

Math 1112
Unit 9: Thinking about Inpatients with Numbers
(Hospital Statistics)

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Additional readings and practice exercises:

Horton, Loretta, A. 2012, *Calculating and Reporting Healthcare Statistics 4th ed.* AHIMA, Chicago;
chapters 3 - 8

Introduction & Terminology

In this unit you will be learning to calculate basic hospital statistics. Healthcare statistics include a wide range of information. This unit will focus primarily on hospital inpatient statistics. These are based on classifications of various types of patients and aspects of their stay in hospital. The mathematical calculations are not complex. The challenge lies in learning terminology and in the details of the formulas and what they are trying to capture.

Raw hospital data will be presented in two ways: aggregated charts (see Appendix 1) and an example of an actual hospital (excel) spreadsheet called the Daily Census Summary (see Appendix 2 for a printout and www.stataras.com for a live excel document). You will use both.

Before beginning it is good to take a look at the booklet as a whole. It is organized into 3 sections: Admissions, Discharges and Population Based Statistics (see the title page).

A patient who comes to hospital gets **admitted** only when they are assigned bed. This is a bureaucratic procedure that triggers a series of events. Some patients get admitted right away, while others who come to hospital may never get admitted. (e.g. outpatients or emergency room patients who die).

Admissions statistics are collected during the period after the patient is assigned a bed and becomes a responsibility of the hospital (i.e. an **inpatient**). Patients that are receiving services, but are not admitted are called outpatients (see below). **Discharge** statistics are calculated after time of discharge. A patient who leaves hospital gets **discharged**, which means only that they are not in an assigned bed anymore. Patients can get discharged alive (go home, or transfer to another hospital) or dead ☹️
Population based statistics are collected on all residents of a jurisdiction (in or out of hospital).

Not all patients receiving services in a hospital are inpatients. Some are called **outpatients** – Outpatient clinic data is collected separately and not included in Admissions data. Outpatients are patients that get service in hospital, but do not get an assigned room (i.e. are not admitted to hospital). A patient who visits a fracture clinic gets evaluated by a doctor, and a cast can be administered, but because they never get assigned a ‘bed’ they are not admitted, and thus not ‘counted’ as inpatients. The same thing for a patient who comes into emergency. They can be physically in a bed, but until they are admitted and have an ‘assigned bed’ they are not an inpatient. You will not be calculating statistics on outpatients except in one instance - Hospital Autopsies.

Newborn (NB) are those babies who are born in hospital to a mother who is an inpatient. Every other baby who is admitted is classified as **Adult & Children**.

Note: rate and ratio are technically different, but usually used interchangeably. When reading a rate/ratio be aware of the following: Is the numerator independent of denominator (e.g. alive:dead = 10:1) or is numerator a subset of the denominator (e.g. alive:all = 10:11). Is numerator and denominator in same unit? (e.g. live:dead – live and dead are same unit: humans; but 7 inpatients : 10 beds is a rate in which there are two different units humans:beds)

Admissions: Census and Inpatient Service Days

Acronyms and key terms

IP	– Inpatient (Admitted)	A&C	– Adult & Children
OP	– Outpatient (not Admitted)	NB	– Newborn
A&D	– Admit & Discharge same day	IPSD	– Inpatient Service Day
CTT	– Census Taking Time	Census	– number of inpatients in facility at CTT
PCU	– patient care unit	Discharge	– inpatient is released from hospital

Census = starting census + Admissions – Discharges

Average Daily Census: The average number of inpatients present at census taking time per day for a period of time - can be calculated for all admissions or for a given patient care unit (PCU), or other group (e.g. newborns).

$$\text{Average Daily Census} = \frac{\text{Total census for a period}}{\text{Total number of days in the period}}$$

Inpatient Service Days (IPSD): A unit of measure that reflects the number of patients who received inpatient services during a 24-hour period.

$$\text{IPSD} = \text{starting census} + \text{Admissions} - \text{Discharges} + \text{A\&D};$$

Total Inpatient Service Days: Sum of all inpatient service days in a period.

Note: Horton(2012) Koch(2004) use another term: Daily Inpatient Census (DIPC) which is exactly the same thing as IPSD. DIPC will not be used in this course.

Example 1: Census at the end of the day (midnight) March 3rd was 453, On March 4th there were 34 patients admitted and 33 discharged; in addition 1 patient was admitted 9AM and then died 11AM, another was admitted at 11AM and died 4PM, 3 patients were admitted and then discharged to their home before midnight, and two came into emergency and were waiting for an inpatient bed all day. Calculate the following. (answers at bottom of the page)

a. Census =

b. IPSD =

answers

Example 1a. Census = 453+34 - 33 = 454; All others were either A&D or were not admitted)

b. IPSD = 453+34-33+ 1+1+3 (include A&D, don't include emergency patients as they haven't been admitted).

