Education Module for Health Record Practice

Module 4 – Healthcare Statistics

In this unit participants are introduced to the collection of statistical data in hospitals, community health centers and primary health care areas.

The various rates and percentages generally calculated in health facilities are discussed along with the formula for their computation and definitions relating to statistical collections.

OBJECTIVES:

At the conclusion of this unit participants should be able to:

1. state the uses of health care statistics
2. list the type of statistical information routinely collected in hospitals on a monthly and annual basis
3. state the formulae used for the calculation of rates and percentages used in the collection of statistical data
4. calculate rates and percentages used in the collection of statistical data in hospitals
5. describe the process of statistical collections in an ambulatory setting
6. prepare appropriate statistical reports.

INTRODUCTION:

The collection of meaningful statistics is an important function of a hospital or clinic. Health records are the primary source of data used in compiling health care statistics. The health record department staff, therefore, may be responsible for the collection, analysis, interpretation and presentation of statistical data wherever possible. Today, computerized systems automatically collect and calculate many of the statistics that were once previously done manually.

Statistics are only as accurate as the original sources from which they are taken. The health information management/health record professional should see that

health records and other source documents are complete and readily available to meet the requirements for the production of useful statistics. Health service statistics are used for:

·   comparison of present and past performance of the hospital or clinic
·   guide for planning future development of the hospital or clinic
·   appraisal of work performed by the medical, nursing and other staff
·   hospital or clinic funding if government funded
·   research

When deciding to collect statistical data, or if reviewing existing collection systems, the hospital administrator and health information management/health record professional should ask:

- Why are the data being compiled?

- What use is being made, or will be made, of the information?

Before proceeding, we should become familiar with some definitions relating to terms used in statistical collections.

A. DEFINITIONS

Definitions used for the collection of statistical data on hospital utilization vary from country to country. To enable you to recognize the terms used in this Unit, the following is a list of definitions used in some countries. If your country has a different definition for an item, or if the item is known by a different term, change the one in this Unit to the one used by your hospital/country.

1. Admission

The formal process whereby a person is accepted by a hospital for the purpose of hospital treatment as an inpatient. If an inpatient is formally discharged from the hospital and then returns for further treatment, the admission process is repeated and a second admission is recorded in the statistics.

Live births in the hospital are considered inpatient admissions, but are always recorded separately as newborn admissions whether or not they require, during their continuous stay in the hospital since birth, special medical care in the nursery or in another clinical service of the hospital (for example, neonatal intensive care unit). A newborn admission is deemed to occur at the time of birth in the hospital.

Typically, a patient should be admitted as an inpatient if treatment and/or care is provided by hospital staff over a period of 24 hours.

2. **Visit (also called Attendance)**

   A visit is a single encounter with a healthcare professional that includes all of the services supplied during the encounter. (Horton) This term is usually used to refer to non-inpatient services, such as outpatient. An outpatient is one who receives ambulatory care services in a hospital based clinic or department. A visit occurs each time an outpatient attends a hospital, nursing home or community health center and receives one or more occasions of service.

3. **Bed count (also called available beds or bed complement)**

   The number of beds (both occupied and unoccupied), set-up and staffed in an inpatient area of a hospital, which are immediately available to be used by inpatients. In statistical returns the number of beds should always be shown as a whole number.

   Bassinets used by normal newborns are counted and reported separately from other hospital beds. Recovery room beds and labor beds are not counted as hospital beds if patients who occupy them for brief periods are assigned to another bed in the hospital.

4. **Bed count day**

   A unit of measure denoting the presence of an inpatient bed (occupied or unoccupied) set-up and staffed for use in one 24-hour period.

5. **Census**

   A count of inpatients at a given time. The census is always taken in a hospital at the same time each day, usually midnight. The census provides the number of inpatients at census taking time

6. **Daily census (daily inpatient census)**

   The daily census is the number of patients present at census taking time, plus any patients who were admitted after the previous census-taking time and discharged before the next census-taking time.

7. **Delivery**

   The act of giving birth to either a living child or a dead fetus. A pregnant woman who delivers may have multiple births. For example, a woman who gives birth to twins will have one delivery but two births.

