system has been affected. Paralysed muscles gradually atrophy.

Rheumatoid arthritis

a chronic disease affecting many joints which results in deformity. It is commonly diagnosed between 20 and 50 years of age.

Rickets

the bone hardening process does not proceed normally because of a lack of Vitamin D. The bones get out of shape when weight bearing, and finally harden in the deformed state.

Scoliosis

an S-shaped abnormal lateral curvature of the spine.

Spondylolisthesis

spondylos = vertebrae, olithesis = forward slipping, a forward slipping of the lower lumbar vertebrae, usually on the sacrum with pelvic deformity.

Sprains

the ligaments that support joints are stretched or

Tenosynovitis

inflammation of a tendon sheath.

6. THE NERVOUS SYSTEM

6.1 Introduction

The nervous system is the system which provides the integration and control of body processes. It consists of the brain and spinal cord, linked to the peripheral part connected with tissues and organs.
Sensory nerve fibres carry messages from tissues and organs to the brain and spinal cord.
Motor nerve fibres carry messages to tissues and organs, from the brain and spinal cord.

6.2 Cerebrum

The cerebrum is the largest part of the human brain. It is made up of two cerebral hemispheres (hemi = half) each of which is divided into lobes. The folds on the surface of the brain are known as *convolutions*. Grey matter forms the outer layer, or *cerebral cortex*. It contains the cell bodies or neurons. The inner white matter is made up of nerve fibres.
The *anterior commissure* is made up of nerve fibres linking the two cerebral hemispheres.
Deep in the substance of the cerebral hemispheres there are additional masses of gray matter which, together with the cerebrum, form the forebrain:

(1) the *basal ganglia*, concerned with the modification and coordination of voluntary muscle movement;

(2) the *thalamus*, an important relay centre for sensory fibres on their way to the cerebral cortex; crude sensation and pain may be felt here;

(3) the *hypothalamus*, contains the centres for the autonomic nervous system.

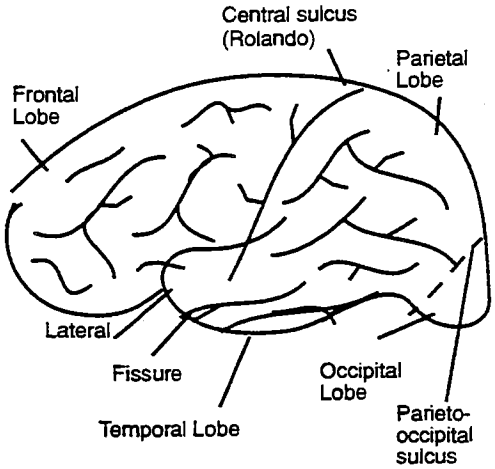
6.3 The midbrain

The midbrain receives impulses from the eye and ear. It serves as a centre for *visual* and *auditory* reflexes. Cranial nerves III and IV stem from the midbrain. The grey matter of the midbrain consists of the bodies of the IIIrd and IVth cranial nerves, and the *red nucleus*.

The midbrain controls skilled muscular movements. The white matter of the midbrain carries sensory and motor fibres, linking the red nucleus with the forebrain, the hindbrain and the spinal cord.

Diagram 5. Left cerebral hemisphere

External (Lateral) aspect



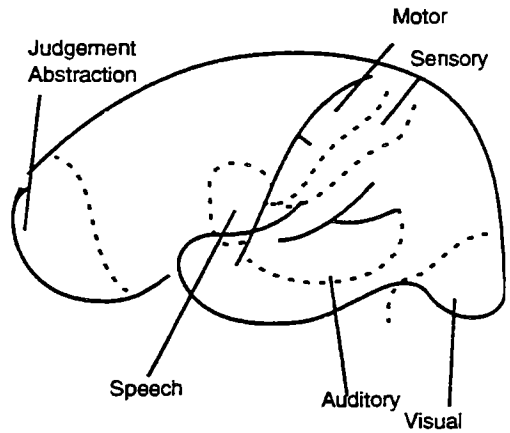
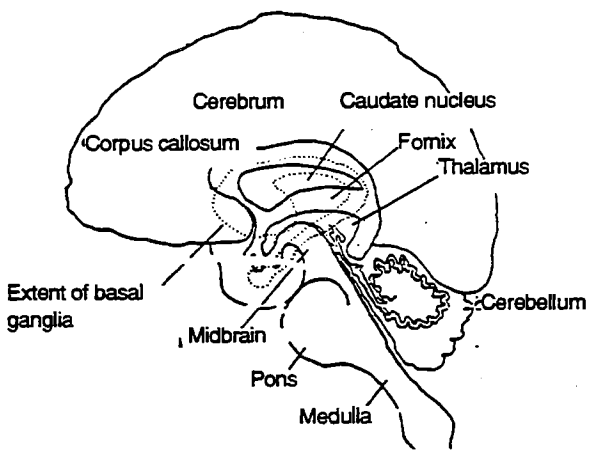


Diagram 6. Mid-Sagittal section-selected structures



6.4 The hindbrain

The *hindbrain* consists of the pons, the cerebellum and the medulla oblongata. The *pons* (L. pons = bridge) bridges the cerebrum and cerebellum. It contains nerve fibres which link the cerebral cortex with the medulla oblongata and the spinal cord (L. medulla = marrow)

The *nuclei* of the cranial nerves V, VI, VII are situated in the pons.

The *medulla oblongata* consists of neurons which form the nuclei of the cranial nerves VIII, IX, X, XI and XII.

The *cerebellum* has centres which are concerned with balance and equilibrium. The function of the cerebellum is to coordinate groups of muscles so that they work together smoothly.

6.5 The spinal cord

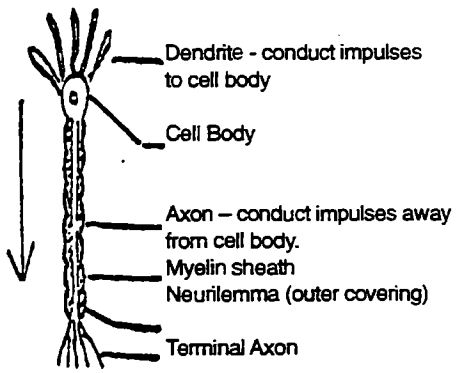
The *spinal cord* extends from the medulla oblongata to the lumbar vertebrae. There are 31 pairs of spinal nerves both motor and sensory. The spinal cord also serves as a reflex centre.

6.6 The nerve cells

The nerve fibres outside the central nervous system in the peripheral nervous system are covered with a *myelin sheath.* An outer thinner covering over this myelin sheath is called *neurilemma.* The presence of the myelin sheath allows the nerve fibre to regenerate. This is a slow process. Nerve tissue in the brain and spinal cord has no myelin sheath and does not regenerate.

Diagram 7. Nerve cell

Dendrite – conduct impulses to cell body.



6.7 Meninges

Three membranes comprise the *meninges*. The *dura mater* is a thick tough membrane lining the skull. The *pia mater* is a thin tissue covering the outermost layer of brain. The *arachnoid mater* lies between the two; it is a thin covering and contains the blood vessels.

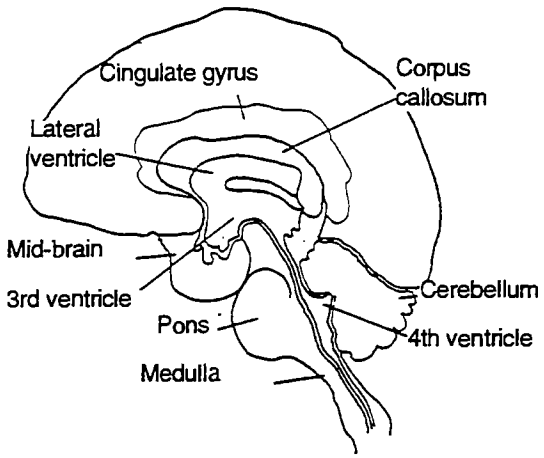
6.8 Cerebrospinal fluid

The *cerebrospinal fluid* is produced by the choroid plexus of the two lateral and 3rd and 4th ventricles. It flows from the lateral ventricles through the foramen of Monro to the third ventricle. From the third ventricle it flows through the aqueduct of Sylvius to the fourth ventricle. Leaving the fourth ventricle, it bathes the brain and spinal cord in the *subarachnoid space* between the arachnoid and pia mater. It is absorbed by the great venous dural sinuses, especially the *superior saggital sinus*.

6.9 The cranial nerves

The cranial nerves carry impulses to or from the brain.

Diagram 8: Mid-saggital section showing ventricles



Bell's palsy

is facial paralysis caused by a lesion of the VIIth cranial nerve.

6.10 Peripheral nervous system

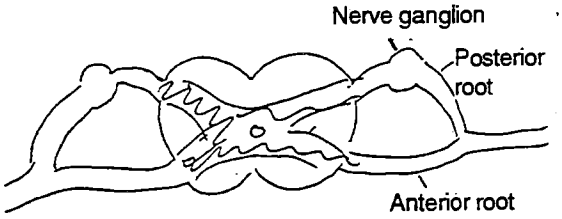
The peripheral nervous system consists of the nerves arising from the spinal cord and running to or from the whole of the body with the exception of areas served by the cranial

Table 3. Cranial nerves

Cranial nerve	Name	Motor function	Sensory function
I	Olfactory		Smell
II	Optic		Sight
III	Oculomotor	All eye muscles except the superior oblique and the external rectus. Also innervates the iris and ciliary body	
IV	Trochlear	Superior oblique m.	
V	Trigeminal	Muscles of mastication	Transmits ordinary sensations from eye, face, sinuses and teeth.
VI	Abducens	External rectus m.	
VII	Facial	Facial muscles, sub-maxillary and sublingual salivary glands	Tactile and taste sensations from the anterior 2/3 of the tongue and the soft palate.
VIII	Acoustic (2 branches) Cochlear Vestibular		
IX	Glossopharyngeal	Pharyngeal muscles and the parotid gland	Tactile and taste sensations from the posterior 1/3 of the tongue, the tonsils, pharynx and the carotid sinuses.
X	Vagus	Heart, lungs, bronchi and digestive tract.	Sensation from the heart, lungs, bronchi, trachea, pharynx, digestive tract and external ear.
XI	Spinal accessory	Sternomastoid, trapezius and constrictor muscles of the pharynx, larynx and soft palate.	
XII	Hypoglossal	Strap muscles of the neck and the tongue muscles.	

nerves and the autonomic nervous system.
Peripheral nerves are connected to the spinal cord by two roots: the anterior or motor root and the posterior or sensory root (Diagram 9).

Diagram 9: The Peripheral nerve



The peripheral nervous system is responsible for the innervation of all voluntary muscles (except those controlled by cranial nerves) and the transmission of sensory impulses from the whole of the body (with the exception of the face).
It is largely under conscious (cerebral) control.
Division, injury or disease of peripheral nerves thus usually results in both sensory and motor loss. However, as already indicated, eventual recovery is possible providing the nerve is largely intact or the ends of the divided nerve are placed close together.

6.11 Autonomic nervous system

The autonomic nervous system controls and regulates the action of glands, the heart and smooth muscle tissue, for example, smooth muscle in the intestines and blood vessel walls.
Autonomic nerves arise at different central nervous system, ranging from the vagus (Xth cranial parasympathetic nerve) to the sacral area of the spinal cord. The autonomic nerves arising from the spinal cord comprise the sympathetic system.
The sympathetic and parasympathetic nerves counterbalance one another.

7. THE SPECIAL SENSE ORGANS

7.1 The ear

The ear has two main functions, those of hearing and equilibrium (or balance). There are three parts to the ear: the external ear, the middle ear and the inner ear. Each of the three parts serves a definitive function in hearing; however, the inner also functions in balance.

The external ear

The *pinna* (L. pinna = wing) is made up of cartilage covered by skin. It collects the sound which is transmitted through the *auditory canal*, leading to the *tympanic membrane* or eardrum, (Gr. tympanon = drum). The auditory canal contains hairs and *ceruminous* (wax) glands.

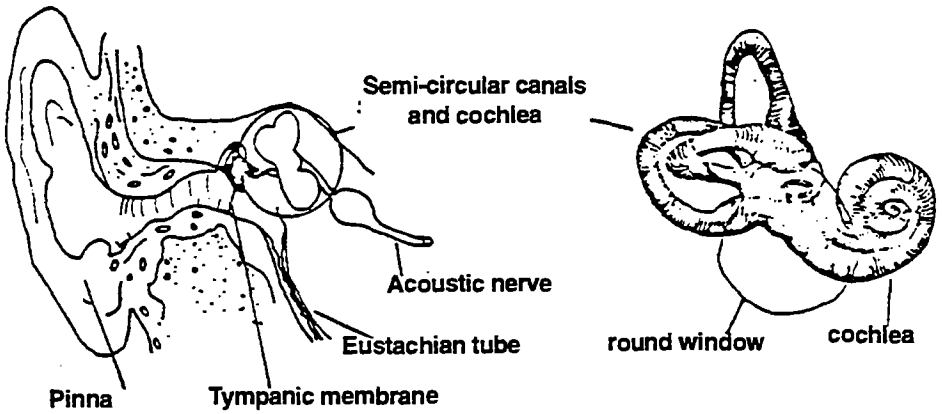
The middle ear

The middle ear lies in a cavity in the temporal bone. It is connected with the nasopharynx by the Eustachian tube, which opens upon swallowing to allow air to enter the middle ear, thus equalizing pressure on both sides of the tympanic membrane.
There are three small bones in the middle ear called auditory ossicles which are connected to form a small lever between the tympanic membrane and the oval window (fenestra cochlea).
The auditory ossicles are named according to their shapes – the malleus, (Latin = hammer), the incus (Latin = anvil), and the stapes (Latin = stirrup). Two small muscles, the tensor tympani connected to the malleus and the stapedius connected to the stapes, contract as a protective mechanism during excessively loud noise.
Sound vibrations set the tympanic membrane in motion and move the ossicles. This amplifies and transmits the sound across the middle ear so that the foot plate of the stapes moves backwards and forwards in the oval window which is in contact with the cochlear fluid, in which vibrations are established. These vibrations stimulate receptors in the Organ of Corti, and nerve impulses are sent to the sound centre in the brain.

The inner ear

The cochlea (Gr. Kochlias = a spiral) is the hearing part of the inner ear. It is a spiral canal containing a receptor for hearing called the *Organ of Corti* to which is attached the cochlear branch of the auditory nerve. It has hair cells which pick up impulses transmitted from the middle ear.
The semicircular canals form the organ of balance. The superior, posterior and lateral semicircular canals each connect by an *ampulla* (L. ampulla = a jug) to the *utricle* (L. utriculus = a small sac), from which impulses travel to the brain by the vestibular branch of the VIIth cranial nerve.

Diagram 10: The ear in coronal section



7.2 The eye

The eye is set in a bony socket, the *orbit.* The visible portion of the eye is covered by a thin transparent membrane called the **conjunctiva.**

(1) Rectus muscles:
- the *external rectus* rotates the eyeball outward
- the *internal rectus* rotates the eyeball inward;
- *inferior rectus* rotates the eyeball downward;
- *superior rectus* rotates the eyeball upward

(2) The *inferior oblique* muscle rotates the eyeball upwards and outwards.

(3) The *superior oblique* muscle rotates the eyeball downwards and outwards.

(4) *Levator palpebrae superioris* raises the upper eyelid.

(5) *Orbicularis oculi:* a muscle which encircles the orbit and closes the eye, and which also compresses the lacrimal (tear) sac.

Other important parts of the eye

Aqueous humor

the fluid produced in the eye, occupying the anterior and posterior chambers.

Vitreous humor

a watery substance, resembling aqueous humor contained within the space of the vitreous body (the main body of the eye).

Fundus oculi

the posterior part, or back of the eye, seen through an ophthalmoscope.

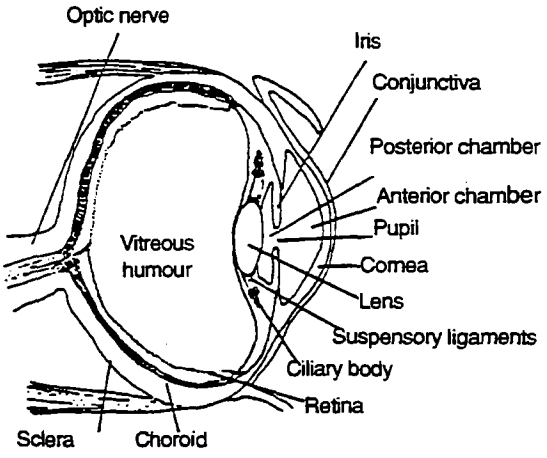
Fovea centralis

a tiny pit in the center of the *macula lutea* composed of slim elongated cones. It is the area of clearest vision

Blind spot

The *optic papilla* where the optic nerve leaves the eyeball.

Diagram 11: The eye in sagittal section



7.3 Smell

The *olfactory epithelium* located in the superior cleft of the nostrils contains the receptors for smell. These receptors respond to chemical stimuli. The sense of smell is transmitted via the olfactory nerve to the smell centre located in the parietal lobe of the cerebrum .

Table 4. Coats of the eyeball

	Structure	Function
Outer	Sclera, tough fibrous tissue Cornea, transparent Extrinsic muscles attached to sclera	Preserves shape of eyeball Allows passage of light rays Permit and limit eyeball movement
Middle or Vascular Pigmented Coat	Contains arteries and veins. Circular opening at front (pupil) Colored muscular ring – iris – surrounds pupil (intrinsic muscle) Ciliary body Ciliary muscle Suspensory ligament Suspends crystalline lens Choroid – post 5/6 of eyeball, the pigmented vascular coat	Controls size of pupil and amount of light entering eye Produces aqueous humor Contracts and moves forward Alters curvature of lens - rays brought to focus in retina
Inner or nervous coat	Retina – lines back of eye, contains receptors for vision. Rods – dim light Cones – bright and colored light	Light-sensitive layer. Converts light energy to nerve impulses to optic nerve

7.4 Taste

The organ of taste is the *tongue*. There are four types of taste buds, these being sweet, sour, salt and bitter. Substances enter solution and stimulate the *gustatory* cells. Nerve impulses are relayed via the facial and glossopharyngeal nerves to the parietal lobe in the opposite side of the cerebrum.

7.5 Definitions

Ophthalmology

a study of disease or conditions of the eye.

Ophthalmologist

one who studies the eye and relative diseases and conditions.

Otology

a study of the ear.

Otorhinolaryngologist

one who specializes in the treatment of diseases or conditions of the ear, nose and throat.

7.6 Signs, Symptoms and diseases of the special sense organs

Accommodation
the adjustment of the lens to form a clear image.

Achromatopia

colour blindness.

Acoustic neuroma

a tumour of the auditory nerve.

Astigmatism
irregular curvature of the eyeball.

Cataract

opacity of the lens of the eye.

Chalazion
small hard tumour similar to sebaceous cyst, on the eyelid.

Conjunctivitis

inflammation of the conjunctiva.

Diktyoma

a ciliary epithelial tumour.

Ectropion

eversion of the eyelid margin, sometimes seen
in the elderly.

Entropion

inversion of the eyelid margin.

Glaucoma

disease of the eye characterized by increase intraocular pressure.

Hordeolum
inflammation of sebaceous gland of the eyelid – a sty.

Hypermetropia
impairment of near vision. Parallel rays come to focus behind the retina due to a flattening of the globe of the eye or refraction error.

Iridocyclitis

inflammation of the iris and ciliary body.

Malignant melanoma (eye)
a pigmented mole or tumour arising from the uveal tract.

Mastoiditis
inflammation of the mastoid process, generally as an extension of otitis media.

Meniere's disease
disturbance in the labyrinth, with sudden onset of tinnitus, deafness, nausea, vomiting and dizziness.

Myopia
defect in vision so that objects can only be seen distinctly when very close to the eyes – caused by elongation of the globe of the eye.

Nystagmus
involuntary rapid movement of the eyeball.

Otalgia
pain in the ear.

Otitis media
inflammation of the middle ear.

Perichondritis (ear)
inflammation of the skin covering the cartilage of the ear.

Presbyopia
defect of vision in advancing age (synonym= farsightedness).

Retinal detachment
the retina detaches – usually due to haemorrhage behind the retina from disease or trauma.

Retinoblastoma
a tumour arising from the retinal germ cells, a malignant glioma of the retina.

Strabismus
the optic axes cannot be directed towards the same object due to lack of muscle coordination (squint).

Tinnitus
ringing in the ears.

Vertigo
dizziness.

8. CARDIOVASCULAR SYSTEM

8.1 The circulation

The *systemic circulation:*
flows from the left ventricle to the aorta and thence via other arteries to the capillary beds in the head, neck, trunk and limbs. It returns to the right auricle (atrium) of the heart via the systemic veins.

Food is absorbed, passes into the capillary bed in the digestive tract and is carried by the portal vein to the hepatic or *portal circulation.*

In the *pulmonary circulation:*

blood flows from the right ventricle to the lungs where oxygen is taken up by the blood and carbon dioxide (CO_2) is given off. The blood then returns to the left auricle (atrium).