Admissions: Percentage Occupancy : What % of available beds (bassinets) were occupied for a given period of time. Bed and bassinet occupancy are calculated separately.

Key Terms

Bed: any adult or child (not a newborn) who is admitted to the hospital gets a 'bed'.

Bassinet: only Newborns (i.e. born to mother who was an inpatient) get a bassinet. Every other baby, no matter how small/young gets admitted as A&C and gets a bed.

Available bed/bassinet: The presence of one inpatient bed (or bassinet) which must be staffed for use in a 24-hour period.

Period: the # of days for which percent occupancy is needed. Always in number of days.

Inpatient bed/bassinet count: The capacity of the hospital for a particular day is called the number of **available beds or 'bed count'** - the bed/bassinet count can change from day to day. Inpatient bed count EXCLUDES beds in areas like Emergency services (they are not inpatients), and Labour, Recovery (those in Labour/Recovery have inpatient beds to go back to).

Total Bed (or bassinet) count days: A unit of measure denoting the number of beds available in a period. The bed count (number of beds available for a given day) multiplied by the total number of days in the period gives you bed count days. Be careful - the bed (or bassinet) count can change in the middle or any day in the period.

$$\text{Inpatient Bed(bassinet) Occupancy Rate} = \frac{\text{Total inpatient service days in a period}}{\text{Total bed (bassinet)count days in the period}}$$

(usually calculated as a decimal then converted to a %)

Example 1: Given that the IPSD for adults and children in a hospital for one day was 455, and there were 500 beds available, what is the bed occupancy for that day?

Example 2: At the start of January 2013, the bed count in a hospital was 345 it was increased to 422 as of January 15th. Given that the Total IPSD for January was 11,333 find the Bed occupancy rate for January.

Answers : Example 1 : IPSD = 455; bed count = 500; bed occupancy = 455/500 = 0.91 = 91%
Example 2. Total IPSD = 11,333; Total Bed count = (14days@345beds) + (17days@422beds) = 14*345+17*422=12,004;
Bed occupancy for Jan = 11,333/ 12,004 = 94.41%

Exercises with Census and bed (bassinet) occupancy

Exercise 1: Medical Center Hospital has 250 patients in the hospital at midnight on May 1st. On May 2nd, 30 patients are admitted. The hospital discharged 38 patients on May 2nd of which 2 patients had died. Additionally, on May 2nd, 2 patients were admitted and discharged. What was the IPSD at midnight on May 2nd?

Exercise 2: Community Memorial Hospital had a total census of 3,000 + 200 A&D for the month of September. Using Horton's (pg 26 of the text) description of Daily Inpatient Census = IPSD calculate the average daily inpatient census for the hospital during September ____.

Exercise 3: Hospital census at end of day on May 3 is 456.

On May 4:	Admissions	58
	Discharges	45
	A&D	6
	DOA	3

Calculate:

- Census for May 4

- Inpatient service days (IPSD) for May 4

Exercise 4: Newborn nursery census for May 1 is 22

On May 2:	Births	4
	Discharges	2
	Fetal-deaths	2

Calculate:

- census for May 2

- IPSD for May 2

Census and bed (&bassinet) occupancy exercises - continued

Exercise 5: A newborn unit records the following data for April:

Bassinet count	14
IP service day total	388
Beginning census	12
Newborn deaths	1
Fetal deaths	3

Calculate the bassinet occupancy rate for April:

Exercise 6: Prairie Hospital, with a complement of 250 beds, finds it difficult to make ends meet due to low occupancy. The administration decides to close a wing of the hospital and the administrative closure is implemented on July 17, reducing the bed count to 200 beds. During July, 5710 IP service days of care were given.

Calculate the bed occupancy for July:

Census and bed (&bassinet) occupancy exercises - continued

Exercise 7: Study the data from one year at Healing Through Hope Hospital attached in appendix 1.

Calculate:

- a) Bed occupancy for period A

- b) Bed occupancy for period B

- c) Bed occupancy for period C

- d) Bed occupancy for the entire year

- e) Census at the end of the year (NB)

- f) Census at the end of the year (A&C)

- g) Bassinet occupancy for the year

Calendar Days: Jan.(31), Feb(28), Mar(31), Apr(30), May (31), Jun(30),
Jul.(31), Aug.(31), Sept.(30), Oct (31), Nov (30), Dec(31)

Admissions: Other Rates & Practice

Key terms

OB admissions: number of pregnant women who were expected to deliver or were admitted for other reasons.

OB discharges: number of women discharged from Obstetrics (could have delivered a live/dead baby, miscarried, or died)

Delivery: the expulsion (or removal) of the product of conception.