7. **Discharge (Separation)**

The formal process whereby an inpatient leaves the hospital at the end of an episode of care.

The number of discharges includes discharges to home, transfers to other hospitals, nursing homes or other institutions, and deaths of persons who were inpatients at the time of death.

8. **Encounter**

   The direct contact between a patient and a physician or other licensed independent practitioner, to order or furnish healthcare services for the diagnosis or treatment of a patient. (Horton)

9. **Fetal death**

   "Fetal death is death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles."

   WHO ICD 10: Vol.1, p. 1235-1236

10. **Health facility**

    A **health facility** refers to any of the following:

    - **State, public, general or country hospitals**
    - **Private hospitals**
    - **Psychiatric hospitals**
    - **Hospices**
    - **Nursing homes**
    - **Community health centers**
    - **Ambulatory care centers**
    - **Primary health care centers**

11. **Hospital patient**

    An outpatient or an inpatient to whom a hospital provides comprehensive care, including all necessary medical, nursing and diagnostic services and, if they are available at the hospital, dental and allied health services, by means of its own staff or by other agreed arrangements.

12. Inpatient

A person who occupies a bed in a hospital for the purpose of hospital treatment.
Where a patient is admitted on the expectation that he or she will remain overnight, but the patient dies or is discharged before the midnight census, the patient should still be regarded as an inpatient, whether or not a hospital bed is occupied or treatment is provided. For example, the patient may die in the operating room or the recovery room, or may be discharged because surgery cannot be performed for medical or administrative reasons.

Patients who are held for observation in the Emergency Department or other observation areas, pending a decision whether to admit or not to admit to an inpatient bed should NOT be regarded as inpatients. However, if a decision is taken to admit such a patient, the time of admission should be regarded as the arrival time at the Emergency Department or observation area.

A hospital **newborn inpatient** is an infant born in the hospital at the beginning of the current inpatient admission. These infants are may be classified as normal newborns, or as those requiring special care because of prematurity, congenital malformations, etc., and are admitted to the neonatal intensive care unit (NICU). Well newborns staying in the regular nursery are listed separately from those in the NICU. Some countries include the special care newborns with regular inpatients; others group them with the well newborns. In both instances the special care newborns should be listed separately.

Policies also vary from country to country regarding certain short-stay cases. In some countries, for example, the following are classified as inpatients (patients may have to meet minimum length of stay criteria); in other countries they are considered outpatients, day patients or day cases.

- outpatient or same day surgery

- chemotherapy patients

- renal dialysis patients

- endoscopic procedures

13. Length of stay (discharge days)

The total number of patient days for an inpatient episode. The duration of an inpatient's hospitalization is considered to be one day if he is admitted and discharged on the same day and also if he is admitted on one day and discharged the next day. The day of admission should be counted but not the day of discharge.

14. **Live birth**

    "The complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born."

    WHO, ICD 10, Vol.1, page 1235

15. **Maternal death**

    Death of any woman while pregnant, or within 42 days of termination of pregnancy, irrespective of duration and site of pregnancy, from any cause related to or aggravated by the pregnancy, or its management, but not from accidental or incidental causes.

    Maternal deaths should be divided into two groups:

    (1) **Direct obstetric deaths**

    Those resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.

    (2) **Indirect obstetric deaths**

    Those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiological effects of pregnancy.

    WHO, ICD10, Vol. 1, page 1238

16. **Neonatal death**

    The neonatal period commences at birth and ends 28 completed days after birth. Neonatal deaths (deaths among live births during the first 28 completed days of life) may be subdivided into early neonatal deaths, occurring during the first seven days of life, and late neonatal deaths, occurring after the seventh day but before 28 completed days of life.

    WHO, ICD10, Vol. 1, page 1237

17. **Occasion of service**

    An occasion of service is a specified, identifiable service involved in the care of patient that is not an encounter, such as a lab text ordered during an encounter. (Horton) Any examination(s), consultation(s) or treatment(s) or other service(s) provided to a patient by a functional unit of a health service facility. On each occasion such service, each specimen, or

simultaneous set of specimens for the one patient, referred to a hospital department, constitutes one occasion of service.

18. **Outpatient**

   An outpatient is a patient who receives care without being admitted to inpatient or resident care.