8.2 The heart

The heart has four chambers which are lined with *endothelium* (*endocardium*). It has thick walls of muscle called *myocardium.* Heart muscle is supplied with blood from the coronary arteries that branch off from the aorta.

The heart is enclosed in a two-layered membrane, the *pericardium.* A thin film of fluid separates the layers of the pericardium.

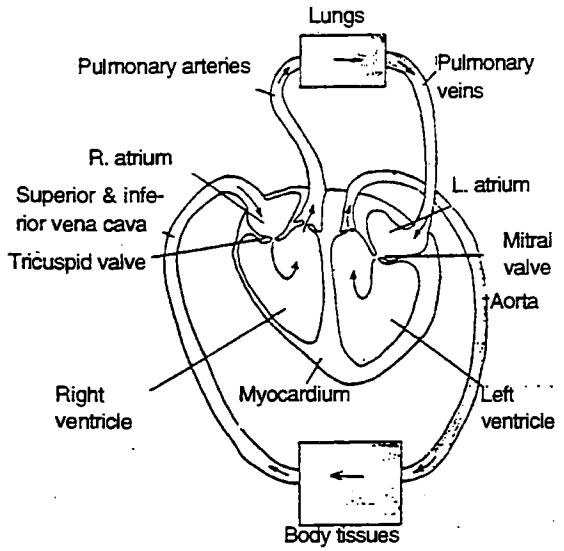
The *cardiac muscles* of the atria are completely separated from the cardiac muscle of the ventricle by a ring of fibrous tissue at the atrioventricular groove. (A-V groove). Extensions from this ring form the *heart valves.* A-V valves are attached by thin *chordae tendinae* to extensions of cardiac muscle called the papillary muscles. The *papillary muscles* contract when the ventricles contract. They pull on the chordea so that the valve flaps cannot be everted, therefore in health, blood can flow in one direction only.

The human heart is really a double pump. The right atrium receives blood from the body tissues with its oxygen supply diminished via the inferior and superior vena cava. This blood passes into the right ventricle which pumps it to the lungs via the pulmonary arteries to obtain a fresh oxygen supply. The blood received back from the lungs via the pulmonary veins passes via the left atrium to the left ventricle, which pumps it to the rest of the body via the aorta.

8.3 The cardiac cycle

The cardiac cycle consists of *diastole* and systole. In diastole, there is a period of relaxation

Diagram 12: Pictorial representation of blood circulation



when first the atria then the ventricles fill. In *systole* there is a period of contraction. Auricular systole causes the ventricles to be completely filled and stretched which is followed by ventricular systole when the semilunar valves are forced open and blood is ejected into the pulmonary artery and the aorta simultaneously. The semilunar valves prevent backflow from the pulmonary artery and the aorta.

8.4 Heart sounds

The A-V valve flaps close at the beginning of ventricular systole, causing the first heart sound. The semilunar valves close at the beginning of ventricular diastole, causing the second heart sound. Heart *murmurs* will be heard if blood is forced forward through narrowed valves or leaks backwards through incompetent valves.

8.5 Origin and conduction of the heart beat

The rhythmic contraction of the heart is called the heart beat. The impulse to contract is generated rhythmically in specialized NODAL TISSUE in the wall of the right atrium, the SINO-AURICULAR NODE (the pacemaker).

The wave of excitation spreads throughout the muscles of both atria which then contract.

The heart beat is not transmitted from the auricles to the ventricles directly. The impulse from the auricular muscles is picked up by another mass of nodal tissue, the atrio-ventricular node and relayed by Purkinje tissue, in the Bundle of His and its branches lying beneath the endocardium on the interventricular septum to the muscles of both ventricles which then contract together, while the atria are relaxing.

An electrocardiograph records the electrical changes in heart muscle caused by contraction and relaxation.

Although the heart initiates its own impulse to contract, the body's changing needs are controlled by nervous impulses discharged from controlling centres in brain and spinal cord. Sympathetic nerves increase the rate and force of the heart beat. The parasympathetic nerves slow the heart and reduce the force of contraction.

8.6 Blood vessels

Beginning at the heart, the blood is pumped into elastic arteries, then to muscular arteries. From arteries the body has a system of arterioles like branches on a tree which end in capillaries which surround body cells. Venous blood is transferred back from the capillaries into venules which unite to form muscular veins that empty into the great veins and thence to the heart. Only from capillaries can blood give up food and oxygen to tissues and receive waste products and carbon dioxide from tissues.

8.7 Coats of blood vessel walls

(1) *Tunica intima*
- endothelium
- internal elastic lamina

(2) *Tunica media*
- smooth muscle
- fibrous tissue
- external elastic lamina

(3) *Tunica adventitia*
- fibrous tissue

8.8 Blood pressure

The pressure within the aorta is highest as the blood leaves the left ventricle at the end of systole and lowest as the blood drains into the right auricle at the end of diastole.

Arterial blood pressure is measured in man by means of a *sphygmomanometer.*

8.9 The pulse

As blood is pumped from the heart during systole, the distention and increase in pressure which starts in the aorta passes along the whole arterial system as a wave – the *pulse wave.*

8.10 Venous return

(1) Adequate blood volume and adequate tone of smooth muscle in blood vessel walls is essential for normal venous return of blood to the heart

(2) Unidirectional valves are present in muscular veins to prevent backflow of blood in the system.

(3) The cardiac pump exerts a residual force which is imparted by the heart's contraction.

(4) Contractions of skeletal muscles help to squeeze veins and move blood towards the heart

(5) Respirations act as a pump by the creation of negative intrathoracic pressure which creates a suctioning pull in the veins in the thorax, and the descent of the diaphragm increases the intra-abdominal pressure which forces blood upwards in the abdominal veins.

(6) Gravity allows blood to drain from the head and neck.

8.11 Signs, symptoms and diseases of the cardiovascular system

Angina pectoris

pain felt in the centre of the thorax on exertion due to anoxia of the myocardium.

Arteriosclerosis

a condition marked by loss of elasticity, thickening and hardening of the arteries.

Atherosclerosis

a lesion of large and medium-sized arteries with deposits of yellowish plaques in the intima (lipid material).

Cardiac hypertrophy

enlargement of the heart tissue.

Cerebral vascular accident

broken blood vessel in the cerebrum.

Congenital pulmonary stenosis

born with a narrowing of the opening between the pulmonary artery and the right ventricle.

Coronary occlusion

a blockage of a coronary artery, cutting off blood supply to a portion of the heart.

Coronary sclerosis

a hardening of the coronary arteries.

Coronary thrombosis

a thrombus formation in a coronary artery.

Dextrocardia

location of the heart in the right hemithorax often with accompanying transposition of abdominal viscera.

Endocarditis

inflammation of the endothelium lining the heart.

Haemopericardium

blood in the pericardial sac.

Hypertension

high blood pressure.

Hydropericardium

an abnormal accumulation of serous fluid in the pericardial cavity.

Myocardial infarction

the formation of a dead area in the heart muscle due to interruption of blood supply.

Myocarditis

inflammation of the muscular walls of the heart.

Pericarditis

inflammation of the lining around the heart.

Phlebothrombosis

thrombus formation in a vein generally due to stasis.

Thromboangiitis obliterans (Buerger's disease)

an obliterative disease of the blood vessels of the extremities leading to ischaemia and gangrene.

Thrombophlebitis

inflammation of a vein with thrombus formation.

Varicose veins

enlarged and tortuous veins.

9. BLOOD AND THE BLOOD-FORMING ORGANS

9.1 Composition of the blood

In the adult, the average amount of blood is 5 litres or approximately 7.7% of the body weight. The blood plasma comprises approximately 55% of the blood. It is almost clear, a straw-coloured fluid of which approximately 90% is water (Table 5).

9.2 Cells in the blood

There are three main types of blood cells, red blood cells, white blood cells and platelets (Table 6).

9.3 Blood coagulation

Blood does not normally clot within healthy blood vessels. When vascular tissues are damaged, blood undergoes a series of changes which result in clot formation:
The platelets cling to the intersections of the fibrin threads. Adhesions form, the clot shrinks with the expression of serum.

9.4 Haematopoiesis – blood formation

Various substances taken in the diet (including iron and other minerals, vitamin B12 and protein) are absorbed (vitamin B12 only in the presence of an intrinsic factor secreted by the gastric mucosa) and taken to the liver. Here vitamin B12 is stored and released to the general circulation as required as a haematopoietic factor which stimulates the production of red cells (erythropoiesis) in the red bone marrow.Other factors necessary for erythropoiesis include iron, and thyroid hormone. The red cells circulate for 120 days and are then broken down (probably in the spleen) to release iron for further use. Haemoglobin without iron is excreted as bile pigments via the liver.
The various mechanisms responsible for producing white blood cells (except lymphocytes) in the red bone marrow are less well understood.

9.5 Blood groups

Present in the plasma of some individuals are antibodies which can cause agglutination (the clumping together) and subsequent haemolysis (breakdown) of the red blood cells received in blood transfusions.
When such reactions occur, the bloods are said to be incompatible. Clumps of cells may block small blood vessels in the lungs or brain causing serious complications. Haemolysis may result in the passage of haemoglobin via the kidneys into the urine, and may lead to kidney failure and death.

The type of antigen present in the red blood cells of the donor's blood, which reacts with the antibodies in the plasma of the recipient help to identify four blood groups (Table 7)

Table 5. Substances in the blood plasma

Substance		Associated functions
Plasma proteins (6-7%) (formed chiefly in liver)	Serum albumin 4% Serum globulin 2.7%	To exert osmotic pressure of 25-30 mm Hg Carries iron and copper. Associated with antibody production.
	Fibrinogen 0.3 %	The precursor of *fibrin* which forms the framework of blood clot.
Regulatory and protective proteins	Hormones Antibodies Enzymes	Chemical messengers from endocrine glands. Important in immunity. Catalysts in chemical reactions.
Inorganic substances (electrolytes) (0.9 %)	Sodium, potassium, calcium, chlorides, bicarbonates, iodine and iron	Fluid and electrolyte balance, body development and function.
Organic substances	Waste material – urea, uric acid, xanthine, creatine, creatinine, ammonia Nutritive materials - amino acids, glucose, fats and cholesterol	Products of tissue activity, transported from the tissues to the kidney and skin for excretion. Absorbed from the gut, are transmitted to the tissues for utilization and storage.
Respiratory gases	(O_2) Oxygen (CO_2) Carbon dioxide	Small amounts of oxygen remain in solution; carbon dioxide in solution as bicarbonate is carried to the lungs for expiration.

Table 6. Blood cells

Cell name	Normal number/mm^3	Nucleus	Function
Red blood cell (or corpuscle)	4.5 - 6.0 × 106 per mm^3	None	Oxygen and carbon dioxide transport.
White blood cell (or corpuscle)	5,000 - 10,000 per mm^3	Granular: - neutrophil - eosinophil - basophil Non Granular: - monocyte - lymphocyte	Body defence against bacteria. Play a role in allergic reactions Useful in heparin formation. Body defence against bacteria. Important in antibody formation.
Platelet	200,000 - 800,000 per mm^3	None	Play an important role in blood clotting

Diagram 13. Blood coagulation

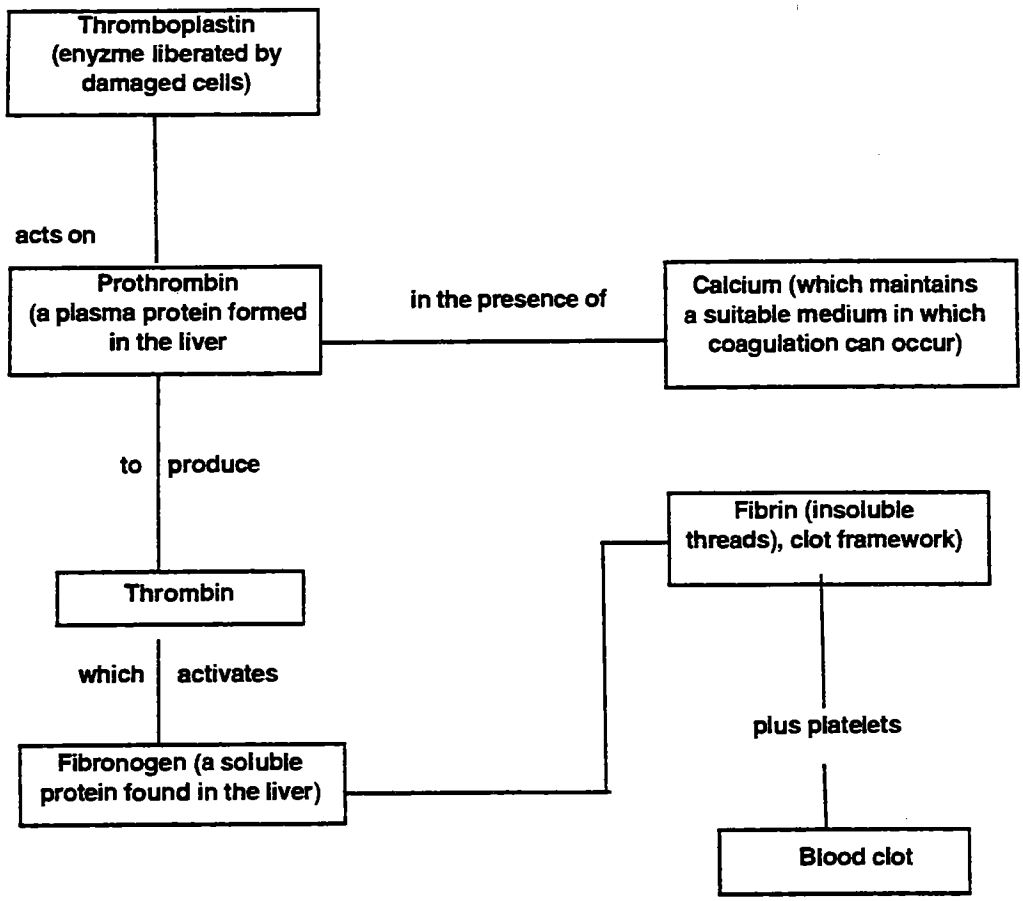


Table 7. Blood Groups

Blood type	Antigen	Antibody
O	None	Anti A & B (universal donor) (can receive only O)
A	A	Anti B (can receive A or O)
B	B	Anti A (can receive B or O)
AB	A and B	None (universal recipient) (can receive A, B, AB or O)

9.6 Rhesus factor

The Rhesus factor may be absent or present in an individual's blood. Eighty-five percent of people are Rh positive, that is, they have the Rh antigen. Rh negative persons have no Rh antigen.
If the Rh antigen is transfused to an Rh negative person, the production of anti-Rh factor (antibody) is stimulated. Should more Rh antigen be transfused, the Rh antigen combines with the anti-Rh antibody reacting to cause *agglutination and haemolysis.*
If a mother who is Rh negative has anti-Rh antibodies present in her blood, and is carrying a foetus who is Rh positive, the transfer of antigens - antibodies between the maternal and foetal circulations can cause agglutination of the blood cells in the foetus. This destruction of foetal erythrocytes is a condition known as *erythroblastosis foetalis* or haemolytic disease of the newborn.

9.7 Lymphatic system

All cells are bathed by tissue fluid, which diffuses from the capillaries. Some of this fluid returns to the capillaries, some drains into thin walled *lymphatic vessels.* The fluid which takes this route is then known as *lymph,* which is similar to plasma but contains less protein.
A network of lymphatic vessels drains the tissue spaces throughout the body, with the exception of the central nervous system. In the case of the larger vessels, lymph is filtered through *lymph nodes.* Afferent lymphatic vessels pour their lymph into a reticular framework of loose sinus tissue in the lymph nodes. Here macrophages, (large cells) ingest foreign material or harmful bacteria. Lymph nodes manufacture *lymphocytes* which produce globulin associated with antibody formation and immunity reactions. Efferent lymphatic vessels receive lymph after it has passed through the lymph nodes. Valves within the vessels prevent backflow. Lymphatic vessels unite to form larger and larger vessels into the blood via the superior vena cava.
There are other lymphoid tissues in the body. The thymus gland, the tonsils, adenoids, and spleen are examples. Lymph nodules exist in the mucous membranes of the intestinal tract and lungs. Aggregated nodules in the small intestine form patches of lymphoid tissue known as Peyer's patches. The latter may be 5–7 cm, 2–3 inches long.
The lymphatic tissue of the body forms an important part of the body's defence against invading organisms and their toxins. These act as antigens stimulating antibody formation which can subsequently destroy or neutralize the antigen.

9.8 The spleen

The spleen is a vascular organ weighing about 200 grams. It is situated on the left side of the abdomen, behind the stomach and above the kidney. The splenic artery and vein and their branches terminate in arterioles that are surrounded by collections of lymphatic tissue (white pulp) which produce lymphocytes. The red pulp is a framework of reticular tissue which acts as a reservoir for blood. Phagocytic cells destroy worn out red blood cells and other foreign particles. During foetal life, the spleen forms both red and white blood cells.

9.9 Signs, symptoms, diseases of the haematopoietic system

(1) Anaemia

Anaemia is a decrease in the amount of circulating red blood cells and/or the total red blood cell haemoglobin. (Normal = 14–15 g per 100 ml of blood). Microcytic - hypochromic anaemia - occurs if iron stores are inadequate, also seen in *chronic* blood loss anaemia.

Macrocytic anaemia

an arrest in the formation of mature red blood cells, accompanied by megaloblasts (large and nucleated) found mainly in bone marrow, caused by deficiencies of dietary protein, folic acid, vitamin B12 and/or the intrinsic factor.

Pernicious anaemia

a form of macrocytic anaemia caused by lack of intrinsic factor. It is macrocytic, hyperchromic with some megaloblasts, with a high degree of anisocytosis and poikilocytosis. It is accompanied by bone marrow *hyperplasia.*

Normochromic – normocytic anaemias

are secondary to other diseases, for example, chronic renal disease, or can occur if the erythropoietic tissue in the bone marrow is crowded out, either by fibrosis (myelofibrosis), or bone formation (osteosclerosis), or metastatic cancer. It also occurs in diseases of the haemopoietic system such as lymphomas or multiple myeloma.

Aplastic anaemia

is a complete failure of the bone marrow to undergo erythropoiesis. It is usually accompanied by *leucopenia.* Its cause may be drug toxicity.

Haemolytic anaemia

involves *lysis* of normal red cells due to antibodies, drugs or poisons, or as a secondary result of other conditions, such as *lymphoma*, lupus *erythematosus*, or chronic *lymphocytic leukemia*.

Words to Note:

anisocytosis

cells vary markedly in size;

poikilocytosis

cells vary markedly in shape;

haemochromatosis

deposition of haemosiderin in parenchymal cells;

haemosiderosis

iron found in macrophages, due to blood transfusion and increased haemolysis.

(2) Myeloproliferative disorders

Agranulocytosis is caused by toxins or poisons. Thrombocytopenia (a decrease in the number of circulating platelets) accompanies bone marrow depression and a decrease in *polymorphonuclear* cells is noted.

Polycythaemia vera involves bone marrow proliferation with an increase in the production of red cells, white cells and platelets causing increased blood volume, increased blood viscosity and may lead to heart failure.

Leukaemia involves the overproduction and liberation of neoplastic white cells; if monocytes, monocytic leukaemia, if lymphocytes, lymphatic leukaemia; if polymorphonuclear elements, myeloid leukaemia.

Leukaemia may be acute or chronic. Monocytic leukaemia is generally acute.

Acute leukaemia is commonly lymphoblastic in childhood and myelogenous in young adults. The precursor cells are primitive cells called blasts.

Chronic myelogenous leukaemia

The predominant immature neoplastic white cell is the myelocyte. It mainly affects patients between 25 and 60 years of age. The spleen characteristically is greatly enlarged.

Chronic lymphocytic leukaemia

Cells present in the peripheral blood are largely mature lymphocytes. The disease generally occurs in older people, 55–80 years of age. Lymphocyte infiltration may be found in all viscera but especially in bone marrow, liver, spleen and lymph nodes. Lymph nodes are enlarged as are the liver and spleen (hepatosplenomegaly)

(3) Reticuloendothelial malignancies

Giant follicular lymphoma

confined to lymph nodes and spleen, causing enlargement, with compression but not obliteration of the sinusoids and reticuloendothelial stroma. The capsule of the lymph node is not usually invaded.

Lymphosarcomas

are primary malignant lesions of lymphatic tissue, lymph nodes and spleen. Neoplastic cells are not usually found in peripheral blood smears.

Lymphocytic lymphosarcoma

the entire lymph node, follicle and stroma, is replaced by a dense mass of lymphocytes which appear normal. The capsule is invaded with spread to neighbouring fat and other viscera, especially the liver and bone marrow.

Lymphoblastic lymphosarcoma

the lymphocytes are enlarged, with primitive nuclei, an increased amount of cytoplasm and invasion is aggressive.

Reticulum cell sarcoma

here, mesenchymal cells with abundant cytoplasm and indented nuclei spread rapidly to all body organs.

Although still used in the ICD, the terms lymphosarcoma and reticulo-sarcoma are increasingly becoming obsolete, being replaced by the generic term

Non-Hodgkin lymphoma.