Undelivered: A woman who is discharged from hospital without having delivered during her stay.

Cesarean Section Rate: Refers to the number of C-sections performed divided by the total number of deliveries (including C-sections)

$$\frac{\text{Total number of cesarean sections performed in a period}}{\text{Total number of deliveries in the period (including cesarean sections)}}$$

Post Operative Infection rate: Refers to all infections in clean surgical cases divided by the number of surgical operations. *Clean surgical case means one in which no infection existed prior to surgery*

$$\frac{\text{Number of infections in clean surgical cases for a period}}{\text{Number of surgical operations for the period}}$$

Practice with “Admissions” Other Rates

Example 1: July obstetrical data:

OB admissions	451
OB discharges	456 (including 3 deaths)
Deliveries	446 (including 4 sets of twins)
Undelivered	7
Cesarean sections	6

Calculate: Cesarean section rate for July

Example 2: A hospital recorded 10 postoperative infections during the past month and performed a total of 250 surgical operations.

Calculate: Post-Operative (postop) infection rate

answers to examples questions

1. $6/446 = 1.345\%$

2. $10/250 = 4\%$

Census and bed (&bassinets) occupancy exercises with spreadsheet

Exercise 1: . You will need to use the information on the Daily Census Summary from Dunchurch hospital for February to practice calculating some basic rates. (See appendix 2 for data)

- a. What is the A&C Census Feb. 25th?
- b. What is the IPSD (A&C) for Feb. 25th?
- c. How many beds were available in the obstetrics ward during the month of February?
- d. What is the bed occupancy at Dunchurch Hospital for February 3rd?
- e. Find the bed occupancy for the Obstetrics ward for the week Feb 1 – 7.
- f. On which day was bed occupancy the highest? What was it?
- g. What was the average A&C daily census for the month of February?
- h. On March 1st there were 12 A&C patients admitted and 14 discharged, 2 of which were A&D. What is the census on March 1st?

Discharges: Length of Stay (LOS)

The following statistics would be calculated **only after** the patient has been discharged from the hospital (dead, alive or transferred). When you see the word ‘discharges’ by itself – then this statistic refers to the number of inpatients who were discharged, and includes those that died (see Q3 on pg. 10). If deaths are not included in ‘discharges’ you will see the heading as discharges (live) or Live Discharges (see Q4 on page10).

Length Of Stay

Acronyms

LOS – Length of Stay

ALOS – Average Length of Stay

DD – Discharge Days

Length of Stay (LOS): # days from admission to discharge (calculated per individual patient). For A&D the LOS = 1. (Count every day then subtract 1 for discharge day)

Discharge Days (DD): # days from admission to discharge (calculated for individual or group) For A&D the DD = 1. DD is what you will see calculated for a group of patients.

Total Length of Stay: The sum of days from admission to discharge of any group of inpatients discharged during a specified period of time.

Average Length of Stay(ALOS): The average number of days that inpatients were admitted for during a specified period.

LOS is typically calculated separately for A&C and NB

Counting LOS and DD

For one patient LOS = DD = # of days of admission minus 1 day for the day of discharge

For group of patients ‘Total LOS’ = Σ DD for all patients in the group

$$\text{Average Length of Stay} = \frac{\text{Total length of stay (discharge days)}}{\text{Total discharges (including deaths)}}$$

In class practice:

Example 1: Patient is admitted into hospital on May 7th and is discharged May 14th.

Example 2: Patient arrives in emergency on April 29th and dies while waiting for admission.

Example 3: Patient is admitted into hospital on May 7th and is discharged June 14th.

Example 4: Find the Total LOS and Average LOS of the three patients above.

Answers to Examples :

1. LOS = 8 – 1 = 7 days; 2. LOS is not calculated since patient was not admitted. note LOS \neq 0 it is not reported at all.
3. LOS = 25 (in may) + 14 in June – 1 = 38 days 4. Total LOS = 7 + 38 = 45; ALOS = (7 + 38)/2 = 22.5

Exercises with LOS and more

Exercise 1:

- a. Patient is admitted on May 12th and is discharged May 14th. LOS = _____
- b. Patient is admitted on April 29th and dies May 12th. LOS = _____
- c. Patient is admitted on Dec. 12th and is discharged June 14th. LOS = _____

Exercise 2: Community Memorial Hospital discharged nine patients on April 1st. The length of stay for each patient was is shown in the following table.

patient	A	B	C	D	E	F	G	H	I
# of days	1	5	3	3	8	8	8	9	9

The average length of stay for these nine patients was ____.