19. **Patient day (inpatient service day)**

   A unit of measure denoting the services received by one inpatient during one 24-hour period.

20. **Perinatal death**

   A perinatal death is one occurring during the perinatal period, which commences at 22 completed weeks (154 days) of gestation (the time when birth weight is normally 500 g), and ends seven completed days after birth.

   WHO, ICD10, Vol. 1, page 1237

   NOTE: In ICD9 it was recommended that countries should present, solely for *international* comparisons, "standard perinatal statistics" in which both the numerator and the denominator of all rates are restricted to fetuses and infants weighing 1000 g or more (or, where birth weight is unavailable, the corresponding gestational age (28 weeks).

   WHO, ICD9, Vol.1, page 766

20. **Surgical procedure (Surgical operation)**

   Any single separate systematic manipulation upon or within the body which can be complete in itself, normally performed by a licensed practitioner or dentist, either with or without instruments, to restore disunited or deficient parts, to remove diseased or injured tissues, to extract foreign matter, to assist in obstetric delivery or to aid in diagnosis.

   Although surgical procedure and surgical operation are considered synonymous here, a surgical operation is defined as one or more surgical procedures performed at one time for one patient via a common approach or for a common purpose. (Horton)

21. **Total length of stay (total discharge days)**

   The number of days of care rendered to a group of inpatients from admission to discharge. The sum of the length of stay of any group of inpatients discharged during a specified period of time.

22. Total patient days (total inpatient service days)

The sum of all inpatient service days for each of the days during a given period. This is taken from the census forms. Every inpatient receives one inpatient service day each day he/she is hospitalized.

23. Transfer

The movement of a patient from one medical care unit to another within a hospital. Transfers to another health care institution are classified as discharges.

24. Underlying cause of death

- **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.**

WHO, ICD10, Vol. 1, page 1235

B. INPATIENT STATISTICAL DATA COLLECTION AND CALCULATIONS

Inpatient statistical data routinely collected and calculated in hospitals on a monthly and annual basis include:

- number of admissions - total hospital and by service
- number of patient days
- number of discharges (live and expired) - total hospital and by service
- number of deaths – total hospital and by service
- total length of stay (total discharge days)
- number of autopsies
- number of Coroner's (medical examiner's) cases
- number of deliveries (obstetric patients)
- number of live births
- number of fetal deaths
- number of obstetric discharges
- number of maternal deaths
- number of perinatal deaths
- number of surgical procedures
- number of anaesthetics administered

The above information is used to calculate the following rates and percentages:

(a) **Hospital utilization**

- daily census
- average daily census
- average length of stay of inpatients
- percentage of occupancy of hospital beds
- turnover interval
- turnover rate

(b) **Death rate**

- hospital death rate
- net death rate
- postoperative death rate
- anesthesia death rate

(c) **Autopsy rates**

- hospital autopsy rate
- net autopsy rate

(d) **Obstetric and perinatal rates**

- caesarean section rate
- maternal death rate
- fetal death rate
- perinatal death rate

The above rates and percentages may be calculated using the following formulae:

1. Hospital Utilization

- **Daily Census (Daily Bed Occupancy)**

  Formula

  Census = Inpatients remaining at midnight the previous night + Admissions up to the next census hour - Discharges/deaths between census taking hours

- **Average Daily Census (Average Daily Bed Occupancy)**

  The average number of inpatients present each day for a given time period. This figure is derived by dividing the sum of patient days for a period by the number of days in the same period.

Formula

Total number of patient days for a period (except newborn)
Total number of days in the same period

Example

In May a hospital rendered 4,280 patient days (excluding newborn babies). May has 31 days. Using the above formula the average daily census is calculated as follows:

$$\frac{4280}{31} = 138.06 \text{ or } 138.1$$

This would be rounded to give the average daily inpatient census during May of 138 patients.

NOTE: This indicator is calculated separately for newborns.

- **Average length of stay (ALOS) of discharged patients**

    The average number of days that inpatients (exclusive of newborn) remained in the hospital.