Within this grouping various types are distinguished according to the predominant histological cell type:

Lymphocytic - well differentiated

Lymphocytic - poorly differentiated

Histiocytic

Mixed lymphocytic and histiocytic

Each type is further divided into Nodular and Diffuse categories. All nodular types have a relatively good prognosis, as does the diffuse lymphocytic well differentiated type.

Hodgkin's disease

differs from the other lymphomas in that the infiltrate is *pleomorphic,* that is, it contains cells of many different types, and occurs in younger age groups.

Multiple myeloma

is a malignancy of the bone marrow where abnormal plasma cells (myeloma cells) occur sometimes in many small areas throughout the marrow (ribs, vertebrae, skull). Myeloma causes dysproteinaemia which can be diagnosed by a test for Bence Jones protein in the urine and myeloma proteins in the blood.

10. RESPIRATORY SYSTEM

10.1 Introduction

All living cells must obtain oxygen and dispose of carbon dioxide. There are two different types of respiration, internal and external.

Internal or cellular respiration is the exchange of gases between the tissue cells and their fluid environment. External respiration is the exchange of gases between the lung alveoli (singular – alveolus) and the external environment. This is accomplished by the respiratory system.

The respiratory passages comprise the nose, larynx, trachea and bronchi.

The lungs are housed in the thoracic cage to which the respiratory muscles the intercostals, and the diaphragm are connected.

10.2 Transportation of respiratory gases

Oxygen in a small amount remains in solution in the blood plasma. A large amount of oxygen enters into loose chemical combination with the haemoglobin in the red blood cells. Carbon dioxide also exists in small amounts in solution in plasma, mostly as bicarbonate and a small amount is linked to the haemoglobin in red blood cells.

10.3 Pulmonary circulation

The blood lacking its full amount of oxygen and containing an excess of carbon dioxide is pumped into the pulmonary artery. From the pulmonary artery, the blood enters the right or left lung and eventually enters a capillary which lies adjacent to an air sac (alveolus). Here by perfusion the blood becomes saturated with oxygen from the air in the alveolus and gives off excess carbon dioxide. It then leaves the capillary, and progresses through larger veins until it enters one of the four large pulmonary veins which carry blood to the left atrium. It will be noted that the pulmonary veins and venules are the only veins which carry oxygenated blood.

10.4 Air pathways

(1) *The nose*

The entry to the nose is called the nares, or nasal orifices.

The *nasal septum* forms the medial wall and is composed of the *vomer* bone, the *perpendicular* plate of the *ethmoid* and cartilage.

The lateral walls of the nasal cavities are formed by three *turbinates* or conchae which project into the nasal cavity. The lateral space below each concha is called a *meatus*. The superior and medial conchae are part of the *ethmoid* bone. Four pairs of paranasal sinuses and two nasolacrimal ducts open into the lateral wall.

The *olfactory* mucosa provides the sense of smell and is situated in the roof of the nasal cavity.

The mucous membrane lining the nasal cavities serves to warm, moisten and filter the air we breathe.

(2) *The pharynx*

There are three parts of the pharynx, the nasopharynx, the oropharynx and the laryngopharynx. The Eustachian tube from the middle ear enters the nasopharynx. The oropharynx lies posterior to the oral cavity. The laryngopharynx connects with the larynx, or voice box.

(3) *The larynx*

The *larynx* is a cartilaginous bow-like structure located in the neck. Posterior to the thyroid gland is the thyroid cartilage. The *cricoid cartilage* which is shaped like a signet ring, with the broad part lying posteriorly is inferior to the thyroid cartilage. The *epiglottis* is a leaf-like structure located at the entrance of the larynx, which closes off the entrance on swallowing. Two arytenoid cartilages, shaped like small pyramids facilitate speech. Two other small paired cartilages, associated with the *arytenoid* cartilages are named the *cuneiform* and the corniculate *cartilages*.

Vocal cords lie between the thyroid and arytenoid cartilages. The arytenoid cartilages move to separate or approximate the vocal cords. The opening between the vocal cords, through which air passes into the trachea, is called the *glottis*. When the cords are slack, there is a wide slit; in quiet respirations, air moves in and out soundlessly. When the cords are taut, the slit is narrowed so that sound is produced when air is expelled from the lungs.

The mouth, nose, sinuses, throat and chest act as resonators; they affect the quality and volume of speech while the lips, tongue and teeth convert the sounds into speech.

The muscles of the larynx are supplied by two pairs of nerves, both branches of the vagus (Xth cranial nerve), called the superior laryngeal and recurrent or *inferior laryngeal* nerves. The recurrent laryngeal nerve lies very close to the inferior thyroid arteries. Nerve damage during thyroid surgery can result in speech impairment.

(4) *The trachea*

The trachea, approximately 11 cm, 4.5 inches long, is located in the lower part of the neck and the upper part of the thorax, anterior to the oesophagus. It is protected by cartilage in the shape of incomplete rings.

(5) *The bronchi and alveoli*

The main bronchi branch inferiorly from the trachea, one entering each lung. Overlapping plates of cartilage give support to the bronchi. Each bronchus branches into smaller tubes called bronchioli and finally ends in the terminal bronchioles. The respiratory bronchioles branch into alveolar ducts which lead to the alveolar sacs, where respiration takes place. The alveoli are part of the lung tissue.

10.5 The lungs and pleura

The lungs differ in shape; the right lung has three *lobes*, the left has two lobes. Each lung has an apex, a base, a *costal* surface and a mediastinal surface. on the mediastinal surface, there is an opening called a *hilus* through which pass the blood vessels, bronchi, nerves and lymphatics. These structures are bound together with connective tissue and are called the root of the lung.

Apart from the blood vessels responsible for transporting gases to and from

the lung, the lung tissue also requires a blood supply. The blood vessels supplying lung tissue are the *bronchial arteries* which branch off from the aorta carrying oxygenated blood, via the root of the lung. The bronchial veins drain into the innominate and axygos veins and eventually back to the superior vena cava.

The pleural cavity is made up of two layers; it is a potential space only. The visceral layer of the pleura is the outermost covering of the lung and it reflects to adhere to the innermost part of the chest wall and diaphragm where it is called the parietal (L. paries = wall) pleura. The entire pleural cavity contains only a small amount of serous fluid for lubrication purposes in health.

10.6 Nerve control of the respiratory system

The lungs are innervated by the autonomic nervous system. Parasympathetic fibres cause constriction of smooth muscle tissue, while sympathetic fibres cause dilation.

In normal breathing, the respiratory rate and rhythm are influenced rhythmically by the *Hering-Breuer* reflex without any conscious muscular exertion.

The most important factor which regulates the activity of the respiratory centre is the level of carbon dioxide in the blood. An increase in the level will stimulate the respiratory rate; a decrease in CO_2 in the blood will depress the respiratory centre in the medulla.

10.7 Signs, symptoms and diseases of the respiratory system

Anthracosis

a condition of the lungs due to coal dust inhalation.

Asthma

paroxysmal dyspnoea accompanied by adventitious sounds caused by spasm of the bronchial tubes or swollen mucous membranes.

Atelectasis

lack of air in the lungs.

Bronchiectasis

destructive dilation of bronchi secreting large amounts of pus.

Bronchitis

inflammation of the bronchial mucous membrane.

Bronchogenic carcinoma

malignancy believed to arise from bronchial epithelial tissue and synonymous with carcinoma of lung.

Common cold

synonymous with *coryza* – an acute catarrhal inflammation of the nasal mucous membranes.

Croup

a disease characterized by suffocative and difficult breathing, laryngeal spasm and sometimes membrane formation.

Dyspnoea

difficulty in breathing.

Emphysema

overdistention of alveoli and smaller bronchial tubes with air. Results in dyspnoea, cough, expectoration characterized by short inspiration, prolonged expiration.

Empyema

pus in the pleural cavity.

Epistaxis

nosebleed.

Hamartoma

a benign tumour due to new growth of blood vessels, may be found as a symptomless coin lesion in the lung.

Hay fever

an allergic disease of mucous passages of the nose and upper air passages induced by external irritation.

Influenza

acute infection often involving catarrh of the respiratory tract.

Laryngitis

inflammation of the larynx with *aphonia.*

Lobar pneumonia

inflammation of lungs involving specific lobes.

Pleurisy

inflammation of the pleura (synonym - pleuritis).

Pneumoconiosis

a condition of the lung due to inhalation of dust particles (Gr. pneumon conis (dust)+ osis (disease)).

Pneumonia

inflammation of the lungs with exudate into the lung tissue.

Pneumothorax

a collection of air or gas in the pleural cavity.

Pneumonitis

inflammation of the lung.

Rhinitis

inflammation of the nasal mucosa (Gr. rhin = nose).

Siderosis

disease of the lungs caused by inhalation of metallic dust (Gr. sidero = iron or steel)

Silicosis

a condition caused by the inhalation of small particles of stone or stone dust (L. silic = flint).

Sinusitis

inflammation of the accessory nasal sinuses.

Tonsillitis

(L. tonsilla = almond) – inflammation of the faucial tonsils.

Tracheo-oesophageal fistula

abnormal opening between the trachea and oesophagus.

Tuberculosis

a specific inflammatory disease caused by the tubercle bacillus characterized by *caseous* granulomatous infiltration.

Wegener's granulomatosis

involves bronchi, trachea, nasopharynx and lung-causing dissolution and necrosis of vessels, alveoli and bronchi, severe pneumonitis, *haemoptysis* and death.

11. DIGESTIVE SYSTEM

11.1 Introduction

This chapter deals with the *alimentary* canal and its associated glands. The function of the digestive system is to:

- *ingest* food and fluids;
- *secrete* enzymes which break large molecules into simpler units;
- *digest* or condense food by chemical and mechanical means;
- *absorb* soluble substances and water into the circulatory system;
- *reject* undigested particles (excretion).

11.2 The mouth

The roof of the mouth is formed by the hard palate and the soft palate which end in the *uvula*, a small soft structure hanging from the free edge of the soft palate, in the midline above the root of the tongue. Upon swallowing, it prevents food or fluid from refluxing into the nasal cavity.

The tongue is a muscular organ. The surface of the tongue has tiny projections called *papillae* which contain nerve endings for taste sensation. The frenulum is a fold of mucous membrane which attaches the underside of the tongue to the floor of the mouth.

The mouth is kept moist by secretions from the salivary glands, the parotid, submandibular, and sublingual glands.

The *fauces* are arches on each side where the mouth meets the pharynx. The two arches are the *glossopalatine* arch anteriorly and the *pharyngopalatine* arch posteriorly, known as the tonsillar fauces.

Digestion in the mouth involves both mechanical and chemical processes. *Mastication* is under voluntary control, salivation is controlled by the autonomic nervous system.

Saliva consists of ptyalin, water, and mucin. Ptyalin is an enzyme which begins the process of splitting starch from dextrose to maltose (a simple sugar). Mucin is a thick secretion which lubricates the food and helps swallowing.

11.3 The oesophagus

The *oesophagus* is a muscular tube about 25 cm in length, which conveys food and fluid to the stomach.

There are four layers comprising the oesophagus. The inner *mucosal* lining is stratified

squamous epithelium. The *submucosal layer* contains glands which secrete lubricant. The muscle coats of the oesophagus consist of an inner circular and an outer longitudinal coat. The upper 1/3 of the oesophagus has striated skeletal muscle. The middle 1/3 is mixed skeletal and smooth muscle, while the lower one third is smooth muscle. The outermost coat of the oesophagus is made up of *connective tissue*. Except during the passage of food, the oesophagus is flattened and closed.
The *cardiac sphincter* separates the oesophagus and the stomach.

11.4 The stomach

The lesser curvature is located superiorly; the greater curvature, on the inferior surface; the fundus extends above the oesophagogastric junction; the body is the largest part of the stomach and pyloric portion is the narrow part which connects with the duodenum at the pyloric sphincter. The mucosal lining has special glands for the secretion of gastric juices. The outer wall of the stomach has three smooth muscle coats, longitudinal (outer), circular (medial) and oblique (internal).

The functions of the stomach are to:

(1) Absorb water, alcohol and glucose into the blood stream;

(2) Secrete gastric enzymes – for example; rennin to clot milk; lipase to initiate the splitting of fats; pepsinogen, which in the presence of hydrochloric acid forms pepsin to begin protein breakdown;

(3) To secrete hydrochloric acid (HCl) which kills bacteria and changes some minerals to salts which are suitable for absorption in the intestine (example, calcium and iron);

(4) The gastric mucosa also produces the intrinsic factor which is necessary for the absorption of vitamin B12;

(5) The pyloric glands secrete an alkaline mucus to neutralize the HCl.

(6) The strong muscular action of the stomach churns the food into a semi-liquid substance and forces it through the pyloric sphincter into the duodenum.

11.5 The pancreas

The *pancreas* is a large gland lying across the posterior abdominal wall. It has two types of secretions, enzymic and hormonal. It is composed of the head, body and tail. The head of the pancreas is cradled in the curve of the duodenum.
The exocrine duct from the pancreas joins with the common bile duct to form the *ampulla of Vater* which empties into the duodenum through the *sphincter* of Oddi.

The exocrine or pancreatic enzymes serve to:

a) neutralize acid from the stomach (water and alkaline salts);

b) split fats (lipase);

c) split starch to maltose (amylose):

d) split proteins (trypsinogen plus enterokinase; produces *trypsin* for this purpose);

e) complete protein digestion (peptidase).

The endocrine or internal secretions are produced by the islets of Langerhans. The hormones insulin and glucagon are absorbed by capillaries which carry these hormones to the blood stream for systemic circulation.

11.6 The liver and gallbladder

The *liver* is situated in the upper right quadrant of the abdominal cavity, directly under the diaphragm. It consists of four lobes, the right, left, quadrate and quadrangular. A fissure of the liver, known as the porta hepatis permits hepatic arteries, the portal vein, the hepatic duct, nerves and lymphatics to enter and leave the liver.
The *gallbladder* is a pear-shaped hollow organ, approximately 2.5 cm, 1 inch in diameter and 5 cm, 2 inches long. It consists of fundus, body and a cystic duct which joins with the hepatic duct to form the *common bile duct*. It is composed of inner mucosa, smooth muscle and an outer layer of connective tissue.
Bile is secreted continuously by the liver. It is stored and concentrated in the gallbladder and periodically, following the ingestion of fat, the gallbladder contracts discharging bile into the duodenum to aid fat digestion. Bile acts to emulsify fats, to activate the pancreatic enzyme *lipase* and to promote the fat absorption.
Some bile pigments are reabsorbed from the digestive tract to be recycled as bile. Some bile pigments enter the general circulation and are transformed to *urobilinogen* and *urobilin* and are subsequently excreted in the urine. Stercobilin gives the *faeces* its brown pigmentation. Clay coloured stools are an indication of biliary obstruction.

11.7 The small intestine

The small intestine is a long muscular tube approximately 6 m, twenty feet long, comprising the *duodenum* 25–30 cm, 10–12 inches, the *jejunum,* approximately 2.4 m, 8 feet, and the *ileum* approximately 3.6 m, 12 feet.

Four layers comprise the small intestine. The outer serous coat of peritoneum is a delicate membrane, the *mesentery* which suspends the intestines to the posterior abdominal wall. The mesentery carries the mesenteric arteries and veins as well as lymphatic vessels which empty into mesenteric lymph nodes, then into the thoracic duct. The muscular coat consists of circular and longitudinal smooth muscles which cause peristalsis by segmental contraction. The submucous layer contains blood vessels and fibrous tissue. The mucous coat is characterized by *villi* which provide an enormous absorptive surface. The crypts of Lieberkühn secrete an alkaline enzyme known as *succus entericus.*

In the small intestine, amino acids, sugars, minerals, glycerol, some fatty acids and vitamins are absorbed. Glycerides and some fatty acids and fat-soluble vitamins are absorbed into the lacteals. Digestion and absorption of food are usually complete by the time the residue reaches the ileocaecal valve.

11.8 The large intestine

The large intestine is approximately 1.8 m, six feet, in length. It comprises the caecum, appendix, ascending colon, transverse colon, descending colon and sigmoid colon.

The outer serous coat consists of peritoneum which carries blood and lymph vessels and nerves. There are two muscular coats. The circular inner muscular coat covers the entire length of the colon; the longitudinal coat consists of three bands of muscle tissue. The submucous coat lies between the muscular and mucous layer. The mucous membrane of the colon is epithelial tissue supplied with numerous capillaries for the absorption of water. Goblet cells secrete mucus.

The main function of the colon is to absorb water and salts thereby conserving the body's fluids and drying the faeces to a normal consistency. Faeces are stored in the sigmoid colon until defecation.

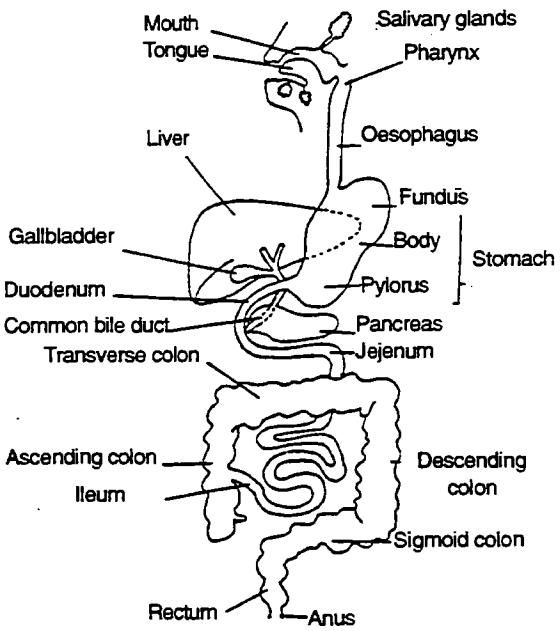
11.9 The rectum and anus

The *rectum* is a pouch with *transverse* folds while the anus has *longitudinal* folds. There are two anal sphincters, the internal sphincter consisting of smooth muscle, while the external sphincter consists of voluntary muscle.

11.10 The peritoneum

The *peritoneum* covers the viscera, known as *visceral peritoneum,* and lines the abdominal cavity known as *parietal peritoneum.*
The *greater omentum* hangs from the greater curvature of the stomach like an apron. The *lesser omentum* is a double fold of peritoneum which connects the lesser curvature of the stomach to the surface of the liver.

Diagram 14. The digestive system



11.11 Signs, symptoms, conditions and diseases of the digestive system

(1) Oral cavity:

Herpes simplex fever

blisters in the skin about the lips.

Leukoplakia

hyperkeratosis with epithelial atrophy, found on mucosa of gums, tongue and inner cheek.

Mucoepidermoid carcinoma

salivary gland neoplasm, contains masses of mucus.

Parotid gland tumour

usually mixed tumours, dense masses of small cells interspersed with mucus, which can be cartilaginous and later may calcify. May recur or spread.

Periodontitis

chronic inflammation of the gums.

Peritonsillar abscess

an abscess in the connective tissue of the tonsil.

Pyorrhea alveolaris

a purulent inflammation of the dental periosteum.

Squamous cell carcinoma

invades locally and metastasizes to lymph nodes, common in lips, tongue and oral cavity.

Tonsillitis

inflammation of the tonsil(s).

Vincent's stomatitis

inflammation of the oral mucosa with large ragged superficial ulcers (synonym – Vincent's angina).

(2) Oesophagus:

Oesophageal varices

varicose veins that may cause haematemesis.

Functional dysphagia

difficulty in swallowing without obvious cause.

Squamous cell carcinoma

obstructs the oesophagus causing dysphagia. Local growth involves the mediastinum.

(3) Stomach:

Adenocarcinoma stomach

often presents as an ulcer with a hard, rolled, firm white edge – infiltrates – may involve the muscle wall.

Dyspepsia

indigestion.

Gastric polyp

large projection overgrown with epithelium arranged around stalk which carries blood vessels and lymphatics - may be premalignant.

Gastritis

inflammation of the stomach, acute or chronic.

Leiomyoma

benign tumour of muscle layer of stomach.

Leiomyosarcoma

may arise from leiomyoma, well differentiated – metastasizes late.

Pectic ulcer

a localized ulcer of the visceral mucosa which may cause bleeding (haematemesis) or perforation.

(4) Pancreas:

Adenocarcinoma pancreas

a mucus-producing tumour often with recognizable glands.

Cystic fibrosis

generalized abnormality of the secreting glands such as those that manufacture mucus and sweat. The pancreas and lungs are involved. The mucus is thick and sticky and the sweat glands have a high concentration of salt. When the lungs are affected, bronchitis occurs, resulting in persistent cough, wheezing, dyspnoea, and emphysema. When the pancreas is affected there is marked disturbance of the bowel, and glandular cells lining other organs may be affected.

Diabetes

a disease where the islets of Langerhans in the pancreas fail to produce sufficient insulin.

Islet cell adenoma

causes oversecretion of gastrin. Most are benign, however some are invasive and metastasize.

Pancreatitis

acute inflammation of the pancreas.

(5) Liver and gallbladder:

Acute catarrhal jaundice

synonymous with infectious hepatitis.