<u>Exercise 3:</u> Healthful Hospital (April 2013)	A&C	NB
Bed/Bassinet count	180	15
Admissions	905	88
Discharges	895	86
Deaths	7	1
IPSD	4820	339
Discharge Days	4785	330

Calculate:

- a. Average LOS for A&C
- b. Average LOS for NB
- c. Bed occupancy April 2013

Exercises with LOS and more - continued

Exercise 4: Hillside Medical Center (October) Bed count: 100 Bassinet Count: 15

PCU	Adm.	Discharges(Live)	Deaths	IPSD	DD
Medical	166	163	10	859	845
OB	92	93	1	365	369
Gynecology	81	80	1	313	325
Urology	60	57	0	231	240
NB	90	93	1	349	352

Calculate the Average Length of Stay for

a. urology

b. gynecology

c. medical

d. NB

e. A&C

Exercise 5: Study the data from one year at Healing through Hope Hospital attached at the back (appendix 1)

Calculate:

a) Total LOS for period A, A&C only

b) ALOS for period B, A&C only

c) ALOS for the whole year, A&C only

d) Bed occupancy rate for the entire year

Discharges: Death (Mortality) Rates

Key Terms

Discharge – patient has left hospital (dead, alive or transferred)

Maternal death – death of a woman directly associated with pregnancy

Fetal Death: is the death of a product of human conception (fetus & placenta) *prior to the complete expulsion or extraction* from the mother (in a hospital facility)

3 types: *Early death* (fewer than 20 weeks of gestation); *Intermediate death* (between 20-28 weeks gestation); *Late death* (>28 completed weeks of gestation)

Stillborn: Fetal death is also called stillborn, but in some texts it means only intermediate/late fetal deaths.

Fetal deaths are NOT considered inpatient deaths Fetal ≠ NB;

Formulas:

Gross Death Rate: the proportion of inpatient (A&C + NB) discharges *that died*, as a percentage.

$$\frac{\text{Number of deaths of inpatients (A\&C + NB) in a period}}{\text{Number of discharges (include deaths) in the period}}$$

Net Death Rate/Institutional Death Rate: same as Gross excluding those who died within 48hrs after admission.

$$\frac{\text{Total number of IP deaths (A\&C + NB) – IP deaths < 48 hrs of admission}}{\text{Total number of discharges – IP deaths < 48 hrs of admission}}$$

Newborn Death Rate: proportion of all NB discharges from hospital that end in death

$$\frac{\text{Total number of newborn deaths for a period}}{\text{Total number of newborn infant discharges for the period}}$$

Postoperative Death Rate/Surgical Death Rate: Refers to the number of *deaths that occur after an operation* has been performed, *within 10 days* after surgery. *This may also be specific to operations. E.g. bowel resection, Lumpectomy, etc.*

$$\frac{\text{Total number of deaths (within 10 days of surgery)}}{\text{Total number of patients who were operated on for the same period}}$$

Anesthesia Death Rate: Refers to the number of deaths *caused by anesthetic agents*.

$$\frac{\text{Total number of deaths caused by anesthetic agents}}{\text{Total number of anesthetics administered}}$$

Maternal Death Rate: Refers to the *death of any woman*, from any cause, *related to or aggravated by pregnancy* or its management. In other words, directly related to pregnancy.

$$\frac{\text{Number of direct maternal deaths for a period}}{\text{Number of obstetrical discharges for the period}}$$

Fetal Death Rate: Refers to the rate of death of intermediate/late fetuses among those pregnancies that lasted beyond 20 weeks for a period.

$$\frac{\text{Total number of intermediate and/or late fetal deaths for a period}}{\text{Total number of live births + Intermediate and late fetal deaths for the period}}$$

Discharges: Death Rates examples

Example 1: Snowflake Hospital recorded the following data for May:

	Admissions	Discharges	all	Deaths
A&C	680	591	44	>48hrs 40
Newborn	56	50	2	2
Calculate:				

- Gross death rate
- Net Death Rate
- Newborn gross death rate

Example 2: Using the following information from appendix 2 (Dunchurch Hospital for February 2009) calculate the following, A&C deaths = 6, discharges = 365; NB deaths = 1, discharges = 75.

- Gross death rate for February
- Given that 2 of the A&C deaths took place within 48 hours of admission: Find the net death rate for February.
- What is the NB death rate for February?

Answers to Example 1:

a. Gross Death rate = $(44+2)/(591+50) = .07176 = 7.18\%$

b. $(40+2)/(591-4+50) = 0.06593=6.59\%$ c. $2/50 = 0.04 = 4\%$

Example 2:

a. $(6+1)/(365+75) = 0.0159 = 1.59\%$ b. $(6 - 2 + 1)/(365 + 75 - 2) = 0.011416 = 1.14\%$

c. $1/(75) = 0.13333 = 1.33\%$;

Exercises: Death Rates: Note: For all hospitals below 'Discharges' include deaths.