    Formula

    Total length of stay of discharged patients for a given period
    Total number of discharges and deaths in the same period

    Example

    In June a hospital discharged 2,086 patients (including deaths, but excluding newborns). Their combined length of stay was 13,654 days. Using the above formula the average length of stay of these patients was:

    $$\frac{13654}{2086} = 6.54 \text{ or } 6.5 \text{ days}$$

- **Percentage of occupancy of inpatient beds**

    The percentage of inpatient beds occupied over a given period.

Formula

Total number of patient days for a given period x 100
Available beds (bed complement) x the number of
   days in the period

Example

A hospital with 210 available beds (excluding newborn bassinets) rendered 4,780 patient days in June. June has 30 days. The percentage of occupancy for the hospital in June was:

$$\frac{4780 \times 100}{210 \times 30} = \frac{78000}{6300} = \quad 75.87 \text{ or } 75.9\%$$

- **Bed Turnover Interval**

  Average period in days that an available bed remains empty between the discharge of one inpatient and the admission of the next.

  Indicates the time that available beds are free.
  Indicates a shortage of beds when negative, and under-use of the hospital or an inefficient admission system, if positive.

  Formula

  Available beds x days in the period - patient days for the period
  Number of discharges, including deaths, in the period

  Example

  A hospital with 210 available beds in June rendered 4,780 patient days and had 736 discharged/died patients. The turnover interval rate using the above formula is:

  $$\frac{210 \times 30 - 4780}{736} = \frac{1520}{736} = \quad 2.06 \text{ or } 2.1 \text{ days}$$

- **Bed Turnover Rate**

  The mean number of patients "passing through" each bed during a period.
  Indicates the use made of available beds.

  Formula

Number of discharges (separations) in the period
Available beds

Example

During the month of June there were 736 discharges (including deaths) from a hospital with 210 beds. The turnover rate for June was:

$\frac{736}{210}$ = 3.50 or 3.5

2. Death Rates

Note: Patients who are dead on arrival (DOA) at a hospital are **not** included when calculating these rates.

- **Hospital Death Rate**

A ratio of all inpatient deaths for a given period to the total number of discharges and deaths in the same period.

Formula

Total number of deaths of inpatients in a given period x 100
Total number of discharges and deaths in the same period

Example

A hospital had a total of 15 deaths during the month of June. A total of 540 patients were discharged (including the 15 deaths) during the month. The hospital death rate according to the above formula is:

$\frac{15 \times 100}{540}$ = 2.77 or 2.8%

- **Net Death Rate**

A death rate, also known as the institutional death rate, that does not include deaths, which occur within 48 hours of admission (24 hours of admission in some countries). Previously, it was that those deaths that occur within 48 hours of admission should not be counted because not enough time had lapsed to allow the health care providers adequate time to directly affect the patient's condition. However, with today's technology, this concept is no longer thought to be valid. Therefore, it is recommended that net death rates not be calculated unless there is a special order to do so.

Formula

Deaths minus those w/in 48 hours of admission in a given period x 100
Total number of discharges and deaths, minus
Deaths w/in 48 hours of admission w/in the same period

Example

Taking the above example, of the 15 deaths, 4 patients died under 48 hours, leaving 11 patients who died 24 hours or more after admission. The total discharges, including deaths were 540. According to the formula the deaths under 48 hours of admission are deducted. Therefore, the calculation of the net death rate would be as follows:

$$\frac{15 - 4 \times 100}{540 - 4} = \frac{11 \times 100}{536} = 2.09\% \text{ or } 2.1\%$$

- **Postoperative Death Rate**

  The ratio of deaths within 10 days after surgery to the total number of patients operated on during that period. Some healthcare providers question the usefulness of this rate, as it is questioned how ten days is considered the "magic number."

  Formula

  Total number of deaths(within 10 days of surgery)   X   100
  Total number of patients who were operated on for the period

  Example

  During the month of November a hospital performed 275 operations, and 269 patients were operated on. There were 2 deaths that occurred within 10 days of surgery, and 1 that occurred after 10 days. The postoperative death rate according to the above formula is:

  $$\frac{2 \times 100}{269} = 0.74\%$$

  Note: it is recommended with small percentages of this nature, that the percentage be left at two decimal places.