Cholangitis

inflammation of the common bile duct.

Cholecystitis

inflammation of the gallbladder.

Cholelithiasis

presence of stones in the gallbladder.

Cirrhosis of liver

fibrosis of the liver.

Hepatoma

primary tumour of the liver.

Hepatitis

inflammation of the liver. Different types include infectious hepatitis, serum hepatitis.

Jaundice

yellow skin and sclera due to liver cell changes and obstruction causing bile pigment, bilirubin, to be diffused into the blood.

Obstructive biliary disease

may be due to intrahepatic or extrahepatic obstruction to bile flow.

Portal hypertension

increased blood pressure in the portal venous system, a complication of cirrhosis of the liver.

(6) Small intestine:

Adenocarcinoma

rare, but if they occur, are usually polypoid or fungating lesions in the duodenum.

Bacterial enteritis

inflammation of the intestine caused by bacteria, such as *Escherichia coli* or *Shigella.*

Coeliac disease

a juvenile form of idiopathic sprue.

Duodenal ulcer

a peptic ulcer of the duodenum.

Enteritis

any inflammatory condition of the small intestine.

Idiopathic sprue

atrophy of the intestinal villi, usually in the jejunum, with thinning mucosa - causes malabsorption syndrome.

Obstruction

of the intestine causes distention of the viscus above the lesion and collapse distal to the lesion. Peristalsis and vomiting are stimulated.

Paralytic ileus

complete absence of peristaltic motility.

Parasitic diseases

common infestations such as the pinworm, *Trichinella spiralis* (from pork), beef tapeworms (*Taenia saginata*) or pork tapeworm (*Taenia solium*).

Peritonitis

inflammation of the peritoneum may be caused by rupture of an abdominal organ.

Regional enteritis

or Crohn's disease – necrosis and ulceration, usually involving the ileum, but it may spread to the jejunum or colon. Marked scarring may cause partial bowel obstruction.

Steatorrhoea

fatty stools.

Volvulus

a twisting of the mesentery causing obstruction of the blood supply and mechanical blockage of the lumen of the intestine.

(7) Large intestine:

Adenocarcinoma of colon

epithelial in origin, involving the caecum, sigmoid and rectum predominantly.

Adenomatous polyp

usually benign, and isolated.

Appendicitis

inflammation of the appendix.

Carcinoid tumour of appendix

usually benign – adenocarcinoma of the appendix is rare, colloid in nature. If it ruptures, the peritoneal cavity is filled with jelly-like substance (pseudomyxoma peritonei).

Diverticulosis

outpouching of mucosa from the lumen due to defective musculature (diverticulitis) with subsequent inflammation.

Familial polyposis

large numbers of polyps throughout the lumen of the colon, premalignant in nature, genetic in origin.

Infarction

death of part of the colon due to obstruction of the blood supply to the area.

Ulcerative colitis

an ulcerative disease of the colon characterized by violent diarrhoeic episodes with blood and mucus in the watery stool – a premalignant condition.

(8) Anus:

Imperforate anus

congenital absence of an anal orifice.

Haemorrhoids

varicose veins of the anus.

Squamous cell carcinoma

may develop from the squamous epithelium of the rectum.

(9) Mesentery:

Fat necrosis

benign inflammatory condition - small numerous white lesions in mesentery.

Panniculitis

(L. pannus = cloth) inflammation of the fatty portion of the panniculus adiposus, the superficial fasciae with fat in its areolar substance.

12. URINARY SYSTEM

12.1 Introduction

The urinary system, consisting of two kidneys, two ureters, a urinary bladder and a urethra, is part of the excretory system of the body, which also includes the respiratory, integumentary and digestive systems.

12.2 The kidney

The kidneys excrete waste products of metabolism and toxic substances from the body. They help maintain the fluid and electrolyte balance.

Each kidney is located laterally to the spinal column, in the upper part of the abdomen. They are retroperitoneal, embedded in a mass of fatty tissue, which is surrounded by a fibrous covering called renal fascia.

Diagram 15: The kidney

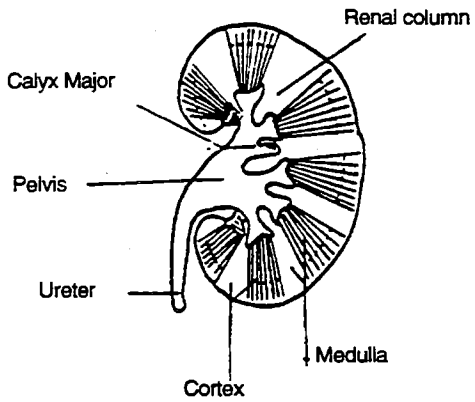
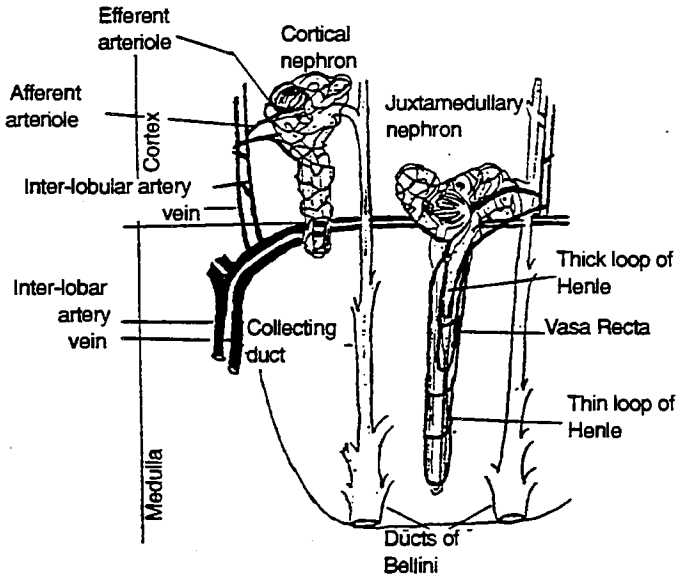


Diagram 16: Nephron unit



(1) The renal circulation

Approximately 25% of the output from the left ventricle is distributed, in each cardiac cycle, to the kidneys for *filtration*. The renal artery which branches from the aorta after several subdivisions (Diagram 16) end in a cluster of capillaries to form the *glomerulus*. All the glomeruli lie in the kidney cortex.

The glomerulus is surrounded by a closed end of a long tortuous renal tubule, the *nephron*. This closed end is named *Bowman's capsule*.

Blood leaving the glomerulus flows to a secondary capillary network around the tubules of its own nephron before draining into a vein.

(2) The nephron

The nephron (Diagram 16) or renal tubule, consists of Bowman's capsule, the proximal convoluted tubule, a loop called "Henle's loop", the distal convoluted tubule and the collecting tubules which empty into the renal pelvis at the calyx of the kidney.

The kidney has approximately one million nephrons.

(3) Formation of urine

Through the capillaries of the glomeruli approximately 120 ml of water and salts are filtered from the blood each minute. Cells and plasma proteins are too large to pass through the capillary membranes into the renal tubule in a healthy nephron.

The filtrate contains glucose, salt, urea, uric acid, potassium, phosphates, sulfates, etc. in approximately the same proportions as blood plasma. However, the body must retain certain of these substances for fluid and electrolyte balance. Thus, as the filtrate passes along the tubule of the nephron, the filtrate is concentrated and essential substances are returned to the circulation via the second capillary network which surrounds the tubule.

Most of the water is reabsorbed into the *proximal convoluted tubules*. Essential or "high threshold" substances are also reabsorbed here, including glucose, sodium chloride and amino acids, unless their concentration in the body is too high.

"Medium threshold" substances such as potassium may be reabsorbed but may be *secreted* in the *distal convoluted tubule*. Additional water is reabsorbed in the *distal convoluted tubule* and partly in the collecting tubules.

The urine passes out through the collecting tubules at a rate of approximately 1.0 ml per minute, so that in health we excrete about 1.5 litres of urine per day.

12.3 The ureters

Each kidney is connected to the urinary bladder by a ureter. These muscular tubes are about ten inches (25 cm) in length, beginning at the renal pelvis.

The wall of the ureter has three layers, an outer fibrous coat, a middle *smooth muscle* layer which propels urine along the ureter and an inner *mucous membrane*.

12.4 The urinary bladder

The urinary bladder is a hollow muscular organ which serves as a reservoir for urine. It lies in the pelvis behind the pubic bone.

Three openings mark off a triangular area. These are the two ureters and the urethra. The *trigone* is smooth, even when the bladder is empty and the remainder of the smooth muscle is in folds.

The bladder has three layers, with the exception of the superior and posterior aspects which are covered by peritoneum. These are a *fibrous* outer layer, a *smooth muscle* layer and a mucous membrane lining the cavity. The adult urinary bladder has a capacity of 300–350 ml.

12.5 The urethra

The urethra is a membranous tube which conveys urine to the exterior.

The proximal end consists of a circular smooth muscle known as the internal sphincter. It is controlled by the autonomic nervous system. The *external sphincter* is a circular striated muscle which is under voluntary control.

Female urethra

The female urethra is approximately 4-5 cm, 1.5-2 inches long, the external sphincter being located midway in the urethra.

Male urethra

The male urethra has three parts. The prostatic part which passes through the prostate gland is approximately 2.5 cm, one inch, long, the membranous part, which comprises the external muscular section, approximately 2.5 cm, 1 inch long and the penile part, 10-15 cm, 4–6 inches long.

12.6 Some constituents of urine

Urea

a nitrogenous waste product of protein metabolism, urea is formed in the liver and enters the kidneys through the blood stream.

Uric acid

is formed from the breakdown of nucleoproteins.

Creatinine

is a nitrogenous waste product derived from the breakdown of body tissues, the amount in the urine is not influenced by the amount of dietary protein.

Ammonia

as sodium is removed from the filtrate back into the blood stream ammonia is formed.

Salts

the amount of salt excreted depends on the amounts ingested in the diet.

12.7 Common tests – urinary system

(1) *Urinalysis*
chemical or microscopical analysis of urine.

(2) *Cystometrography*
the graphic recording of the pressure exerted at varying degrees of filling of the urinary bladder.

(3) *Cystoscopy*
direct visual examination of the urinary tract with an endoscope (Cysto + skopein (Gr.) = to examine).

(4) *Intravenous pyelogram*
dye is injected into the blood stream. This dye is excreted by the kidneys. X-rays of the kidney and ureter are taken following the injection of dye.

(5) *Retrograde pyelogram*
here the contrast media (dye) is injected into the renal pelvis via the ureter, prior to roentgenography.

12.8 Signs, symptoms, conditions and diseases of the urinary tract

Acute oliguria

Damage to the nephron resulting in anuria and rapidly developing uraemia. It may be caused by poisons or incompatible blood transfusions, and is also seen in traumatic shock.

Acute urethritis

May be of venereal origin formation – may cause stricture formation

Congenital anomalies
Kidneys may be absent, have double ureters, fused ureters or none, or placed ectopically in the abdominal cavity or pelvis.

Cystitis
Inflammation of the urinary bladder may be due to infection, trauma or urethral obstruction.

Glomerulonephritis
Lesions in the glomeruli with nephritis. Symptoms and signs: haematuria, headache, dysuria, lethargy, hypertension, and periorbital oedema. (May be acute or chronic in nature).

Haematuria
Blood in the urine.

Hydronephrosis
A collection of urine in the renal pelvis owing to obstructed outflow.

Incontinence – (urinary)
Loss of sphincter control due to cerebral or spinal lesions.

Malignant tumours of the kidney

(1) *Adenocarcinoma*
spreads commonly to lung and bones. May be cured by early resection. May also be called hypernephroma as its structure may resemble that of the cortical tissue of the adrenal gland.
Transitional cell carcinomas of the pelvis also occur.

(2) *Wilms' tumour or embryoma* (Infancy).

Nephrolithiasis

Stone formation which may be due to endocrine abnormalities or following pyelonephritis. When the stone fills the renal pelvis and projects into the calyces, it is known as a *staghorn calculus*.

Nephroptosis

Prolapse or downward kidney displacement.

Perinephric abscess

An abscess in the tissue immediately surrounding the kidney.

Polycystic kidney disease

Numerous cysts form in the kidney, exerting pressure on normal tissue, causing atrophy and loss of function in the affected area.

Pyelonephritis

(Gr. pyelo = pelvis + nephros = kidney + itis = inflammation). Inflammation of the kidney substance and pelvis, acute or chronic.

Renal calculi

Stone in the kidney causing paroxysmal *renal colic.*

Primary – without inflammation prior to formation.

Secondary – developing alkaline urine due to inflammation. (Syn. nephrolithiasis).

Transitional cell carcinoma

Common neoplasm of bladder. May also occur in the ureter with obstruction of urinary flow causing hydronephrosis and uraemia. Occasionally occurs in the renal pelvis.

Uraemia

A toxic condition due to urinary constituents in the blood, due to suppression or deficient excretion of urine for any cause.

Urinary retention

Failure to expel urine from the bladder.

Urinary suppression

Failure of the kidneys to produce urine.

13. REPRODUCTIVE SYSTEM

13.1 Introduction

Living things perpetuate their species by reproduction. The asexual method is not a common process in organisms. Certain very primitive forms of life multiply by this method which is also known as fission.

In humans, as in all higher forms of life, the sexual method or union of two sex cells (known as gametes) is the method of reproduction. The male and female gametes are symbolically designated as male, or female. These gametes are produced in gonads. The union of the male sperm with the female ovum is known as fertilization. Other functions of the gonads are to produce the male and female sex characteristics, such as voice, shape, bone structure, distribution of body hair, etc.

13.2 The male reproductive system

The testis

The testes are two oval glands which produce large numbers of spermatozoa. They are suspended below the groin in a sac of skin and muscle called the scrotum.

They also produce the male sex hormone. The sperm is a microscopic cell with a whip-like tail and it swims very rapidly in the semen. Millions of sperm are found in one drop of seminal fluid.

The epididymis

The epididymis is the tube along which the sperm cells travel from the testes. This tube is 20 feet (6 metres) long but very tiny. It lies coiled along the top and the side of the testis.

The seminal duct (vas deferens)

The seminal duct leads from the epididymis. The seminal duct passes through the inguinal canal into the abdominal cavity and continues over the top and down the posterior surface of the bladder.

The seminal vesicles

The seminal vesicles are pouches which secrete fluid and also store spermatozoa. The ducts which lead from them join the seminal ducts and pass through the prostate.

The prostate gland

The prostate is a musculo-glandular organ about the shape and size of a horse chestnut. It lies just below the urinary bladder. The prostate produces a secretion which is added to the seminal fluid. This increases the motility of the sperm. As the duct leaves the prostate gland, it joins the urethra from the bladder. An enlarged prostate presses on the urethra, stopping a normal flow of urine.

The bulbourethral (or Cowper's) glands

The bulbourethral glands which lie just distal to the prostate add a thin lubricant viscid secretion.

The penis

The penis is a cylindrical shaped organ located externally. It is made up of cavernous tissue with cavern-like spaces. During sexual excite-

ment blood fills these spaces, changing the soft, limp penis to an enlarged rigid organ.

The foreskin (prepuce)

At the end of the penis is a fold of loose skin which forms the foreskin or prepuce. Circumcision, or cutting away of the foreskin, is frequently performed on babies to prevent infection or irritation.

13.3 The female reproductive system

External genitalia

The external genitals or vulvar parts comprise the:

(a) *Mons pubis,* which is a prominence of fibrous and adipose tissue located in front of the symphysis pubis. It is enclosed by skin. At puberty, a thick growth of hair covers the mons pubis.

(b) *Labia majora,* which are two liplike folds of skin extending down from the mons pubis towards the anus;

(c) *Labia minora,* which are two thin hairless liplike folds found between the labia majora;

(d) *Clitoris,* which is a small organ (a vestige of the male penis) covered by mucous membrane. It is located at the upper junction of the outer and inner labia;

(e) *Vestibule,* which is the triangular-like flat space enclosed by the labia minora. The vaginal orifice is found in the lower part of the vestibule, while the urethral orifice lies directly superior to the vaginal orifice;

(f) *Hymen,* which is a thin fold of mucous membrane which usually closes the vaginal orifice in a virgin. It varies greatly in shape and extent and is largely obliterated by sexual intercourse or childbirth;

(g) *Perineum,* which is the tissue situated between the vaginal orifice and the anus.

The internal genitals are:

The vagina

The vagina is a flattened tube about 3 inches (8 cm) long. It opens into the vulva externally. At its upper end, the cervix or lower portion of the uterus projects into it. The inner surface of the vagina is moistened by a fluid which is secreted from glands within the walls. The vagina has three functions. These are to:

(a) receive the male organ during intercourse;

(b) serve as an outlet for uterine secretions;

(c) form part of the birth canal through which the baby passes during normal delivery

The uterus

The uterus is a hollow, pear-shaped muscular organ about three inches (8 cm) long, located in the centre of the pelvic cavity, posterior to the bladder and anterior to the rectum. It has three parts, the fundus, the body and the neck (cervix). During pregnancy, it expands many times its original size. Lined by a specialized mucous membrane called the endometrium, the uterus functions to protect and nourish the growing foetus and to expel the foetus at the time of delivery.

Strong ligaments hold the uterus in position. These are two broad ligaments, two cardinal ligaments as well as one anterior and one posterior ligament.

The ovary

The ovaries are two greyish white puckered glands about the size of an almond, which lie one on either side of the pelvic cavity, just below the brim of the pelvis. Their functions are to:

(a) produce female germ cells: (the ova, singular = ovum);

(b) secrete hormones that help regulate reproduction;

(c) produce female sex hormones for the development of female characteristics. There are many ova in various stages of development in the ovaries and one ovum is usually discharged every 28 days from the menarche (11–14 years) to the menopause. The ovaries consist of connective tissue covered with a specialized epithelium in which are embedded thousands of *Graafian follicles*. The Graafian follicle matures to produce an ovum. Upon maturation the Graafian follicle ruptures, discharging the ovum into the pelvic cavity. This act is called *ovulation.*

The fallopian tubes

The fallopian tubes are two thin muscular tubes which open into the uterus at its upper corners. At the proximal end, the tubes have hairlike projections (fimbria) which open into the pelvic cavity near the ovaries. The function of the fallopian tubes is to carry the ova from the ovaries to the uterus. Fertilization normally takes place within these tubes.

13.4 Signs, Symptoms, Conditions and Diseases of the Reproductive System

Balanitis is an inflammation of glans penis.

Carcinoma of the cervix is usually squamous cell. The symptoms are leukorrhoea and vaginal spotting or bleeding.

Carcinoma in situ of the cervix is a pre-invasive stage of the natural history of carcinoma of the cervix detected by the pap smear.

Chancre is the primary lesion of syphilis.

Chorionepithelioma (endometrium) is malignant, actively invading trophoblasts.

Congenital anomalies in the lower urinary tract are epispadias, hypospadias and congenital vulvular stricture.

Cryptorchism is a developmental defect characterized by failure of the testis to descend into the scrotum.

Cystocele is a pouch-like protrusion of the bladder wall towards the vaginal orifice.

Dilatation and curettage of the uterus is usually done for diagnostic purposes, or incomplete abortion or retained products of conception.

Ectopic pregnancy is an extra-uterine pregnancy, often occurring in the Fallopian tube (ectopic from the Greek ektopos or displaced).

Endometriosis is a seeding of peritoneum with tissue which more or less resembles endometrium, the symptoms tend to be cyclic paralleling menstrual periods.

Endometritis is an inflammation of the endometrium usually associated with inflammation of the Fallopian tubes and referred to as pelvic inflammatory disease, (P.I.D.). It may be due to gonorrhoea or post abortal infection.

Epididymitis is an inflammation of the epididymis.

Fibroadenoma of breast is a benign tumour, usually occurring in young women. It is firm and relatively mobile on palpation (breast mouse).

Fibrocystic disease of the breast is the development of cystic spaces characterized by an overgrowth of fibrous tissue.

Fibroid tumours of the uterus arise from muscle tissue.

Gynaecomastia is excessive development of the (male) mammary glands.

Gynaecologist is a physician who specializes in treatment of the genital tract in women.

Gynaecology is a branch of medicine concerned with the genital tract in women.

Hydatidiform mole is a hydropic degeneration of the placenta which turns into grape-like fluid filled vesicles.

Hydrocele is a collection of fluid in the sac surrounding the testis.

Leiomyoma is a tumour of the muscular wall of the uterus, usually benign, but can become malignant (leiomyosarcoma).

Mastitis is inflammation of breast tissue.

Orchitis is inflammation of a testis.

Ovarian cysts are usually simple and benign (though they may reach a large size).

Special types are:

(a) *Serous cystadenoma* - approximately 1/3 are malignant, seeding onto the peritoneal surface causing *ascites*.

(b) *Pseudomucinous cystadenoma* – secretes a jelly like material into the peritoneum.

Ovarian carcinoma

The classification is complex, terms used include serous, mucinous, endometrioid, clear cell, epithelial and undifferentiated.

Phimosis (phimos = a muzzle) is the tightening of the foreskin so that it cannot be drawn back over the glans penis.