1. Snowflake Hospital recorded the following data for May:

	Admissions	Discharges	Deaths	
			<48 hrs	>48hrs
A/C	686	691	6	30
NB	58	60	1	4

Calculate:

- gross death rate
- net death rate
- newborn mortality rate

2. The following data are recorded for November:

Service	Admissions	Deaths		Discharges
		<48hrs	>48hrs	
Medical	250	5	20	261
Surgical	150	2	8	103
Pediatric	33	0	2	35
Obstetrical	36	1	0	34
Psychiatric	47	1	0	45
Newborn	40	1	1	38

Calculate:

- gross death rate
- net death rate
- newborn death rate
- Net death rate for medical service
- Clinical service with the lowest gross death rate

Exercises: Death Rates - continued:

3. A newborn nursery reports the following data for February:

Bassinet count	15
Births (NB)	88
Discharges	84
Newborn deaths	2 (1 under 48hrs; 1 over 48hrs)
Fetal deaths	5 (2 early; 2 intermediate; 1 late)
IP service days	398

Calculate: NB death rate for February

4. Morris County Hospital reports the following for November:

	Admissions	Live Discharges	Deaths	
			<48hrs	>48hrs
Adults/Children	386	388	4	12
Newborn	91	95	1	2

Calculate:

a. gross death rate for November

b. net death rate for November

c. newborn mortality rate for November

d. gross death rate for A&C for November

e. fetal death rate for November

5. A hospital newborn nursery reports a total of 234 births during the month of July. During the same month there were a total of four deaths – two newborn and two fetal deaths. One of the newborn deaths occurred under 48 hours after admissions; the other occurred over 48 hours. During July a total of 238 newborns were discharged. The bassinet count for the month was 15.

Calculate: the newborn death rate for July

Exercises: Death Rates - continued:

6. June statistics:

Admissions – adults/children	650		
newborn	55		
Discharges – including deaths			
adults	602		
children	45		
newborn	57		
Deaths – medical	28	<48hrs	>48hrs
Surgical	3	4	24
Pediatric	1	1	2
Obstetric	1	0	1
Newborn	1	0	1
Fetal (intermediate & late)	2	1	1
	3		

Calculate:

- a. gross death rate for June

- b. net death rate for June

- c. newborn death rate for June

- d. fetal death rate for June

7. Feel Good Hospital during August reported the following surgical statistics:

Admissions	193	
Discharges	189	
Deaths	7	(3 under 48hrs; 4 over 48hrs) (5 under 10 days; 2 over 10 days)
Operations performed	210	
Patients operated on	188	

Calculate the postoperative death rate for August

Exercises: Death Rates - continued:

8. Chastity Hospital reports the following surgical data for the year:

Admissions	1843	
Discharges	1849	
Deaths	40	(of which 9 are < 48 hrs; 31 are > 48hrs) (12 are < 10 days postop; 28 are > 10 days postop) (2 reported due to anesthetic agent)
Operations performed	2010	
Patients operated on	1852	
Anesthetics administered	1854	

Calculate:

- anesthetic death rate for the year
- postoperative death rate for the year
- gross death rate for the surgical department for the year
- net death rate for surgical patients for the year

9. In July, Blessing Hospital reported the following surgical data:

Admissions	258	
Discharges	262	
A&D	45	
Deaths	9	(2 under 48 hrs; 7 over 48 hrs) (4 under 10 days postop; 5 over 10 days postop) (0 due to anesthetic agent)
Anesthetics administered	298	
Surgical procedures performed	301	
Patients operated on	260	

Calculate:

- anesthesia death rate for July
- postoperative death rate for July
- gross death rate for surgical patients for July
- net death rate for surgical patients for July

Discharges: Autopsy Rates

Key Terms

Inpatient (IP) death – patient died in hospital as an inpatient at time of death (includes A&C + NB)

Outpatient (OP) death – patient died in hospital (or arrived DOA) but wasn't admitted at time of death.

Autopsy - examination of dead body to determine the cause of death

Hospital Inpatient Autopsy – autopsy performed on the body of an inpatient by a hospital pathologist.

Hospital Autopsy – autopsy performed on either the body of an inpatient or outpatient by a hospital pathologist. (technically includes 'postmortem examination of the body who has *at some time been a hospital patient*'... including home care or even body found beside roadway of former patient.)

Coroner's case – bodies that are **removed** by the government appointed coroner for autopsy. A case labeled as a coroner's case is removed unless explicitly stated otherwise. Coroner's cases cannot be counted in the numerator for any of the autopsy rates. Also known as Medical Examiner's Case.