- **Anesthesia Death Rate**

  The ratio of deaths caused by anesthetic agents during a

specified period of time to the number of anesthetics administered. This formula includes those deaths that occurred within 10 days of surgery.

Formula

$$\frac{Total\ deaths\ caused\ by\ anesthetic\ agents \quad X \quad 100}{Total\ number\ of\ anesthetics\ administered}$$

Example

During the month of August a hospital performed 750 operations, and 750 anesthetics were administered. There was 1 death due to anesthesia. The anesthesia death rate according to the above formula is:

$$\frac{1\ X\ 100}{750} \quad = \quad 0.13\%$$

3. **Autopsy Rates**

- **Hospital autopsy rate**

    The ratio of all autopsies performed in the hospital to all inpatient deaths in the hospital. Patients who are dead on arrival (DOA) at the hospital and fetal deaths are excluded from both the numerator and the denominator

    Formula

    $$\frac{Total\ number\ of\ autopsies\ for\ a\ given\ period\ x \quad 100}{Total\ number\ of\ inpatient\ deaths\ for\ the\ same\ period}$$

    Example

    In a hospital with 15 deaths during the month of June, 7 autopsies were performed on hospital patients whose bodies were available for hospital autopsy. The hospital autopsy rate is calculated as follows:

    $$\frac{7\ x\ 100}{15} \quad = \quad 46.66\ or\ 46.7\%$$

- **Net autopsy rate**

    A hospital may be prevented from performing an autopsy because the death is a coroner's or medical examiner's case and must be

sent to the coroner's court for autopsy. It would not reflect the scientific interest of the doctors to include such cases in a measure of unautopsied hospital cases. Cases, which are not available for autopsy, are not included in the net autopsy rate.

Formula

Total number of autopsies for a given period x 100
Total number of deaths minus unautopsied
Coroner's cases for the same period

Example

In the above example, of the 15 deaths and 7 autopsies in June 2 deaths were reported to the coroner/medical examiner and the bodies removed from the hospital and no hospital autopsy was performed. The net autopsy rate, therefore, was:

$$\frac{7 \times 100}{15 - 2} = \frac{700}{13} = 53.84 \text{ or } 53.8\%$$

4. Obstetric and Perinatal Rates

- **Cesarean section rate**

    A ratio of the number of cesarean sections performed to total deliveries.

    Formula

    Total number of cesarean sections performed in a period x 100
    Total number of deliveries in the period

    Example

    During the month of May, 310 deliveries occurred. Of this number 5 deliveries were by cesarean section. Using the above formula, the cesarean section rate is calculated as follows:

    $$\frac{5 \times 100}{310} = 1.61 \text{ or } 1.6\%$$

- **Maternal Death Rate**

    The ratio of maternal deaths to total obstetric discharges, including deaths. NOTE: Deaths due to abortions are maternal deaths even though the patient may have been hospitalised on a

gynaecology ward.

Formula

Total number of maternal deaths for a given period   x   100
Total number of obstetric discharges, including deaths,
for the same period

Example

During May an obstetric hospital discharged 230 obstetric patients, of this number, 1 patient died. Using the above formula the maternal death rate would be:

$$\frac{1 \times 100}{230} = 0.43 \text{ or } 0.4\%$$

- **Perinatal Death Rate**

  The ratio of perinatal deaths to live births and fetal deaths.

  Formula

  Total number of perinatal deaths in a given period x 100
  Total number of live births and fetal deaths in the same period

  Example

  In the month of May, there were 294 births, including 4 fetal deaths, and 2 babies subsequently died within seven days of birth. The perinatal death rate for May, therefore, was:

  $$\frac{6 \times 100}{294} = 2.04 \text{ or } 2.0\%$$

- **Fetal Death Rate**

  A ratio of fetal deaths to the total number of live births and fetal deaths in a period.