Prostatic hypertrophy is benign hyperplasia – proliferation of prostatic stroma and glands encroaches on the bladder neck and urethra. If severe, urinary retention results.

Prostatitis is inflammation of the prostate gland.

Rectocele. The rectum pouches upward, pushing the vaginal wall in front of it.

Salpingitis is acute inflammation of the fallopian tubes.

Spermatocele is cystic dilatation of epididymis.

Sterility is the inability to procreate.

Testicular neoplasms

(a) *Seminoma*
(b) *Embryonal carcinoma* – often a mixed lesion, spreads early.
(c) *Choriocarcinoma* — highly malignant.
(d) *Teratoma* – contains diverse tissues.

Uterine bleeding

(a) *Menorrhagia* – excessive uterine bleeding.
(b) *Metrorrhagia* – uterine bleeding occurring at irregular intervals.
(c) *Menometrorrhagia* – excessive menses at irregular intervals.
(d) *Amenorrhoea* – lack of menses

Vaginitis is inflammation of the vagina. General causes include gonorrhoea, Trichomonas vaginalis, and Candida albicans (common in diabetes and pregnancy).

Varicocele is varicosities of the spermatic vein.

Vulvitis is inflammation of the vulva.

14. THE ENDOCRINE SYSTEM

14.1 Introduction

The endocrine system is a series of ductless glands which manufacture an internal secretion. These internal secretions (or hormones) are absorbed directly by the blood stream.
There are eight important glands or groupings in the body, each with its own distinct function but all bearing an inter-relationship with each other.
The islets of Langerhans of the pancreas are part of the endocrine system. They have already been described in sub-section 11.5, while the endocrine functions of the ovaries and testis were described in section 13.

14.2 The pituitary gland

The pituitary gland is controlled by the thalamus. Located at the base of the brain behind the eyes, it is the size of a pea but controls all secretions of hormones within the body. The pituitary gland has two lobes. Each lobe has definite functions.
The functions of the anterior lobe are to produce:

(a) adrenocorticotrophic hormone (ACTH)
(b) thyroid stimulating hormone (TSH)
(c) parathyroid stimulating hormone
(d) gonad stimulating hormones
(e) follicular stimulating hormones
(f) luteinizing hormone
(g) somatotrophic hormone (STH)

The function of the posterior lobe is to produce:

(a) pitocin (pituitrin) and also
(b) provide an antidiuretic function

4.3 The thyroid gland

The thyroid gland, shaped like a bow necktie, is located over the larynx and on either side of the trachea. It produces the hormone thyroxin which helps control the rate of body metabolism. Iodine is required to produce thyroxin.
Hypothyroidism is caused by insufficient thyroxin in the body. In childhood, the condition is known as *cretinism*; in the adult as *myxedema.*
Hyperthyroidism is caused by the overproduction of thyroxin. Symptoms of hyperthyroidism are overactivity and underweight.

14.4 The parathyroid glands

There are four parathyroid glands located intimately posterior to the thyroid gland; there is, however, little correlation between their functions. Each parathyroid is about the size of a grain of rice.
Their function is to secrete a hormone, parathormone, which maintains the calcium level in the body at a normal level of 9–11 mg%.
In the kidney, parathormone controls the excretion of phosphorus. In bone, parathormone mobilizes calcium and phosphorus. It

can also increase the absorption of calcium from the intestinal tract.
An excess of *parathormone* causes *Von Recklinghausen's disease* (osteitis fibrosa cystica) when calcium and other salt is taken from the bones. Pathological fractures may result.

14.5 The pineal gland

The *pineal gland* is located in the brain. Its function is unknown.

14.6 The adrenal glands

There are two adrenal glands, the size of the last digit of the little finger, located at the upper poles of the kidneys (ad-renal).
The adrenal *medulla* produces *adrenaline*, a stress hormone used in emergency situations.
The *adrenal cortex* produces cortisone which regulates salts in the body, and aldosterone which promotes sodium retention and potassium loss in the urine. The adrenal cortex also produces male and female hormones.

14.7 Other hormones

The stomach wall secretes a hormone called *gastrin* which stimulates the blood vessels and secretions of the stomach glands.
The upper part of the small intestine secretes a hormone called *secretin* which stimulates the pancreas and causes the gall bladder to contract.
The *placenta* produces chorionotrophic hormones which help to maintain pregnancy.

14.8 Endocrine tumours

Tumours of the endocrine glands, if well differentiated, may produce hormones which may be effective, tend to be unregulated, and may or may not be excessive. Benign tumours are more likely to be functional than malignant. Tumour size does not necessarily dictate the degree of functional activity.

14.9 Signs, symptoms, conditions and diseases of the endocrine system

Acromegaly
(Gr. akron = extremity; megale = great) - a condition characterized by hyperplasia of the extremities: the nose, jaws, fingers and toes.

Adenomas of anterior pituitary

(a) acidophilic – increased STH (somatotrophic hormone) produces giantism or acromegaly;

(b) basophilic – increased ACTH production, cause of Cushing's syndrome, q.v.;

(c) chromophobe – inactive tumour of pituitary.

Adenomatous goitre

enlargement of the thyroid caused by adenoma.

Addison's disease

caused by hypofunction of the adrenal glands, characterized by bronze-like pigmentation of the skin, weakness progressing to prostration, anaemia, hypotension.

Aldosteronism

caused by adrenal cortical adenoma with an increase in the amount of aldosterone, resulting in electrolyte and fluid imbalance.

Athyreosis

the absence or inadequate functioning of the thyroid gland; (a - neg. + thyroid = thyroid + osis).

Craniopharyngioma

(Rathke's pouch tumour) - a tumour arising from the cell rests derived from the *hypophyseal* stalk.

Cretinism

congenital lack of thyroxin.

Cushing's syndrome

hypertrophy of basophil cells in the anterior pituitary, marked by adiposity of face, neck and trunk, kyphosis, amenorrhoea (in females), impotence (in males), dusky complexion, hypertension, polycythaemia and muscle weakness.

Diabetes insipidus

a posterior pituitary disorder due to a decrease in antidiuretic hormone (ADH). *Polydipsia* and *polyuria* are symptoms.

Follicular carcinoma of the thyroid

malignant cystlike tumour of thyroid gland, filled with a colloid substance.

Fröhlich's syndrome

(dystrophia adiposogenitalis) defective genital development related to tumours of the anterior pituitary.

Gigantism

excessive size and stature, due to hyperpituitarism.

Goitre

an enlargement of the thyroid gland.

Hypoparathyroidism

a condition produced by defective action of the parathyroids or their removal; disturbed calcium metabolism, fall in serum calcium resulting in tetany.

Hashimoto's thyroiditis

(synonym = struma lymphomatosa) a progressive disease of the thyroid gland with replacement by lymphoid and fibrous tissue.

Iatrogenic Cushing's disease

caused by the administration of corticosteroids.

Myxoedema

caused by hypothyroidism; (Gr. myxa = mucus; iodema = swelling) - a condition characterized by a dry waxy type of swelling and distinctive facial changes, i.e. swollen lips and thickened nose.

Phaeochromocytoma

a small vascular tumour of adrenal medulla associated with hypertension.

Simmond's disease (panhypopituitarism)

a condition characterized by decreased growth, decreased basal metabolic rate, loss of *libido* and sexual infantilism, caused by non-functioning of the anterior pituitary - premature senility - also known as hypophysial *cachexia*.

Thyroiditis

inflammation of the thyroid gland.

15. PHARMACOLOGY

15.1 Classification of medications

Medication is one of the most effective methods of treating many diseases. Drugs act in two basic ways:

(1) They may destroy or render harmless cells that are normally not part of the body, either derived from normal body constituents or external microorganisms, which enter the body and cause disease. Drugs acting in this way tend to be called chemotherapeutic drugs.

(2) They may act on cells that are normally part of the body and stimulate or depress normal body functions in such a way that the nature or course of the disease is altered. These drugs are called "pharmacodynamic drugs".

Drugs are used in all types of medical care and are commonly grouped according to the disease or symptom they treat or the body function they effect. It is important that you are familiar with the most common groups of medications. However, some drugs because they affect different parts of the body, or different functions, can be used to treat a number of different diseases. The charts on the next few pages describe the major drug categories for treating non-cancer diseases. They are not complete lists of categories, nor do they include all the possible uses for each drug.

15.2 Chemotherapeutic drugs

The term chemotherapy can be particularly confusing to a records officer in a cancer clinic, as in general medical practice it is used to define a group of drugs used to treat micro-organisms causing disease. The same term "chemotherapy" is used for the groups of drugs that are used in anti-cancer chemotherapy, and to avoid confusion the words "*anti-cancer*" should as far as possible always be used to distinguish these drugs. A list of such drugs used for cancer is given in Appendix 2.1 (Ch. 2). In this section only chemotherapy used to treat other diseases is considered. Micro-organisms are by definition too small to be seen without a microscope, and include viruses, bacteria, fungi, protozoa, rickettsiae and spirochetes. Many of these can be destroyed by drugs. The most common groups of chemotherapeutic drugs are as follows:

(a) **Antiseptics**: these are chemical agents that inhibit growth and development of micro-organisms, but do not necessarily kill them. The term is usually restricted to chemical agents used outside the body and examples are: mercurochrome and boric acid.

(b) **Disinfectants**: these are chemical agents that kill harmful micro-organisms; again these are generally used outside the body. Examples include: phenol, formaldehyde and alcohol.

(c) **Antibiotics**: these are chemical substances produced by micro-organisms that prevent the growth of, or destroy, other micro-organisms. Examples

include: penicillin, streptomycin, erythromycin, the tetracyclines and ampicillin.

(d) **Sulfonamides**: these are chemical substances that weaken susceptible bacteria. They are commonly called "sulfa drugs." Examples include: sulfadiazine and sulfisoxazole.

(e) **Tuberculostatics**: these are drugs that inhibit the growth of tubercle bacteria. Examples include: isoniazid, paraaminosalicylic acid (PAS) and ethionamide.

15.3 Pharmacodynamic drugs

Diseases may be caused by the malfunction of an organ or a body part. Pharmacodynamic drugs serve either to depress specific body functions or to stimulate them. The tables that follow list drugs commonly used for various conditions of different body systems.

15.4 Names of drugs

The chemical name is a precise description of the chemical constitution of a drug.
The generic name is usually proposed by the company that has developed the drug. It is

Table 8. Drugs that affect the nervous system

Category	Comment	Examples
Stimulants	Used to counteract depression	Amphetamines
Analgesics	Given for relief of pain without loss of consciousness	
1. Narcotic analgesics	Habit-forming analgesics	Morphine, Codeine, Demerol Darvon
2. Non-narcotic analgesics	Not usually habit-forming; no important action outside analgesia	Aspirin, ACC's, ASA
3. Analgesic-antipyretics	In addition to pain-relieving this group reduces fever	
Hypnotics and sedatives	Exert a depressant effect on the nervous system. Hypnotics produce sleep; when used in smaller doses they are called sedatives.	
1. Barbiturates	Can produce addiction	Phenobarbital, secobarbital, pentobarbital
2. Non-barbiturate hypnotics		Paraldehyde, chloral hydrate
Tranquillizers	Do not produce stupor even in large doses	Reserpine, Thorazine Meprobamate
Anaesthetics		
1. General	Produces loss of sensation, accompanied by loss of consciousness	Nitrous oxide, cyclopropane
2. Basal	Used as an adjunct to inhalation anaesthesia or alone for minor procedures	Sodium pentothal
3. Local		Novocain, xylocaine

Table 9. Drugs that affect the endocrine svstem

Category	Comment	Examples
Insulins	Used in treating diabetes mellitus	Regular Insulin,Protamine Zinc Insulin (PZI), Isophane Insulin (NPH)
Oral hypoglycaemics	Chemicals taken by mouth to lower the blood sugar	Orinase, Diabenese, DBI
Corticosteroids	Used in inflammatory conditions	Cortisone, Hydrocortisone, Prednisone

Table 10. Drugs that affect the respiratory system

Category	Comment	Examples
Antitussives	Given to relieve cough	Codeine
Expectorants	Aid in the expulsion of sputum	Potassium iodine

Table 11. Drugs that affect the gastrointestinal system

Category	Comment	Examples
Antacids	Counteract the acidity of the gastric contents	Amphojel, Gelusil
Antiemetics	Stops vomiting and relieves nausea	Compazine, Dramamine
Cathartics	Aid in the production of a	Milk of Magnesia,
	bowel movement	Castor Oil, Cascara Sagrada
Antidiarrheals	Cause reduction in bowel movements	Paregoric
Antispasmodics	Relieves spasms of the digestive tract	Lomotil

Table 12. Drugs that affect the circulatory system

Category	Comment	Examples
Cardiotonics	Improves the tone of myocardium	Digoxin
Diuretics	Increase the flow of urine	Diuril
Vasoconstrictors	Increase the tone of blood vessels	Adrenalin
Vasodilators	Dilate the blood vessels	Nitroglycerin, apresoline
Anticoagulants	Inhibit blood clotting	Heparin, dicumarol

Table 13. Pharmaceutic abbreviations

Name	Abbreviation	Name	Abbreviation
Ampules	Amp.	Oil	Ol.
Capsules	Caps.	Ointment	Ung.
Compound	Comp.	Pills	Pil.
Elixir	Elix.	Powder	Pulv.
Emulsion	Emul.	Solution	Sol.
Enteric-coated	E.C.	Spansules	Spans.
Extract	Ext.	Suppository	Supp.
Fluid extract	Fldext.	Syrup	Syr.
Liniment	Lin.	Tablets	Tab.
Liquid	Liq.	Tincture	Tr., Tinct.
Lotion	Lot.	Troches, lozenges	Troch.
Mixture	Mit.		

then processed through the World Health Organization. Many hospitals require their pharmacies to label all medications with their generic name. It is never capitalized.
The trade or brand name is the special name given to a drug by each company manufacturing it.
Most pharmaceutical preparations are indicated by an abbreviation

16 PATHOLOGY

16.1 Introduction

Pathology is the branch of medicine concerned with the study of changes in cell structure and function as a result of disease.
Causes of disease usually fall under one of two general headings:

1. Predisposing causes;

2. Specific or immediate causes.
   i.e. a weak and malnourished person will more readily succumb to pneumonia than one who is healthy and able to resist an invasion of bacteria; in this case the state of health was a predisposing cause, the bacteria the immediate cause.

16.2 The body's response to injury

Inflammation, the most common of all body reactions to injury, is a local reaction of body cells.
Injury may be produced by trauma, foreign bodies, chemicals, electricity, heat, cold, pathogenic micro-organisms or pathogens, radiation.
In a simple inflammatory process such as a surgical incision, the blood supply to the area is increased. White blood cells and serum leave the blood stream and suround the injured part. When no pathogens are present inflammation subsides; the white blood cells devour dead cells (phagocytosis) and return to the blood stream. Excess fluid is reabsorbed, the wound edges grow together and healing occurs.
When inflammation is caused by pathogenic organisms, the same defensive reaction starts. After leaving the blood stream, the leukocytes (white blood cells) try to kill invading organisms. Antitoxins and antibodies are two important immune substances which are carried to the area by the blood. If immune substances and leukocytes are strong enough to kill the organisms, inflammation begins to disappear. When the body's resistance is too weak, or the pathogens are too virulent, many tissue cells or leukocytes are killed. A collection of dead tissue cells, bacteria and dead white cells is called pus. The process of pus

formation is called suppuration. The body attempts to build a wall of white blood cells and tissue around the pus. This collection of pus surrounded by a wall is known as an abscess or a boil. Infectious particles which escape are picked up by the lymphatic system. When these reach the lymph nodes, specialized cells within the nodes try to render the bacteria harmless.
Local symptoms of inflammation are redness and swelling due to the increased blood supply plus heat and pain.
General symptoms of inflammation are fever, increased pulse and respiration rate, headache, dry skin, flushed cheeks, increased white blood cell count and malaise.

16.3 Specific causes of disease

Congenital: congenital diseases result from an abnormal development during foetal life and are apparent at birth or soon thereafter.

Injuries to tissues: physical injury is known as trauma. Chemical injuries are detrimental to the body's cells and tissues.

Parasites: are organisms which live in or on another animal, depending on the host for nourishment.

Deficiency diseases: result from inadequate intake of essential nutrients or from the body's failure to properly utilize essential nutrients. The most common are vitamin deficiencies e.g. scurvy, rickets, pellagra.

Degenerative diseases: are due to deterioration in the function of organs from atrophy or even necrosis (death of tissues). The term is usually restricted to diseases of old age for which no specific cause has been determined, for example arterial disease such as hardening of the arteries (arteriosclerosis).

Infection: bacteria and viruses are the most common causative agents in infections. Bacteria are microorganisms, tiny living bodies visible only through a microscope. Micro-organisms capable of producing disease in humans are called pathogens. Those which are usually not harmful to cells and tissues are called nonpathogenic organisms.

Pathogenic bacteria are divided into groups according to their shape:

a) Cocci (round) e.g. streptococcus, staphylococcus, pneumococcus;
b) Bacilli (rod-shaped) e.g. shigella, Escherichia coli, pseudomonas, Salmonella typhi;
c) Spirochetes (spiral or corkscrew) - syphilis.

The manner in which bacteria arrange themselves is also a means of classifying them. Some grow in pairs (diplococci); some in chains (streptococci); and some in clusters (staphylococci).

Some bacteria produce toxins which are poisonous substances.

Viruses are extremely small, living pathogenic organisms. An electron microscope is usually required to see them. Virus-caused diseases can spread very rapidly and produce epidemics.

Examples of virus infections which affect the skin are smallpox, measles, and chickenpox. Poliomyelitis, rabies and encephalitis (sleeping sickness) are virus-caused diseases which affect the central nervous system. Viruses attack the respiratory system. They produce the common cold, influenza and viral pneumonia.

Allergies are reactions employing defense mechanisms closely related to immunity.

Neoplasms are literally new growths. They may be benign or malignant. Benign neoplasms should not be thought of as completely harmless. They may grow so large as to cause damage to nearby tissues and organs.

Malignant growths are referred to as cancers. The cells of a malignant growth interfere with and sometimes destroy the cells of normal tissue; they may spread to other parts of the body from their original site as a "metastasis".

Tumour classification (Table 14)

A carcinoma is a malignant change of epithelial cells located in the skin, mucous and serous membranes; for example, adenocarcinoma.

A sarcoma is a cancer of connective tissue, e.g. bone cartilage, fat, tendons. For example, an osteosarcoma is a malignancy of the bone. A liposarcoma is a malignancy of fatty tissue.

Table 14. Classification of neoplasms

Tissue of origin	Benign	Malignant
1. Epithelial neoplasms		
a) Surface epithelium (Squamous and transitional epithelium)	Papilloma	Basal cell carcinoma Squamous cell carcinoma Transitional cell carcinoma
b) Glandular epithelium	Adenoma	Adenocarcinoma
– liver	Hepatoma	Hepatocarcinoma
– sweat glands	Hidradenoma	Hidradenoid carcinoma
2. Connective tissue neoplasms		
a) Fibrous tissue		
– adult	Fibroma	Fibrosarcoma
– embryonal	Myxoma	Myxosarcoma
b) Cartilage	Chondroma	Chondrosarcoma
c) Bone	Osteoma	Osteosarcoma (osteogenic)
d) Fat	Lipoma	Liposarcoma
e) Blood vessels	Hemangioma	Hemangiosarcoma
f) Lymph vessels	Lymphangioma	Lymphangiosarcoma
g) Smooth muscle	Leiomyoma	Leiomyosarcoma
h) Striated(skeletal muscle)	Rhabdomyoma	Rhabdomyosarcoma
3. Haematopoietic tissue neoplasms		
a) Lymphoid tissue	None recognized	Lymphomas a) Hodgkin's disease b) Lymphosarcoma c) Follicular lymphoma d) Reticulum cell sarcoma
b) Granulocytic tissue	None recognized	Myelogenous leukaemia
c) Erythrocytic tissue	Polycythemia vera	
d) Plasma cells	Plasmacytoma	Multiple myelomas
4. Neural tissue neoplasms		
a) Glial tissue	Glioma (rare)	Gliosarcoma
b) Meninges	Meningioma	Meningeal sarcoma
c) Peripheral neurons	Ganglioneuroma	
d) Primitive neurons	None recognized	Neuroblastoma
e) Retina	None recognized	Retinoblastoma
f) Adrenal medulla	Phaeochromocytoma	None recognized
g) Nerve sheath	Neurilemmoma	Neurilemmal sarcoma
5. Neoplasms of more than one tissue		
a) Breast	Fibroadenoma	Cystosarcoma phylloides
b) Embryonic kidney		Wilm's tumor
c) Multipotent cells	Teratoma	Teratocarcinoma
6. Neoplasms which do not fit into one of the other groups easily		
a) Melanoblasts	Pigmented naevus	Malignant melanoma
b) Placenta	Hydatidiform mole	Chorioepithelioma
c) Ovary	Serous cystadenoma	Serous cystadenocarcinoma Endometroid carcinoma
d) Testis	Interstitial cell Sertoli tumour	Seminoma Embryonal carcinoma
e) Thymus	Thymoma	Malignant thymoma

The type of cell of a tumour is also important. **Anaplasia** is the loss of normal cellular differentiation or organization. **Desmoplasia** means that excessive fibrous tissue formation is present in the tumour stroma. **Metaplasia** indicates a change in the type of adult cell to one not normally present in a tissue. **Dysplasia** is an abnormal, atypical cellular proliferation which is not a tumour.