Available for Autopsy: all inpatient deaths are available for autopsy except for those coroner's cases removed by the coroner. Only those outpatients that are autopsied are considered available for autopsy (Outpatients (OP) will include those bodies who *at some had been a hospital patient*).

Special case: If the coroner asks a hospital pathologist to perform an autopsy the body is not considered as removed, and is counted as a hospital autopsy.

Gross Autopsy Rate: $\frac{\text{\# of hospital inpatient autopsies (A\&C + NB)}}{\text{\# of inpatient deaths}}$
$$\frac{\text{\# of hospital inpatient autopsies for a period}}{\text{Total inpatient deaths for the period}}$$

Net Autopsy Rate: $\frac{\text{\# of all hospital inpatient autopsies (A\&C + NB)}}{\text{\# of inpatient deaths minus coroner's cases removed for autopsy}}$
$$\frac{\text{\# of hospital inpatient autopsies for a period}}{\text{Total inpatient deaths - coroners' cases that were removed}}$$

Hospital Autopsy Rate: $\frac{\text{\# of hospital autopsies (A\&C + NB + OP)}}{\text{\# of inpatient deaths (A\&C + NB) - coroner's cases (that were removed) + OP deaths that were autopsied}}$
$$\frac{\text{\# of hospital autopsies for a period}}{\text{Total number of deaths whose bodies are available for hospital autopsy}}$$

Newborn Autopsy Rate: $= \frac{\text{\# number of hospital inpatient autopsies on newborns for a period}}{\text{\# of newborn deaths for the period}}$

Fetal Autopsy Rate: $= \frac{\text{\# of autopsies on intermediate/late fetal deaths for a period}}{\text{\# of intermediate/late fetal deaths for the period}}$

In class practice In a one month period a hospital had 6 A&C and 1 NB deaths.

Given information on hospital inpatient autopsies for A&C = 4, Cor = 1, NB = 1

Additional information on outpatients 3 deaths, 2 Hospital autopsies, 1 Coroner's case

- a. Calculate Gross autopsy rate: b. Net autopsy rate: c. NB autopsy rate: d. Hospital autopsy rate:

a. $4+1/(6+1) = 5/7 = 71.43\%$ b. $(4+1)/(6 + 1 - 1) = 5/6 = 83.33\%$ c. $1/1 = 100\%$ d. $(4+1+2)/6+1 - 1 + 2) = 7/8 = 87.5\%$

Exercises: Autopsy Rates - continued

5. A hospital with 250 beds recorded 6 deaths for the month of September. During this period there were 315 discharges of adults/children. The bassinet count was 18, and 95 newborns were discharged as well, with no newborn deaths recorded. The OP department recorded 5 OP deaths, 2 of which were reported from the emergency room. Autopsies were performed on 3 inpatients and 3 outpatients.

Calculate:

a. September hospital autopsy rate

b. Gross autopsy rate for September

6. Newborn figures for October:

Admissions	223
Discharges	225
Deaths	2
Autopsies	1
Fetal deaths	5 (2 early; 2 intermediate, 1 late)
Fetal autopsies	1 (done only on late fetal death)

Calculate the newborn autopsy rate for October

Exercises: Autopsy Rates - continued

7. Second-quarter statistics from General Hospital contained the following data:

Inpatients:		Hospital	Coroner's
Month	Deaths	Autopsy	Cases
April	7	4	1
May	6	3	0
June	9	4	2

Outpatients:		Hospital	Coroner's
Month	Deaths	Autopsy	Cases
April	3	2	1
May	4	2	1
June	5	2	2

Calculate:

- a. Net autopsy rate for the period

- b. Gross autopsy rate for the period

- c. Hospital autopsy rate

Exercises: Autopsy Rates - continued

10.

PCU	Adm.	Disch.	Deaths	<u>Hospital Autopsies</u>		Removed by coroner
				Yes	No	
Medical	467	461	27	8	18	1
Surgical	102	98	5	2	2	1
Pediatrics	70	65	1	1	0	0
OB	332	330	1	1	0	0
GYN	65	62	0	0	0	0
Orthopedics	63	65	1	0	1	0
Neurology	26	27	3	2	0	1
NB	277	275	1	0	1	0
Totals	1402	1383	39	14	22	3
Outpatient	xxx	xxx	7	4	2	1

Calculate:

- a. Newborn autopsy rate

- b. Gross autopsy rate

- c. Net autopsy rate

- d. Net autopsy rate for the medical unit

- e. Gross autopsy rate for the surgical unit

- f. Hospital autopsy rate

Discharges: Other Rates

Bed Turnover Rate: A unit of measure denoting the rate of change of patients per bed. How many different occupants occupied the average bed.