  Formula:

  Total number of fetal deaths for a given period x 100
  Total number of births and fetal deaths for the same period

  Example

The fetal death rate, using the perinatal death rate example above, is calculated as follows:

$$\frac{4 \times 100}{294} = 1.36 \text{ or } 1.4\%$$

C. OUTPATIENT STATISTICAL DATA COLLECTION AND CALCULATION

- number of outpatient visits
- number of outpatient visits for each clinic
- number of emergency department visits
- occasions of service (i.e., number of special services, e.g. Ultrasound, X-ray, pathology tests)

Most of the above are collected to assess the workload of each department or clinic, and plan for future needs. It may be found that the Wound Clinic staff see twice as many patients than other clinics, therefore more staff will be required in the clinic area on the wound clinic days; or, patient waiting time may be too long and the administration decides to look at the statistics for each clinic to see if it is because too many patients are given appointments when sufficient medical staff are not available.

This data may be manually tallied each day and totalled at the end of the time frame, or if a computerized patient registration system is used, the computer may automatically count these statistics. Therefore, no formulae are necessary to calculate this information.

1. **Outpatient Visits (per day or per clinic session)**
   The average number of patients seen per day or per clinic session.

   Formula

   $$\frac{\textit{Total number of visits in period}}{\textit{Total number of days in the time period (or clinic session held)}}$$

   Example

   During the month of September the Wound Clinic was held 12 times and there were 287 visits. Using the above formula, calculate the number of visits per clinic session.

   $$\frac{287}{12} = 23.92 \text{ or } 23.9$$

D. REPORTS

Quite frequently, the health facility's administrator, accreditation agency, or a government agency establishes various reports that must be presented. It is important to ensure that these reports are prepared in a timely and accurate manner since, directly or indirectly, this is one of the ways the health record department is evaluated.

The data collected and reports prepared should be reviewed and evaluated on at least an annual basis to determine if they are be used. Data that are collected for no apparent reason or reports that are prepared that no one uses are a waste of staff time and resources.

Sometimes reports prepared only present the work accomplished during the reporting period, and may not be particularly useful for problem identification or for decision-making. A report that compares selected data and indicators over different time periods may prove useful.

For example, the data and indicators for a month and the year to date can be compared with data for the same month and year to date of the previous year.

	Current year		Previous year	
	Month	YTD	Month	YTD
Admissions				
Discharges				
Deaths				
Patient days				
Average daily census				
Average length of stay				
Percentage of occupancy				
Turnover rate				
Outpatient visits				

E. QUALITY CONTROL

Health record professionals are evaluated on the timeliness, completeness, and accuracy of the statistical reports they are responsible for preparing. It is therefore important to have policies and procedures that help ensure that reports meet these criteria.

Policies and procedures should include the following points:

1. Monitor that the Health Record Department receives all reports within the established time period (e.g., unit census reports received daily; operating room reports received within 5 work days following end of the month).

2. Follow-up immediately on delinquent reports.

3. Check each unit census daily to be sure that:

    - ·every patient listed as a transfer in or transfer out appears as a transfer on the census report of another ward;

    - ·the number of patients remaining at the end of the day agrees with the number obtained by adding to the patients remaining the previous day the number of entries to the ward (admissions and transfers in) and from this total subtracting the number of departures (live discharges, deaths, transfers out) from the ward.

4. Verify that for the hospital as a whole the number of transfers in agrees with the number of transfers out.

5. At the end of each day, month, and year (or other time period), check the hospital inpatient statistical report as outlined in point 3 above.

6. Check all indicators for accuracy and to be sure that they make sense. For example, the number of patients remaining at the end of the time period should be lower than the number of beds unless, of course, more than one patient occupies a bed.

7. Proofread all reports before distribution to be sure that they contain no typographical errors.

SUMMARY:

Before proceeding to collect or compute any statistical information, the health record professional must find out what is needed and how and when it is to be used.

The reports generated are also very important and are used as a tool of communication. All presentations should be simple and readable with important facts highlighted. Although most reports will be in tabular form, they would be easier to read if visual aids such as graphs, bar charts and pie diagrams were used to illustrate clearly what the figures indicate.

In addition, reports should be clear and concise, and leave no doubt as to what the figures represent.

Many health facilities around the world today use computers to analyze and present their statistical data. This often results in the collection of more than basic data, which is readily retrievable and useable.

To assist in your understanding, complete the following exercises in Appendix 1. Answers are included in Appendix 2, but please work through each exercise before checking your answers. If any of your answers are incorrect, work through them again to find out where you went wrong.

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