Malignant tumours are further classified according to their cellular grade. Tumours are often graded numerically into five grades, the lowest number implying the lowest degree of malignancy.

Mitosis

Normal cells usually exhibit less than one mitosis per thousand cells, whereas malignancies may have as many as twenty mitotic cells per thousand cells.

Metastases

Usually routes of spread of tumour cells are via lymphatic and blood vessels as emboli, via serous cavities (pleura and peritoneum), or through the spinal fluid.

Tumour cells may lodge in lymph nodes and grow in the regional node, invading the pulp and stroma.

When transported by the blood stream, cells from an organ which normally drain into the portal vein system tend to lodge in the liver, whereas cells from organs which drain into systemic veins usually cause secondary lung metastases. However malignant cells seem to be able to pass through the lungs, thus metastases commonly occur in the brain, bones and also in the liver from tumours draining into systemic veins (presumably via the hepatic artery).

Vascularity is an important factor in the ability of a tumour to metastasize.

16.4 Common symptoms of illness

Temperature: Fever is elevated temperature, a defence reaction of the body during an infection.

Pulse: The pulse beat differs in individuals depending upon age, activity and the need of the body cells for oxygen. It increases in fever. A notable increase in the rate of the heart beat is called *tachycardia*. A slowing of the pulse rate is known as *bradycardia* (below 60 beats per minute).

Respiration: Dyspnoea (difficult breathing) may be accompanied by cyanosis, a bluish tint to the skin, most noticeable around the lips and fingernails. Apnoea is the absence of respirations. *Orthopnoea* is a symptom where the patient cannot breath except in the upright position.

Oedema: (Edema) is a swelling of a part of the body due to a collection of excess fluid in tissues.

Pulmonary oedema: results from a collection of fluid within the lungs.

Dehydration: Drying up of the cells due to an excessive loss of fluids.

Nausea: Is a feeling of discomfort in the stomach region with an urge to vomit. Extreme nausea is usually accompanied by emesis (vomiting).

Diarrhoea: Is the passing of frequent or watery stools or both.

Convulsions: May appear in many diseases especially with extremely high temperatures in childhood.

16.5 Clinical laboratories

NOTE: The normal levels given in this section may differ from those in your own laboratory. Please check your own laboratory normal levels and amend accordingly.

1. Urine
   - Routine urinalysis
   - Colour
   - Characteristics – amount, odour, transparency
   - Reaction (pH)
   - Specific gravity (sp. gr.) 1.015–1.025
   - Proteins (albumin)
   - Sugar - glucose
   - Acetone
   - Diacetic acid
   - Microscope (Micro) for
   - Red blood cells (RBC)
   - White blood cells(WBC)
   - Bacteria (Bact.)
   - Crystals - XIs (Amorphous)
   - Casts

Table 15a. Clinical analysis: urine

Examination	Abbreviation	Normal
Ammonia	NH3	20–70 meq/L/24 h
Catecholamines		
Culture and sensitivity	C & S	
Haemoglobin	Hgb	Negative
Porphyrins		Under 100 g
Urea		10 –15 g.
Urobilinogen		Less than 4.0 mg/24 h
17-Ketogenic steroids		5–15 mg/24 h
17-Ketosteroids		Men : 8–25 mg/24 h
		Women: 5–18 mg/24 h

2. Blood

Table 15b. Clinical analysis: blood

Examination	Abbreviation	Normal
Erythrocytes	RBC Eryths	4,500,000–5,000,000/cu mm
Leukocytes	WBC Leukos	5,000–10,000/cu mm
Differential count:		
Myelocytes	Myelos	Negative
Lymphocytes	Lymphos	25–33%
Monocytes	Monos	2–6%
Neutrophils	Neutros	60–70%
Eosinophils	Eos	1–3%
Basophils	Basos	0.5-1%
Reticulocytes	Retics	0.5-1.5% RBC
Platelets		150,000-400,000/cu mm
Haemoglobin	Hb Hgb	Male : 14-17 g
Female: 12-15 g		
Haematocrit	Hct	Male : 40-54%
Female : 35-45%		
Acid phosphatase		0-2 UI/100 ml
Alkaline phosphatase		50 I.U.
Plasma proteins:		
Albumin - globulin ratio	AG ratio	4:3
Albumin		4 g/100 ml
Globulin		3 g/1 00 ml
Total proteins		7 g/100 ml
Amylase		Less than 50 u/100 ml
Anti streptolysin titre	AST	150 u/ml serum
Bilirubin		0.5-1.5 mg%
Bleeding time		1-3 min
Blood urea nitrogen	BUN	10-20 mg%
Bromsulphalein	BSP	45 min retention less than 5%
Calcium	Serum Ca.	10 mg%
Electrolytes:		
Total $C0_2$	CO_2	24-26 meq/L

Table 15b. Clinical analysis: blood

Examination	Abbreviation	Normal
Chlorides	Cl	95-105 meq/L
Potassium	K	3.5-5.5 meq/L
Sodium	Na	140 meq/L
Cholesterol (varies with age)		150-250 mg%
Circulation time (arm-tongue)		9-16 s
Creatinine		1.0-2.0 mg%
Erythrocyte sedimentation rate	ESR (Wintrobe)	Male : 10 mm/h
Female: 15 mm/h		
Fasting blood sugar	FBS	80-105 mg%
Glucose tolerance test		
(at 1-1+ and 2 h)		160 140 120 mg%
Lee White clotting time		6-10 min
Phosphorus		3.5 μg %
Protein bound iodine	PBI	4-8 μgm%
Prothrombin time		12-15 sec
Serum glutamic oxalacetic transaminase	SGOT	40 units
Creatinine clearance		95-105 ml/min/1.73 cu mm
Uric acid		4-6 mg%
Venereal disease research laboratory (Wasserman)	VDRL	Negative
Lactodehydrogenase	LDH	160 I.U.
Cortisol – 8:00 a.m. – 8:00 p.m.		16-32 μg% 8-16 μg %

3. Miscellaneous specimens

Table 15c. Clinical analysis: miscellaneous specimens

Examination	Abbreviation	Normal
Stool:		
Culture and sensitivity	C & S	Up to 5 g/24 h
Fat	0 & P	Up to 1+
Guaiac		–
Mucus		–
Ova and parasites		
Gastric analysis:		
Guaiac		Negative
Sputum:		
Culture and sensitivity	C & S	Negative
Vomitus:		
Guaiac		Negative
Cerebrospinal fluid:		
Protein	CFS	15–45 mg%
Glucose		40–60 mg%
Cells		Up to 5/cu mm
Pressure		150–250 mm H20
Culture		Negative

17 SURGICAL PROCEDURES

17.1 Incision

Incision - cutting into

(o)tomy	tomos – cutting
(o)stomy	stoma – mouth
centese	kentesis – puncture

(1) *Otomy* – to cut into

(a) Exploratory

Laparotomy (lapara – the flank),

- opening the peritoneal cavity for exploratory purposes

(b) Removal of foreign bodies

Accidental
Therapeutic
Pathological – e.g. removal of calculi

(c) Division for investigation

Transection of muscle - tendons - nerves

(d) Discission

Needling of lens

(e) Decompression

Craniotomy

(f) Re-opening

Examples of *otomy* procedures:

Choledochotomy

incision of the common bile duct

Chordotomy

division of tracts of the spinal cord

Craniotomy

procedure on the cranium in which the skull is opened

Cystotomy (suprapubic)

cutting into the bladder by an incision just above the pubic symphysis

Enterotomy

opening the small intestine for exploration

Episiotomy

incision of the perineum for obstetrical purposes

Lithotomy

removal of a stone by cutting into an organ

Nephrolithotomy

incision of the kidney to remove a renal calculus osteotomy cutting of a bone

Pyelolithotomy

removal of a calculus from the renal pelvis

Pyloromyotomy

(Ramstedt procedure, Fredet-Ramstedt procedure) – operation (for congenital stenosis of pylorus) in which the thickened pylorus is incised: down to the mucosa

Thoracotomy

incision through the chest wall

Tracheotomy

formation of an artificial opening into trachea

(2) *Ostomy* – to cut to form an opening

Examples of *ostomy* procedures:

Cholecystogastrostomy

anastomosis between the gallbladder and the stomach to relieve obstruction to the flow of bile

Cholecystojejunostomy

anastomosis between the gallbladder and the jejunum

Cholecystostomy

incision to drain the gallbladder

Choledochostomy

formation of an opening in the common bile duct

Colostomy

establishment of an artificial opening into the colon, e.g. colostomy, transverse – bringing a loop of the transverse colon onto the abdominal wall, and making an opening in this loop

Enterostomy

artificial formation of a permanent opening into the small intestine (either an ileostomy or a jejunostomy)

Gastroenterostomy

creation of an opening between the stomach and intestines

Gastrojejunostomy

an anastomosis between the stomach and the jejunum

Gastrostomy

an opening in the stomach for the introduction of food

Jejunostomy

insertion of a tube into the jejunum

Nephrostomy

drainage of the renal pelvis through the kidney substance

Oesophagogastrostomy

an anastomosis between the oesophagus and the stomach

(3) *Centesis* – puncture or aspiration

(a) Aspiration – of free fluid
(b) Puncture – thoracentesis, paracentesis
(c) Trephination – of cornea

Examples of centesis procedures:

Cul-de-sac aspiration

drainage of an abscess in the posterior cul-de-sac through the vagina

Paracentesis

puncture of a cavity for drainage, e.g. paracentesis abdominis

Thoracentesis

tapping through the chest wall for the removal of fluids

17.2 Excision

Suffixes:

ectomy	Gr. ektome	a cutting out
exerese	Gr. exairesis	removal

(1) *Ectomy* – to cut out

(a) Partial, Subtotal
- (i) Resection – subtotal gastrectomy
- (ii) Biopsy – bios – life – opsis – vision
- (iii) Guttering – of bone
- (iv) Saucerization – of bone
- (v) Curettage – curette – spoon-shaped instrument

(b) Complete, Total

(i)	Radical excision radix – root	Mastectomy
(ii)	Obliteration obliterare – to efface	Varicose veins (close lumen)
(iii)	Avulsion of avellere - to tear away	fingernail, scalp
(iv)	Extraction trahere - to draw	of cataract
(v)	Enucleation nucleus - nux (nut)	whole cleaning shelling out eye
(vi)	Evisceration viscera - bowels – insides	(eye) (leaving sclera)
(vii)	Epilation - pilus – hair	
(viii)	Ablation Ab - from latus detached	of a tumour

Examples of *ectomy* procedures:

Abdominoaortic aneurysm resection

ligation and resection of an aneurysm of the abdominal aorta; a Teflon graft is inserted.

Abdominoperineal resection

resection of the rectum and anus, with formation of a permanent colostomy.

Adenoidectomy

removal of adenoid tissue.

Colectomy

left (Mikulicz procedure)
removal of a portion of the colon in a multiple-stage operation with resection of tumour.

partial (with end-to-end anastomosis)
resection of a segment of the colon with direct suture of the two ends.

right

a) Ileocolostomy, end-to-side anastomosis – resection of terminal ileum and ascending colon with anastomosis between them

b) Side-to-side anastomosis
the stumps of the terminal ileum and transverse colon are closed

Dilation and curettage

dilating or stretching the cervical canal for the purposes of exploration and scraping the uterine cavity with a curette.

Embolectomy

removal of a blood clot from an artery.

Enucleation

removal of an organ, tumour, or other body completely.

Evisceration

removal of the viscera or the contents of a cavity.

Fistulectomy

excision of a fistula.

Gastrectomy, subtotal

removal of a large part of the stomach.

Gastrectomy, total

removal of all of the stomach.

Haemorrhoidectomy

excision of haemorrhoids.

Hydrocelectomy

operation for the removal of a hydrocele.

Hysterectomy, complete, and bilateral salpingo-oophorectomy

removal of the entire uterus, cervix, tubes and ovaries.

Hysterectomy

a) abdominal – removal of the uterus through an abdominal incision.
b) complete (or total) – removal of the body and cervix of the uterus
c) Porro – subtotal hysterectomy following caesarean section.
d) subtotal or supracervical – removal of the uterus, leaving the cervix uteri in place.
e) vaginal – removal of the uterus through the vagina.

Laminectomy

removal of the posterior arches of the vertebrae in order to expose the spinal cord.

Lobectomy

excision of one or more lobes of the lung.

Mastectomy, radical

removal of a breast, all of the axillary contents, the pectoralis minor and major muscles.

Mastectomy, simple

removal of a breast without the pectoral muscles.

Mastoidectomy, radical

removal of the infected bone of the mastoid process.

Nephrectomy

removal of a kidney.

Nephrectomy, partial

removal of part of a kidney.

Nephrectomy, transperitoneal

removal of kidney through an abdominal incision.

Oophorectomy

removal of an ovary.

Oophorectomy, partial

removal of part of an ovary.

Orchectomy, Orchidectomy, Orchiectomy

removal of testicle.

Pelvic exenteration

removal of all pelvic viscera, hysterectomy, cystectomy with colostomy, and ureteral transplant.

Pilonidal cyst, excision of

removal of a pilonidal cyst (a cyst containing hairs behind the anus).

Pneumonectomy

removal of an entire lung.

Prostatectomy, perineal

removal of the prostate through a perineal incision.

Prostatectomy, retropubic

removal of the prostate anteriorly without going through the bladder.

Prostatectomy, suprapubic

removal of prostate above the pubis and through the urinary bladder.

Prostatectomy (transurethral resection)

removal of obstructing tissue in small portions by means of an electrotome introduced into the urethra.

Salpingectomy

removal of a fallopian tube.

Salpingo-oophorectomy

removal of a tube and ovary.

Saphenous vein, excision of

ligation and excision of the saphenous vein.

Sequestrectomy

excision of a necrosed piece of bone.

Splenectomy

excision of the spleen.

Sympathectomy

transection of the sympathetic nervous pathways.

Thyroidectomy, partial

removal of a part of the thyroid gland.

Thyroidectomy, total

removal of the thyroid gland.

Tonsillectomy

removal of the tonsils.

Varicocele, excision of

excision of varicose veins of the spermatic cord.

17.3 Exeresis

To strip out. Example of *exeresis* procedures:

Neuroexeresis

operation of tearing out of a nerve; synonym = neurexairesis

17.4 Amputation

Amputation

cutting off

Disarticulation

at a joint

Dismemberment

through a bone

Examples of *amputation* procedures:

amputation

of an extremity

Circumcision

removal of the prepuce or foreskin.

Hallux valgus

removal of the large bunion over the proximal great toe joint.

17.5 Introduction

Intro = within, ducere = to draw or lead

1) *Injections*

serum, air, radio-opaque substance, dye (jacere = to throw).

2) *Transfusion*

whole blood, plasma, serum (fundare = to pour).

3) *Implantation*

radon.

4) *Insertions*

radium, wire, nails, pins, tampons, catheters, tubing, drains.

Examples of *introduction* procedures:

Myelography

a gas or a radiopaque liquid is injected into the subarachnoid space, usually in the lumbar area.

Pneumoencephalography

visualization of the brain after injection of air or gases into the ventricles (Ventriculography).

Retrograde aortography

insertion of dye through a catheter intoabdominal aorta via the femoral artery.

Pneumothorax artificial

introduction of air into the pleural cavity to produce pulmonary collapse.

17.6 Endoscopy

Endo = inside, scopy = to examine

Examples of *endoscopy* procedures:

Cystoscopy

direct visual examination of the interior of urinary bladder through a cystoscope.

Cystoscopy and retrograde pyelography

cystoscopy and radiography of the renal pelvis and ureter through dye introduced into catheters in the ureter.

Laryngoscopy

examination of the interior of the larynx.

Oesophagoscopy

direct visualization of the oesophagus through the oesophagoscope.

Others include:
Bronchoscopy, Gastroscopy, Otoscopy, Peritoneoscopy, Proctoscopy, Rhinoscopy, Thoracoscopy, Tracheoscopy, Urethroscopy.

17.7 Repair

Repair (plastics – to form)

Plasty	Ostomy	Desis	Pexy
(form)	(a mouth)	(a binding)	(a fixing)

(1) *Plasty* – a repair or reform
Ostomy – anastomosis – gastroenterostomy
Desis – fusion – of a joint – arthrodesis – stabilization
Pexy – fixation – gastropexy – suspension – hysteropexy

Examples of *repair* procedures:

Anastomosis

joining of two ends of small intestine; three methods: end-to-end, end-to-side lateral.

Colpoperineoplasty

repair of the perineum and posterior vaginal wall.

Colpoplasty

anterior repair of the anterior vaginal wall.

Grafts, skin

skin which is detached from its original position and transplanted to another part of the body.

(a) Thin grafts
Thin split graft (Ollier-Thiersch).

(b) Thick grafts
Multiple small grafts, pinch graft, thick split graft, full thickness graft, or pedunculated flap grafts.

Manchester procedure

anterior-posterior vaginal repair and cervical amputation.

Pyloroplasty

surgical repair of the pylorus.

Salpingoplasty and implantation

re-establishment of the patency of the fallopian tubes.

Tracheloplasty

repair of the cervix in which there is laceration or erosion

(2) *Desis*
Example: *Epiphysiodesis*
repair of epiphysial separation due to injury.

Fusion operation of the knee
arthrodesis planned to induce body ankylosis.

Fusion operation of the spine
arthrodesis to unite several vertebrae.

(3) Pexy
Examples:

Hysteropexy
suspension of the uterus to correct displacement.

Nephropexy
fixation of the kidney.

Orchiopexy, Orchidopexy, Orchiorrhaphy
suturing of an undescended testicle in the scrotum.

17.8 Destruction

breaking down

Clasis – fracturing and refracturing – osteoclasis
Tripsy – crushing – neurotripsy
Lysis – to free – from adhesions – enterolysis

Also:

Cauterization

sealing off bleeding points by heat.

Fulguration

destruction of ulcerated tissue by electricity.

Debridement

cleaning out dirty wounds and lacerations.

Diathermy

heating cells of tissues to point of destruction.

Example of *destruction* procedures:

Phrenic nerve operation

when the phrenic nerves are divided, crushed, or injected paralysis of the corresponding side of the diaphragm is produced.

17.9 Suturing

(Gr. rhaphe – a seam)

Colporrhaphy, anterior

repair of the anterior vaginal wall.

Colporrhaphy, posterior

repair of the posterior vaginal wall.

Colpotomy, posterior

drainage of an abscess through the vagina.

Herniorrhaphy

repair of a hernia.

Perineorrhaphy

stitching of the perineum.

Saphenous vein, high ligation of

ligation of the saphenous vein in the groin for varicosities of the saphenous system.

Trachelorrhaphy

stitching of a torn cervix uteri.

17.10 Manipulation

Manipulation (handling)

Tasis	a stretching
Ectasia	ek – out, tasis – stretched

Tasis – of muscle – myotasis

Ectasia – dilatation – gastrectasis

Closed reduction

application of plaster cast

Diagram 17. Abdominal regions

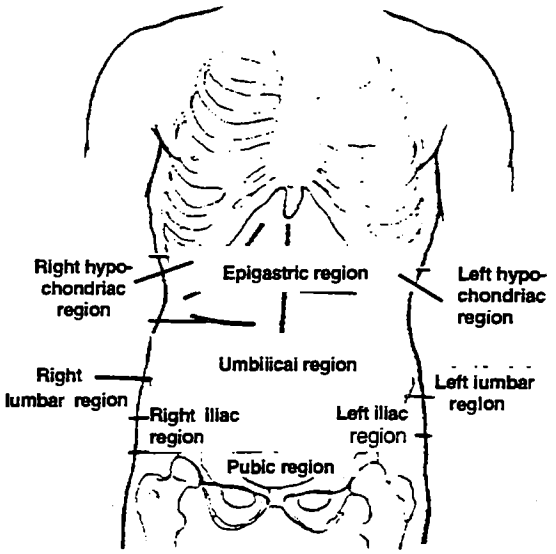
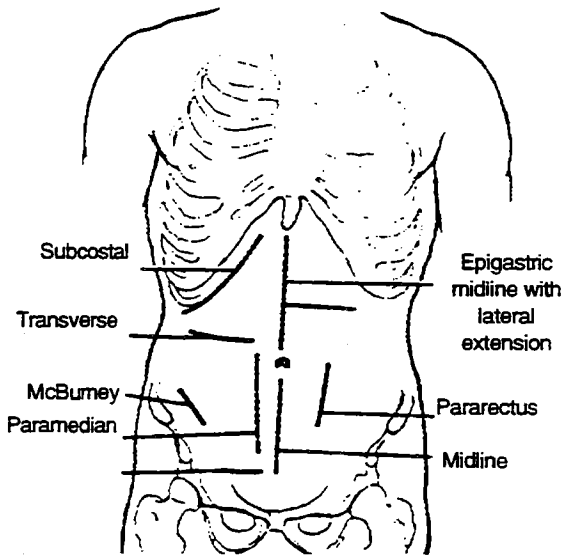


Diagram 18. Usual abdominal incisions



18 GLOSSARY

18.1 Introduction

The following list of word elements is arranged alphabetically. A hyphen preceding a word element denotes a suffix. A more complete listing can be found in **Dorland's Illustrated Medical Dictionary**(1).