Bed Turnover Rate Direct:

$$\frac{\text{Number of discharges (including deaths) for a period}}{\text{Average bed count (per day) during the period}}$$

Bed Turnover Rate Indirect:

$$\frac{\text{Occupancy rate} \times \text{number of days in a period}}{\text{Average length of stay}}$$

Nosocomial Infection Rate (Hospital Acquired Infection Rate): Refers to infections that were *acquired in the hospital*.

$$\frac{\text{Total number of nosocomial infections for a period}}{\text{Total number of discharges (including deaths) for the period}}$$

Infection Rate: Refers to the number of *all infections* divided by the number of discharges (including deaths) *May be calculated separately for any individual type of infections*

$$\frac{\text{Total number of infections in a period}}{\text{Total number of discharges (including deaths) for the period}}$$

Consultation Rate: Refers to the total number of patients that received a consultation divided by the total number of patients discharged (including deaths)

$$\frac{\text{Total number of patients receiving a consultation}}{\text{Total number of patients discharged (including deaths)}}$$

In Class Practice

Example 1. Bed turnover rate

Given: In May there were 450 discharges with a bed count of 62 find the direct bed turnover rate.

Bed turnover rate =

Example 2. Given that the ALOS for Dunchurch hospital (see chart appendix 2 for details) for

February (28 days total) is 5.388, there were 365 discharges, IPSD was 1708, and bed count was 91.

a. Find direct bed turnover rate =

b. Find indirect bed turnover rate (first need bed occupancy for February)

Bed occupancy for Feb:

Indirect bed turnover rate:

answers

1. $450/62 = 7.258$;

2. a. $(317+48)/91 = 4.01$ b. bed occupancy = $1708/(91 \times 28) = 1708/2548 = .6703$; Indirect bed turnover rate = $(.6703 \times 28)/5.388 = 3.48$ (close to direct bed turnover rate. It would be exact except the ALOS is an estimate!)

Exercises: Discharges - Other Rates

Exercise 1: A 200-bed hospital recorded the following during the past year:

Discharges	7000
Average LOS	8.5 days
Bed occupancy rate	82%

Calculate:

- a. The bed turnover rate direct

- b. The bed turnover rate indirect

Exercise 2: Shoreline Hospital reported the following during the past non-leap year:

	<u>A&C</u>	<u>NB</u>
Bed/bassinet count	250	15
Admissions	9205	1256
Discharges(includes deaths)	9180	1245
Deaths	103	5
IPSD	69, 608	4846
Discharges days	70, 150	4888

Calculate:

- a. Bed turnover rate direct

- b. Bed turnover rate indirect

- c. Bassinet turnover rate direct

- d. Bassinet turnover rate indirect

Appendix 1: Healing Through Hope Hospital: 2006 data

Beginning census: A&C = 180, NB = 10

	Dates	Bed Count	Bassinet Count
Period A	Jan 1 - Apr 30	300	30
Period B	May 1 - Aug 31	320	30
Period C	Sep 1 - Dec 31	315	30

Admissions:	A&C	NB
Period A	6036	648
Period B	6588	661
Period C	6271	653

Discharges:	A&C	NB
Period A	6025	645
Period B	6567	662
Period C	6272	650

IPSD:	A&C	NB
Period A	34 227	1944
Period B	36 540	2015
Period C	36 475	1988

DD:	A&C	NB
Period A	20 316	1977
Period B	23 129	2021
Period C	21 533	2004

Surgeries	Total	procedures	postop infections
Period A	235	264	12
Period B	356	374	6
Period C	227	256	21

Appendix 2 Admissions data on spreadsheet (Excel) – see excel chart below

Now that you have some sense of how hospital patients are classified and are comfortable calculating a few rates, you are ready to extract that information from an actual spreadsheet used at an Ontario hospital. The spreadsheet is real, but the hospital and patient information is not.

Note 1: This the the format and terminology used in one hospital – the formats are not standardized throughout Ontario... yet 😊

Note 2: All rate formulas and calculations from previous pages remain the same. The challenge is finding the information on the chart.

Preparation: take a careful look throughout Appendix 2. Read all column and row information carefully – a larger format of the chart is posted on www.stataras.com.

Note1: The summary is for a complete month – in this case February. The first column (content includes numbers 1-28) represent the days of the month – it was not a leap year.

Note2: as you would expect information for Adults and Children (here called Adults and Pediatrics) is kept separately (columns 2-9) from Newborns (columns 25-32)

Note 3: IPSD is named Total Patient Days (column 9); #Discharged (column 5) does not include A&D(column 8)

Note 4: there is a large series of columns that breaks down the data by various wards – or types of service (columns 10 – 23) Note that the total (column24) is exactly the same as column 9.

Note 5: Beds available is to be found in the last row under ‘beds staffed and in operation’.

Note 6: Make sure to spend time getting to know the chart – think slowly.