Pronounce each word as if you were learning a new language.

(1) Dorland's Illustrated Medical Dictionary, (London: W.B. Saunders Company, 1988)

18.2 Elements

Word Element	Refers to or Means	Example	
A-, AN-	without, lack of, absent, deficient	aseptic anoxia	a/SEP/tic an/OX/ia
AB-, ABS-	from, away	abduction	ab/DUCT/ion
		absent	ABS/ent
AD-	near, toward	adnexia	ad/NEX/ia
ADENO	gland	adenoma	ad/en/O/ma
AERO	air	aerobic	aer/O/bic
ALB	white	albuminuria	al/BU/min/UR/ia
-ALGIA, -ALGESIA	pain	neuralgia	neur/AL/gia
AMBI-	both	ambiopia	am/bi/OP/ia
ANGIO	vessel (blood or lymph)	angiography	an/gi/OG/raphy
ANO	anus	anoscopy	A/no/scopy
ANTE-	before	antepartum	an/te/PART/um
ANTI-	against	antibiotic	an/ti/BI/o/tic
ARTERIO	artery	arteriogram	ar/ter/i/O/gram
ARTHRO	joint	arthrodesis	ar/thro/DE/sis
-ASTHENIA	weakness	neurasthenia	neur/as/THE/nia
AUTO-	self	autogenous	au/TO/gen/ous
BI-	two, twice	bipolar	BI/po/lar
BRADY-	slow	bradylexia	brad/y/LEX/ia
BRONCHO	bronchus	bronchogenic	bron/CHO/gen/ic
CARDIO	heart	pericardium	per/i/CAR/di/um
-CELE	tumour, swelling, hernia, sac	hydrocele	HYD/ro/cele
-CENTESIS	puncture	paracentesis	par/a/cen/TE/sis
-CEPHALO	head	hydrocephalic	hy/dro/CEPH/a/lic
CHOLE	gall	cholelithotomy	chol/e/lith/O/tomy
CHOLECYSTO	gallbladder	cholecystostomy	choleXcys/tost/o/my
CHOLEDOCHO	common bile duct	choledochotomy	chol/E/doch/o/tomy
CHONDRO	cartilage	chondrosarcoma	chon/DRO/sarc/oma
-CIDE	kill	germicidal	GERM/i/CI/dal
CIRCUM-	around	circumorescent	cir/CUM/cre/scent
-CISE	cut	incise	in/CISE
COLO	colon	colectomy	co/LECT/om/y

Word Element	Refers to or Means	Example	
COLPO	vagina	colpodynia	col/PO/dy/nia
CONTRA	against	contraindicant	con/tra/IN/di/cant
COSTO	rib	costochondral	COS/to/CHON/dral
CRANIO	skull	cranium	CRA/ni/um
CYANO	blue	cyanosis	cy/an/OS/is
CYSTO	urinary bladder	cystometrogram	CYS/to/MET/ro/ gram
CYTO	cell	leukocyte	LEUK/o/cyte
DE-	down, from	debrider	de/BREDE
DENTI	tooth	dentist	DEN/tist
DERMO DERMATO	skin	dermatologist	derm/a/TOL/o/gist
DI-	two	diatomic	di/a/TOM/ic
DIA-	through, between, across	diaphragm	di/a/PHRAGM
DIS-	apart	dislocate	dis/lo/CATE
DYS-	painful, difficult, disordered	dysphagia	dys/PHAG/ia
ECTO-	outer, on the outside	ectoderm	ec/TO/derm
-ECTOMY	surgical removal	laminectomy	lam/in/ECT/o/my
-EMESIS	vomiting	hyperemesis	hy/per/em/E/sis
-EMIA	blood	anemia	an/E/mi/a
ENCEPHALO	brain	encephalitis	en/ceph/a/LI/tis
ENDO-	within, inner, on the inside	endoderm	EN/do/derm
ENTERO	intestine	gastroenterostomy	gas/tro/EN/ter/ os/ tomy
EPI	above, over	epichondyle	ep/i/CHON/dyle
ERYTHRO	red	erythrocyte	er/yth/RO/cyte
-AESTHESIA	sensation	anaesthesia	an/aes/THE/si/a
EX-	out	extropion	ex/TRO/pion
FEBR	fever	febrile	FEB/rile
FIBRO	connective tissue	fibrocystic	FI/bro/cyst/ic
GASTRO	stomach	gastrectomy	gas/TRECT/o/my
-GENE, -GENIC	production, origin	osteogenic	os/TEO/gen/ic
GLOSSO	tongue	glossitis	gl/oss/I/tis
GLUCO,GLYCO	sugar, sweet	glycolysis	GLY/co/ly/sis
-GRAM	record	pneumsencephalo-gram	Pneum/o/en/CEPH/ a/lo/gram
-GRAPH	machine	electrocardiograph	e/lec/tro/CARD/ i/o/ graph
-GRAPHY	practice, process	lymphography	lymph/OG/ra/phy

Word Element	Refers to or Means	Example	
GYNAE	woman	gynaecological	gy/nae/COL/o/gi/cal
HAEMA, HAE-MATO, HAEMO	blood	haematocrit	haem/at/O/crit
HEMI-	half	hemiparesis	hem/i/PAR/e/sis
HEPA, HEPATO	liver	hepatitis	hep/a/TI/tis
HERNI	rupture	herniorrhaphy	her/ni/ORRH/a/phy
HISTO	tissue	histology	his/TOL/o/gy
HYDRO-	water	hydrocele	hy/dro/CELE
-MANIA	insanity	kleptomaniac	klep/to/MAN/iac
MAST	breast	mastitis	mas/TI/tis
MEGA-	large	megacolon	MEG/a/CO/lon
MEN	month	menstrual	men/stru/AL
MESO	middle	mesoderm	MES/o/derm
-METRE	measure	kilometer	kil/OM/e/ter
METRO	uterus	metroptosis	met/rop/TO/sis
MICRO-	small	microphage	MIC/ro/phage
MONO-	single, one	mononuclear	MON/o/nuc/lear
MUCO	mucous membrane	mucinoid	mu/cin/OID
MYELO	spinal cord, bone marrow	myeloblast	my/el/o/BLAST
MYO	muscle	myoblastoma	my/O/blast/O/ma
NARCO	sleep	narcolepsy	nar/CO/lep/sy
NASO	nose	nasopharyngeal	nas/o/PHA/ryn/geal
NECRO	death	necrosis	NEC/ros/is
NEO-	new	neoplastic	NE/o/plas/tic
NEPHRO	kidney	nephrosis	ne/PHRO/sis
NEURO	nerve	neurology	neu/ROL/o/gy
NON	no, not	nonantigenic	non/AN/ti/gen/ic
HYPER-	over, above, increased, excessive	hyperthyroid	hy/per/THY/roid
HYPO-	under, beneath, decreased	hypothyroid	hy/po/THY/roid
HYSTER	uterus	hysterotomy	hys/ter/OT/o/my
-IASIS	condition of	nephrolithiasis	neph/RO/lith/I/a/sis
ICTERO	jaundice	icterus index	IC/ter/us in/DEX
ILEO	ileum (part of small intestine)	ileostomy	il/e/OS/tom/y
ILIO	ilium (bone)	iliococcygeal	il/i/o/COCC/y/gea
INTER-	between	interstitial	inter/STIT/ial
INTRA-	within	intravenous	in/tra/VEN/ous
-ITIS	inflammation of	gastritis	gast/RI/tis
LAPARO	abdomen	laparoscopy	la/par/O/scop/y
-LEPSY	seizure, convulse	epilepsy	EP/i/lep/sy

Word element	Refers to or means	Example	
LEUKO	white	leukoplakia	leu/ko/PLAK/ia
LIPO	fat	liposarcoma	lip/O/sar/co/ma
LITH	stone, calculus	ureterolithiasis	ur/E/ter/o/lith/i/a/sis
-LYSIS	loosen, dissolve	hemolysis	hem/OL/y/sis
MACRO-	large, long	macrophage	MAC/ro/phage
MAL-	bad, poor, disordered	malodorous	mal/O/dor/ous
OCULO	eye	oculomotor	O/cu/lo/mo/tor
-OLOGY	study of	gerontology	GER/ont/OL/o/gy
-OMA	tumour	myoma	my/O/ma
OOPHOR	ovary	oophoritis	oo/phor/I/tis
OPHTHALMO	eye	ophthalmologist	oph/THAL/mol/o/gist
-OPIA	vision	myopia	my/O/pi/a
ORCHI	testicle	orchidectomy	ORCH/i/dec/tom/y
-ORRAPHY	to repair a defect	colporrhaphy	colp/OR/raph/y
ORTHO-	straight	orthodontist	orth/o/DONT/ist
-OSCOPY	look into, see	panendoscopy	pan/en/DOS/co/py
-OSIS	condition of	cirrhosis	cirrh/O/sis
OSTEO	bone	osteotomy	os/te/O/to/my
-OSTOMY	surgical opening	cecostomy	cec/ost/o/my
OTO	ear	otolaryngology	OT/o/lar/nyg/O/log/y
-OTOMY	incision, surgical cutting	cystotomy	cyst/OT/o/my
PARA-	alongside of	pararenal	par/a/REN/al
PATH	disease	pathogenic	pa/THO/gen/ic
PED (Latin) foot	pedalgia	PED/al/gia	
PED (Greek) child	pediatrician	pe/di/AT/ric/ian	
-PENIA	too few	thrombocytopenia	throm/bo/cyt/o/PEN/i/a
PERI	around, covering	periosteum	pe/ri/OS/te/um
-PEXY	to sew up in position	orchidopexy	OR/chid/O/pex/y
PHARYNGO	throat	pharyngitis	pha/RYN/gi/tis
PHLEBO	vein	phlebotomy	phle/BO/to/my
-PHOBIA	fear, dead	claustrophobia	claus/tro/PHO/bi/a
-PLASTY	operative revision	mammoplasty	MAMM/o/plas/ty
PLEGIA	paralysis	hemiplegia	hem/i/PLE/gi/a OR hem/i/PLA/gia

Word element	Refers to or means	Example	
-PNEA	breathing	dyspnoea	dys/p/NE/a (p silent)
PNEUMO	air, lungs	pneumothorax	pneu/MO/thor/ax
POLY-	much, many	polycythaemia	po/ly/cy/THE/mia
POST-	after	postoperative	post/OP/er/a/tive
PROCTO	rectum	proctoscope	proc/TO/scope
PRE-	before	prevention	pre/VEN/tion
-PTOSIS	falling	nephroptosis	neph/ROP/to/sis
-PYELO	pelvis of kidney	pyelonephrosis	py/el/o/neph/RO/sis
PYO	pus	pyodermia	py/o/DERM/ia
PYRO	heat, temperature	antipyretic	an/ti/PY/ret/ic
RENAL	kidney	adrenal	ad/REN/al
RETRO	behind, backward	retroperitoneal	ret/ro/PER/i/ton/eal
-RHAGE	haemorrhage, flow	haemorrhagic	HEM/or/rhag/ic
-RHoEA	flow	dysmenorrhoea	dys/MEN/orrh/ea
RHINO	nose	rhinoplasty	rhi/NO/plas/ty
SALPINGO	oviduct	salpingogram	sal/pin/GO/gram
SEMI-	half	semilunate	sem/i/LUN/ate
SEPTIC	poison, infection	antiseptic	an/ti/SEP/tic
STOMATO	mouth	enterostomal	en/ter/O/STO/mal
SUB-	under	subnormal	sub/NOR/mal
SUPER	above	supraclavicular	su/pra/CLAV/ic/ul/ar
-THERAPY	treatment	radiotherapy	RA/dio/THER/a/py
-THERMY	heat	thermometer	ther/MO/meter
THORACO	chest	thoracentesis	thor/a/CENT/e/sis
THROMBO	clot	thrombophlebitis	throm/BO/phleb/i/tis
THYRO	thyroid gland	thyrotoxicosis	thy/RO/tox/i/cos/is
TRANS-	across	transabdominal	trans/ab/DOM/in/al
URO	urine	urology	UR/o/lo/gy
-URIA, -URIC	condition of, presence in urine	albuminuria	AL/bum/in/ur/ia
UNI	one	unilateral	u/ni/LAT/er/al
VASO	blood vessel	vasodilator	vas/o/DI/lat/or

19 ASSIGNMENTS FOR MEDICAL TERMINOLOGY COURSE

Using your glossary or a medical dictionary, break the following words down into prefixes, roots and suffixes, and write the meaning of the word:

	Prefix	Root	Suffix	Meaning
1. antenatal				
antepartum				
antipyretic				
ante mortem				
antibiotic				
antihistimine				
antidote				
anticoagulant				
2. adenectomy				
adenocarcinoma				
adrenaline				
adermia				
anaerobe				
amenorhoea				
anaemia				
analgesia				
anaesthesia				
angioma				
anoxia				
anovesical				
asepsis				
3. cytology				
cytocide				
cytolysis				
cystocele				
cystoplasty				
cystitis				
4. diacidic				
diataxia				
diathermy				
diuretic				

	Prefix	Root	Suffix	Meaning
5. dysmenorrhoea				
dysuria				
dysarthria				
dyspnoea				
disarticulate				
disinfect				
dislocate				
6. endocranial				
endoderm				
enterolith				
enteropathy				
encapsulate				
engorgement				
environment				
enthermic				
7. haemoglobin				
haemolith				
haematuria				
haematemesis				
hemiopia				
haemialgia				
8. hypertension				
hyperventilate				
hyperthermia				
hypotension				
hypoventilate				
hypothermia				
hypodermic				
9. Ileus				
ileitis				
ileostomy				
ilium				
iloinguinal				
iliac crest				

	Prefix	Root	Suffix	Meaning
10. intervaginal				
interrenal				
intertubular				
intraabdominal				
intracranial				
intrathoracic				
11. macrodactyly				
macropodia				
macroglossia				
macrycyte				
microdactyly				
microcyte				
microlith				
microorganism				
microscope				
12. myelocele				
myeloma				
myelocyte				
myoma				
myocele				
myocarditis				
13. necropsy				
necrotomy				
nephrotis				
nephrolith				
neuritis				
neuroma				
14. otitis				
otolith				
otogenous				
osteitis				
osteoma				
osteopathy				
15. perfusion				
perception				
pericardium				

	Prefix	Root	Suffix	Meaning
perirenal				
periangitis				
peridontal				
precordial				
precancerous				
16. pyonephrosis				
pyoderma				
pyometritis				
pyrotoxin				
pyrometer				

Integumentary system assignment

Root	Meaning	Medical term	Meaning of term
Cutis	Skin	Subcutaneous	
Derma	Skin	Epidermis	
Diaphoreo	Perspiration	Diaphoretic	
Onychia	Nail	Paronychia	
Papilla	Nipple	Papillary	
Pilus	Hair	Depilation	
Trichos	Hair	Trichophobia	

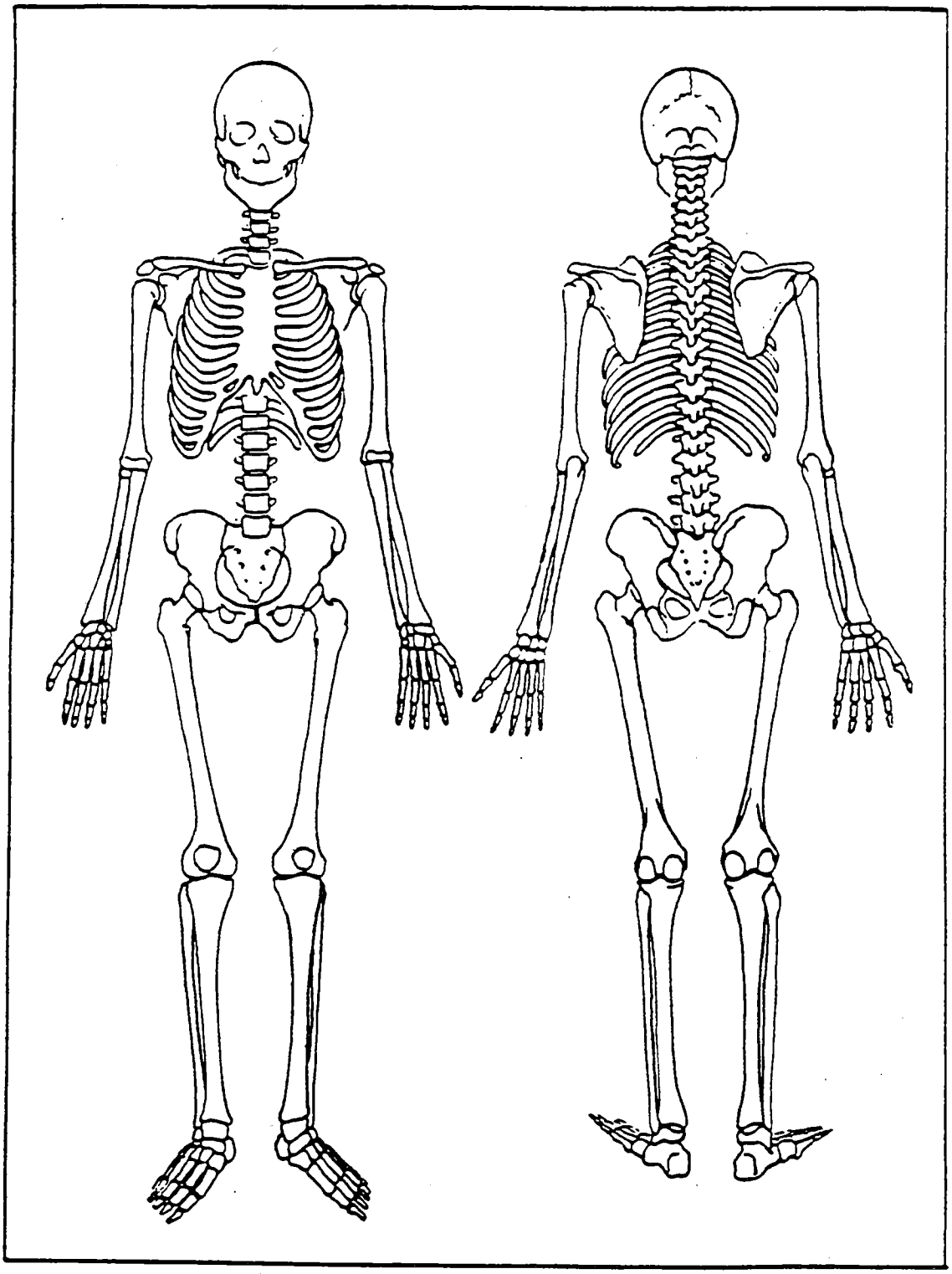
Skeletal system assignment

On Diagram 19 label the following:
Joints: Ball and socket joint, hinge joint, pivot joint.

Bones:	Parietal	Clavicle
	Occipital	Humerus
	Frontal	Radius
	Temporal	Ulna
	Mandible	Carpus
	Cervical vertebrae	Metacarpus
	Thoracic vertebrae	Patella
	Lumbar vertebrae	Tibia
	Sacrum	Fibula
	Ilium	Tarsus
	Ischium	Calcaneus
	Scapula	

Because all physicans rely heavily on accuracy and baseline data, a sound knowledge of radiological terminology is essential. The dictionary homework relative to the skeletal system is therefore lengthy, however, time spent in becoming familiar with the words will be well worth the effort.

Diagram 19: The skeleton



Dictionary homework

Words to note: Pertaining to appendicular skeleton

Acromion –
Appendicular –
Astragalus –
Capitate –
Cephalad –
Condyle –
Coracoid –
Coronoid –
Cuneiform –
Ensiform –
Gladiolus –
Hamate –
Lunate –
Manubrium –
Meniscus –
Navicular –
Nucleus pulposus –
Obturator –
Olecranon –
Pisiform –
Plantar –
Popliteal –
Scaphoid –
Sesamoid –
Styloid –
Talus –
Trapezium –
Triquetrum –
Trochanter –
Tuberosity –
Unciform –
Volar –
Xiphoid –

Words to note: pertaining to skull

Acoustic –
Ala (Alea) –
Apophysis –
Asterion –
Basalis –
Bregma –
Canthus –
Carotid –
Choana –
Clinoid –
Cornu –
Coronal –
Cribriform –
Crista Galli –
Glabella –
Hyoid –
Hypophysis –
Infundibulum –
Lambdoid –
Opisthion –
Palpebral –
Petrous –
Pterion –
Pterygoid –
Ramus –
Stephanion –
Styloid –
Vomer –
Zygomatic –

Words to note: pertaining to vertebral column and thoracic cage

Bifid –
Cornu –
Epistropheus –
Homologous –
Imbricate –
Lamina –
Odontoid –
Piriformis–
Scalene –
Sulcus –

Musculoskeletal system assigment

(Dictionary Assignment)

Word	Medical Term	Definition
Joint	Synarthrodial	
Bursa (small sac between moving parts)	Bursectomy	
Wrist	Metacarpal	
Head	Encephalitis	
Hand	Chiroplasty	
Cartilage	Chondrolysis	
Coccyx	Coccygectomy	
Rib	Intercostal	
Hip	Coxodynia	
Finger	Dactylomegaly	
Ligament	Desmorrhexis	
Diaphragm	Diaphragmatic hernia	
Movement	Kinetosis	
Skull	Cranioplasty	
Muscle	Intramuscular	
Marrow	Myelogenous	
Muscle	Myoblastoma	
Mucus	Myxadenoma	
Shoulder	Omohysid	
Bone	Osteosarcoma	
Fibula	Peroneus	
Foot	Talipes	
Foot	Pediatrist	
Vertebrae	Spondylopathy	
Tendon	Tenosynovitis	

NERVOUS SYSTEM ASSIGNMENT

Word	Notes
convolution	
cerebrum	
cortex	
neurone	
ganglion	
thalamus	
commissure	
corpus striatum	
medulla	
cerebellum	
myelin	
neurilemma	
dura-mater	
pia-mater	
arachnoid	
axon	
cisterna magna	
cisterna pontis	
saggital	
autonomic	
cauda equina	
neurologist	
aphasia	
chordotomy	
hydrocephalus	
astrocytoma	
epilepsy	
cerebral palsy	
cerebral sclerosis	
Niemann-Picks disease	
Ataxia telangiectasia	
meningitis	
hemi-paresis	
glioma	
medulloblastoma	
ependymoma	
oligodendroglioma	
meningioma	
neurofibroma	
neurosurgeon	

Special sense organs assignment

Dictionary homework

Word	Derivation	Meaning
acoustic		
uveal tract		
gustatory		
tarsus		
olfactory		
sclera		
cochlea		
retina		
eustachian		
limbus		
labyrinth		
lens		
mastoid		
lacrimal		
tympanic		
iris		
aqueous		
cornea		
canthus		
conjonctiva		
choroid		
vitreous		

Cardiovascular system assignment

Root	Meaning	Example	Definition
Angeion	Vessel	Angiogenesis	
Aorte	Aorta	Aortectasia	
Arteria	Artery	Arteriorraphy	
Cardia	Heart	Endocardium	
Phlebo	Vein	Phlebothrombosis	
Vena	Vein	Venesection	
Sphygmos	Pulse	Sphygmomanometer	
Aden	Gland	Adenocarcinoma	
Haema	Blood	Haemoglobin	
Splen	Spleen	Splenomegaly	

Blood and blood forming organs assignment

Word	Root	Meaning
afferent		
agglutination		
agglutinogen		
agglutinin		
aplastic		
efferent		
erythroblast		
erythropoiesis		
haemolysis		
haematopoiesis		
incompatible		
leukopoiesis		
lymph		
lymphocyte		
myeloblast		
myeloid		
normoblast		
normochromic		
precursor		
reticulocyte		
reticuloendothelial		
trabeculae		
megaloblast		
myeloma		
intrinsic factor		
hyperplasia		
polymorphonuclear		
polycythaemia		
pleomorphic		
vera		
myelogenous		
hepatomegaly		
splenomegaly		
metastases		
myelophthisic		
thrombocytopenia		
lymphoma		
lymphosarcoma		
dysproteinaemia		

Respiratory system assignment

Root	Meaning	Example	Definition
Bronch	Bronchus	Bronchoscopy	
Pectus	Chest	Pectus excavatum	
Phren	Diaphragm	Phrenicectomy	
Pneumon	Lung	Pneumonitis	
Rhin	Nose	Rhinostenosis	
Thorax	Chest	Thoracotomy	
Trachea	Windpipe	Tracheoplasty	

Dictionary homework

Word	Meaning
alveolus	
aphonia	
arytenoid	
bronchiole	
bronchus	
caseous	
catarrh	
concha	
corniculate	
coryza	
cricoid	
cuneiform	
dyspnoea	
epiglottis	
epistaxis	
glottis	
haemoptysis	
hilus	
larynx	
lung	
meatus	
mediastinal	
nares	
nasolacrimal	
olfactory	
osmosis	
pharynx	
pleura	
septum	
sinus	
trachea	
turbinates	

Digestive system assignment

Root	Meaning	Example	Definition
Amygdale	Tonsil	Amygdaloid fossa	
Cheilos	Lip	Cheilostomatoplasty	
Chole	Bile	Cholelithasis	
Chylos	Chyle	Chyluria	
Colon	Colon	Colostomy	
Copros	Excrement	Copremesis	
Dipsa	Thirst	Dipsomania	
Emesis	Vomiting	Haematemesis	
Enteron	Gut	Enterostatis	
Gaster	Stomach	Gastrectomy	
Glossa	Tongue	Glossitis	
Glottis	Glottis (a part of voice box)	Epiglottis	
Hepato	Liver	Hepatomegaly	
Ileos	Ileum	Ileocaecal	
Larynx	Larynx	Laryngectomy	
Mesoenteron	Mesentery	Mesenteritis	
Odont	Tooth	Odontologist	
Oesophagos (Esophagus)	Gullet	Osophagitis	
Orexis	Appetite	Anorexia	
Phagein	Swallowing	Dysphagia	
Pharynx	Pharynx	Pharyngeal	
Proktos	Anus or Rectum	Proctodynia	
Pyloros	Pylorus	Pylorostenosis	
Stoma	Mouth	Stomatitis	
Tonsilla	Tonsil	Tonsillitis	

Medical terminology assignment: Digestive system

Dictionary homework

Word	Root	Meaning
Absorb		
Alimentary		
Ampulla		
Annular		
Antrum		
Anus		
Appendix		
Areola		
Assimilate		
Bilirubin		
Buccal		
Cecum		
Chyle		
Colon		
Common bile duct		
Crypts of Lieberkühn		
Cystic duct		
Duct		
Duodenum		
Dysphagia		
Emesis		
Epiploic		
Excretion		
Fauces		
Faeces		
Frenulum		
Fundus		
Fungating		
Gastroenterologist		
Gastroenterology		
Glossopalatine		
Glucagon		
Haematemesis		
Haemorroids		
Hiatus		
Hyperglycemic		
Hyperkeratosis		
Ileocaecal		
Ileum		
Ingest		
Insulin		
Islets of Langerhans		
Jejunum		
Lacteal		
Mastication		
Meckel's diverticulum		

Word	Root	Meaning
Mesentery		
Mucin		
Omentum		
Palate		
Pancreas		
Parietal		
Parotid		
Peristalsis		
Pharyngopalatine		
Plica		
Polypoid		
Porta hepatis		
Ptyalin		
Pylorus		
Rugae		
Salivary		
Salivation		
Scirrhous		
Secrete		
Sphincter of Oddi		
Stercobilin		
Sublingual		
Submandibular		
Succus entericus		
Urobilin		
Urobilinogen		
Uvula		
Vermiform		

Urinary system assignment

Root	Meaning	Example	Definition
Cystitis	Bladder	Cystotomy	
Nephros	Kidney	Nephrectomy	
Pyelos	Kidney/Pelvis	Pyelogram	
Ren	Kidney	Adrenal	
Urina	Urine	Polyuria	
Vesicula	Vesicle	Intravesicular	

Urinary system medical terminology

Dictionary Homework

Word	Meaning
Afferent	
Arcuate	
Azotaemia	
Bowman' capsule	
Calculus	
Calyces	
Convoluted	
Cortex	
Creatinine	
Cystitis	
Cystocele	
Cystometrogram	
Dysuria	
Efferent	
Filtration	
Glomerulus	
Haematuria	
Henle's loop	
Hilum	
Hydronephrosis	
Incontinent	
Intravesicular	
Nephron	
Nephroptosis	
Oliguria	
Parenchymatous	
Pelvis	
Penile	
Perinephric	
Polyuria	
Postpartum	
Renal fascia	
Retention	

Word	Meaning
Retrograde	
Retroperitoneal	
Suppression	
Synthesis	
Transitional	
Trigone	
Urea	
Uraemia	
Ureter	
Urethra	
Venereal	
Vesical	
Void	

Reproductive system assignment

Root	Meaning	Example	Definition
Colpos	Vagina	Colpomyomotomy	
Didymoi	Epididymis (small body lying above testes)	Epididymitis	
Genos	Genesis	Genetics	
Hymen	Hymen	Hymenectomy	
Hystera	Womb/Uterus	Hysteromyoma.	
Kleitoris	Clitoris	Clitoriditis	
Metra	Womb/Uterus	Metrorrhagia	
Oophorein	Ovary	Oophorectomy	
Orchis	Testicle	Orchidectomy	
Salpinx	Fallopian tube	Salpingectomy	
Sperma	Semen	Spermicide	
Uterus	Uterus	Uteropexy	

Reproductive system medical terminology

Dictionary homework

Word	Meaning
abortion	
amenorrhoea	
amitosis	
areola	
atrophicus	
bulbouretral	
cavernous	
cervix uteri	
clitoris	
corpora cavernosa	
corpus luteum	
dysmenorrhoea	
ectopic pregnancy	
endometrium	
epididymis	
estrogen	
fertilization	
fimbria	
foreskin	
gamete	
gonad	
Graafian follicle	
hymen	
hyperplastic	
inguinal	
labia	
lactation	
menorrhagia	
menopause	
menstruation	
metrorrhagia	
mons pubis	
myometrium	
nulliparous	
ostium abdominale	
ovary	
oviduct	
ovulation	
ovum	
parametrium	
penis	
perineum	
prepuce	
progesterone	
prostate	

Word	Meaning
puberty	
scrotum	
semen	
seminal vesical	
spermatozoa	
testis	
tunica vaginalis	
uterus	
vagina	
vas deferens	
vestibule	
vulva	
zygote	

Endocrine system assignment

Root	Meaning	Example	Definition
Carotis	Carotid	Carotid gland	
Gone	Gonad	Gonadotrophic	
Pinea	Pineal	Pinealopathy	
Pituita	Pituitory	Pituitrin	
Thymos	Thymus	Thymectomy	
Thyreos	Thyroid	Thyroadenitis	
Galact	Milk	Galactemia	
Mamma	Breast	Mammary gland	
Mastos	Breast	Mastitis	
Thel	Nipple	Thelalgia	

Endocrine system medical terminology

Dictionary Homework

Word	Root(s)	Meaning
androgen		
cachexia		
cell rests		
chromaffin		
cortex		
diabetes		
endocrinology		
estrogen		
exophthalmos		
gastrin		

Word	Root(s)	Meaning
glucosuria		
gonad		
glycosuria		
hormone		
hypophyseal		
hypotension		
iatrogenic		
insular		
intracranial		
libido		
medulla		
morbid		
myxoedematous		
parenchyma		
placenta		
polydipsia		
polyphagia		
prostration		
secretion		
somatotrophic		
testosterone		
tetany		
thyroxin		
vascular		

Pathology assignment

Dictionary homework

Signs and symptoms	Meaning
Cephalalgia	
Diplopia	
Tinnitus	
Epistaxis	
Rhinorrhoea	
Dyspnoea	
Haemoptysis	
Palpitation	
Oedema	
Syncope	
Dysphagia	
Aerophagia	
Borborygmus	
Nausea	
Haematemesis	
Jaundice	
Constipation	

Signs and symptoms	Meaning
Diarrhoea	
Pruritis	
Frequency	
Tenesmus	
Incontinence	
Enuresis	
Nocturia	
Polyuria	
Dysuria	
Haematuria	
Impotence	
Amenorrhoea	
Dysmenorrhoea	
Metrorrhagia	
Paraesthesia	
Skin eruptions macular papular desquamating	
Pigmentation	
Petechiae	
Telangiectasia	
Atheroma	
Cicatrix	
Verrucae (Verruca)	
Naevi (Naevus)	
Hirsute	
Alopecia	
Cerumen	
Auricular tophi	
Ptyalism	
Gingivitis	
Pyorrhoea	
Parulis	
Stridor	
Aphonia	
Bruit	
Gynaecomastia	
Tachypnoea	
Bradypnoea	
Dyspnoea	
Orthopoea	
Apnoea	
Ascultation	
Rales	
Bradycardia	
Tachycardia	
Aneurysm	

Signs and symptoms	Meaning
Pulse – dorsalis pedis – posterior tibial	
Condylomata	
Introitus	
Retroversion	
Retroflexion	
Ankylosis	
Crepitus	
Flaccid	
Spastic	
Romberg test	
Cremasteric	
Euphoria	
Necropsy	
Oncology	
Forensic medicine	
Idiopathic etiology	
Degeneration	
Infiltration	
Amyloidosis	
Metastatic calcification	
Calcinosis	
Ochronosis	
Melanomata	
Porphyrins	
Hyperaemia	
Pyknosis	
Karyorrhexis	
Karyolysis	
Caseation	
Rubor	
Calor	
Dolor	
Intermitotic	
Postmitotic	
Aplasia	
Hypoplasia	
Atrophy	
Metaplasia	
Dyplasia	
Hyperplasia	
Hypertrophy	
Neoplasia	
Carcinogen	
Papilloma	
Anaplasia	

REVIEW MEDICAL TERMINOLOGY ASSIGNMENT

Prefixes which indicate location, direction and tendency

	Prefix	Meaning	Example	Meaning of example
1.	Ab	)	Abduction	
	Apo	)From, away from	Apoplexy	
	De	)	Detract	
2.	Ad	To, near, toward	Adrenal	
3.	Ambi	Both	Ambidextrous	
4.	Amphi	)	Ampitheatre	
		) On both sides		
	Ampho	)	Amphogenic	
5.	Ana	Up, apart, across	Anabolism	
6.	Ante	)	Antenatal	
	Pre	)Before	Precancerous	
	Pro	)	Prognosis	
7.	Anti	)	Antispasmodic	
	Contra	)Against	Contraindication	
	Counter	)	Counterbalance	
8.	Cata	)Down	Catabolism	
9.	Circum	)	Circumference	
		)Around		
	Peri	)	Pericardium	
10.	Co	)	Co-ordination	
	Com	)	Compound	
	Con	)With, together	Congenital	
	Sym	)	Symbiosis	
	Syn	)	Synarthrosis	
11.	Dia	)	Diaphoresis	
	Per	)Through	Percutaneous	
	Trans	)	Transhepatic	
12.	Di	)	Diarthrosis	
		) Apart from		
	Dis	)	Disarticulation	
13.	E	)	Enucleate	
	Ec	)Out from	Eczema	
	Ex	)	Exhale	
14.	Ect	)	Ectopic	
	Exo	)Outside	Exogenous	
	Extra	)	Extravasation	
15.	Em	)	Empyema	
	En	)	Encapsulated	
		) In		
	Im	)	Impacted	
	In	)	Inspiration	

	Prefix	Meaning	Example	Meaning of example
16.	End	)	Endocardium	
	Ento	) Within	Entopic	
	Intra	)	Intravenous	
17.	Epi	Upon	Epicondyle	
18.	Infra	)	Inframamary	
	Hypo	) Under	Hypodermic	
	Sub	)	Subelavian	
19.	Inter	Between	Intercostal	
20.	Intro	Into	Introduction	
21.	Meta	Change	Metaplasia	
22.	Para	Beside	Paranasal	
23.	Post	After	Postoperative	
24.	Re	Again	Recurrence	
25.	Retro	)	Retroflexion	
		) Backward		
	Re	)	Relapse	
26.	Super	)	Superimpose	
		) Above		
	Supra	)	Suprapubic	
27.	Ultra	Excessive	Ultrasonic	
Negative prefixes				
1.	A	)	Apnoea	
		) Without		
	An	)	Anaesthetic	
2.	Im	)	Immature	
		) Not		
	In	)	Incurable	
Pseudoprefixes denoting number and measurement				
1.	Uni	)	Unilateral	
		) One		
	Mono	)	Monocyte	
2.	Bi	)	Bifocal	
	Bin	) Two	Binocular	
	Di	)	Dichromatic	
3.	Ter	)	Tertiary	
		) Three		
	Tri	)	Trigone	
4.	Quadra	)	Quadriceps	
		) Four		
	Tetra		Tetragenous	
5.	Quinque	)	Quintuplet	
		) Five		
	Pent(a)		Pentose	
6.	Sex	)	Sextipara	
		) Six		
	Hex(a)	)	Hexadactylism	

	Prefix	Meaning	Example	Meaning of example
7.	Sept	)	Septan	
		) Seven		
	Hept(a)	)	Heptose	
8.	Octa	Eight	Octogenarian	
9.	Nonagen	)	Nonan	
		) Nine		
	Novem	)	Novemlobate	
10.	Dec	)	Decigram	
		) Ten		
	Dec(a)	)		
11.	Cent	)	Centimetre	
		) Hundred		
	Hect(o)	)	Hectogram	
12.	Milli	)	Millimetre	
		) Thousand		
	Kilo	)	Kilogram	
13.	Demi	)	Demilune	
	Semi	) Half	Semicircular	
	Hemi	)	Hemiplegia	
14.	Multi	)	Multinodular	
		) Many		
	Poly	)	Polycythaemia	
15	Super	)	Supernumerary	
	Per	)	Pertussis	
		) More		
	Hyper	)	Hyperaemia	
	Extra	)	Extrasystole	
16.	Sub	)	Subnormal	
		) Less		
	Hypo	)	Hypocrinism	
Prefixes denoting colour				
1.	Albumin	)	Albuminuria	
	Alb	)	Albinism	
	Luc	) White		
	Leuc	)	Leucitis	
	Leuk	)	Leukaemia	
2.	Aure	Golden	Auriginous	
3.	Ciner	)	Cinerea	
		) Grey		
	Polio	)	Poliomyelitis	
4.	Chlor	)	Chlorophyll	
	Glauc	) Green	Glaucoma	
	Verdin	)	Verdohaemoglobin	
5.	Cirr	)	Cirrhosis	
	Lutein	) Yellow	Corpus luteum	
	Xanth	)	Xanthopsis	

6.	Rube	)	Rubella	
		) Red		
	Erythr	)	Erythrocyte	
7.	Cyan		Cyanosis	
		) Blue		
	Indigo	)	Indigouria	
8.	Purpur		Purpura	
		) Purple		
	Porphyr	)	Porphyrin	
9.	Melan	Black	Menanoma	

Miscellaneous pseudo-prefixes

Prefix	Meaning	Example	Meaning of example
Aniso	Unequal	Anisocytosis	
Atel	Imperfect	Atelectasis	
Blast	Germobe	Blastomycosis	
Brachy	Short	Brachygnathia	
Brady	Slow	Bradyeardia	
Cry	Cold	Cryosurgery	
Crypt(o)	Hidden	Cryptorchidism	
Cyt	Cell	Cytology	
Fibr	Ropelike	Fibroma	
Gyn	Woman	Gynaecology	
Hetero	Different	Heterogeneous	
Hydr	Water	Hydronephrosis	
Leio	Smooth	Leiomyoma	
Lith	Stone	Cholelithiasis	
Micr	Small	Microscope	
Morph	Form	Morphology	
Myc	Fungus	Mycoplasm	
Neo	New	Neoplasm	
Olig	Few	Oliguria	
Onc	Tumour	Oncology	
Pachy	Thick	Pachyderm	
Pan	All	Pan hysterectomy	
Pseudo	False	Pseudocyesis	
Py	Pus	Pyorrhoea	
Scirrh	Hard	Scirrhous	
Scolio	Crooked	Scoliosis	

Prefix	Meaning	Example	Meaning of example
Sten	Contracted	Stenosis	
Tachy	Fast	Tachycardia	
Toxi	Poison	Toxicology	
Troph	Nourishment	Thyrotropic	
Vas	Vessel	Vasospasm	

Suffixes

Suffix	Meaning	Example	Meaning of Example
oma	New growth	Carcinoma	
algia	Pain	Neuralgia	
atresia	Without opening	Proctatresia	
blast	Germ	Myeloblast	
cele	Swelling	Hydrocele	
cide	Killer	Germicide	
cleisis	Closure	Enterocleisis	
clysis	Injection	Hypodermoclysis	
cyst	Sac of fluid	Dacrocyst	
cyte	Cell	Leukocyte	
dynia	Pain	Pleurodynia	
ectasis	Expansion	Atelectasis	
emesis	Vomiting	Haematemesis	

Suffix	Meaning	Example	Meaning of example
aemia	Blood	Anaemia	
itis	Inflammation	Iritis	
lith	Stone	Fecolith	
ogy	Study of	Biology	
malacia	Softening	Osteomalacia	
orexia	Appetite	Anorexia	
pathy	Disease	Adenopathy	
penia	Poor	Thrombopenia	
plasia	Formation	Aplasia	
pnoea	Breathing	Dyspnoea	
ptosis	A falling	Nephroptosis	
orrhagia	Bursting forth	Metrorrhagia	
rrhoea	Flow	Diarrhoea	
spasm	Contraction	Pylorospasm	
stasis	Position	Metastasis	
uria	In the urine	Haematuria	

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