Make sure to spend time with this sheet before doing questions.

Example 1: Find the following inpatient statistics using Daily census summary in appendix2 (answers at the bottom of the page)

- a. IPSD for February 12th = b. Total IPSD for Feb 1 – 4th =



Example 2: Calculate the following using the excel chart (Daily Census summary) in appendix 2.

- a. The bed count for every day of February is:
- b. The bed occupancy rate for February 1st is:
- c. The bassinet occupancy rate for February 1st is:
- d. The bed occupancy rate for February 1-7 is:

answers

Example 1: a. $IPSD \text{ for February } 12^{\text{th}} = 51 + 1 = 52$ (52 at start of day + 10 – 11 + 1A&D = 52) b. $47+47+47+46=187$
Example 2 : a. 91; b. $47/91 = 51.65\%$ c. $5/13 = 38.46\%$ d. $(367/(91*7))=57.61\%$

Appendix 2: Dunchurch Hospital A&C census summary

Daily Census Summary			Facility Number: 171 Dunchurch Hospital Dunchurch ,Ontario			Send to: Dosyt Zymy, Ministry of Health and Long-Term Care			e-mail:																			
Submit	Hospital Info	Import old version file	Master Number: 2208	Acute	Period: 2008/2009	February	1177 Yonge St. 4th Floor	Snort York ON, M2R 4K5	tel: (416) 377-7777	fax: (416) 377-7776																		
Day of Month	Movement of Adults and Paediatrics (A)								Days by Type of Beds assigned to type of service-Adult and Pediatric Patient																			
	In Residence at start of day	Admitted during day	Total Patients under care	Discharged during day (no A&D)	Died during day	In Residence at end of day	Total Admitted and Discharged same day	Total Patient Days (IPSD)	Medical	Surgical	Combined Medical & Surgical (separa	Intensive Care and Coronary care	Obstetrics	Paediatric	Emerg. Dept.	(C) Mental Health							Chronic or Rehab	Total Patient Days (IPSD)				
Functional Centre								7* 2 10* & 7* 2 42 10 & 7* 2 12 11	7* 2 20* & 7* 2 42 20 & 7* 2 42 30	7* 2 30* & 7* 2 42 30	7* 2 40* Excluding 7* 2 40	7* 2 50*	7* 2 70*	7* 3 10*	7* 2 76 25*	7* 2 76 45*	7* 2 76 50*	7* 2 76 55*	7* 2 76 90*	7* 2 76 95*	7* 2 95 20 or 7* 2 81 10							
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)					
1	45	7	52	6	1	46	1	47	2	4	3	6	12	5	9	1	1	0	0	2	1	1	47					
2	46	13	59	15	0	44	3	47	4	4	5	7	11	3	8	1	0	1	0	1	1	1	47					
3	44	15	59	13	1	46	1	47	4	5	3	9	11	6	7	1	0	0	0	0	1	0	47					
4	46	12	58	14	0	44	2	46	3	2	5	7	15	5	5	1	1	0	1	0	1	0	46					
5	44	14	58	6	0	52	1	53	4	3	6	8	14	7	7	0	0	1	1	0	1	1	53					
6	52	22	74	10	0	64	3	67	5	6	8	17	12	5	8	1	1	1	0	1	1	1	67					
7	64	7	71	12	1	59	1	60	4	5	9	13	7	7	10	2	2	0	0	0	1	0	60					
8	59	5	64	13	0	51	0	51	4	2	5	11	5	8	10	2	2	0	0	0	1	1	51					
9	51	9	60	15	0	45	2	47	3	1	4	9	7	7	11	0	0	2	0	0	1	2	47					
10	45	21	66	11	0	55	1	56	4	2	5	9	8	11	9	1	1	2	0	1	1	2	56					
11	55	14	69	17	1	52	3	55	3	1	5	12	10	11	9	1	1	0	0	1	1	0	55					
12	52	10	62	11	0	51	1	52	2	2	4	9	9	9	12	2	0	1	0	0	1	1	52					
13	51	9	60	7	0	53	2	55	3	2	8	9	10	9	9	0	1	1	0	1	1	1	55					
14	53	12	65	7	0	58	0	58	4	1	6	12	9	12	9	0	1	0	0	1	1	2	58					
15	58	21	79	6	1	73	1	74	5	3	9	22	9	9	10	1	0	1	1	2	1	1	74					
16	73	12	85	14	0	71	1	72	6	3	5	21	11	11	11	1	0	0	0	1	1	1	72					
17	71	7	78	9	0	69	3	72	4	2	7	22	11	12	11	1	1	0	0	0	1	0	72					
18	69	8	77	6	0	71	1	72	5	3	8	19	13	10	10	0	1	1	0	0	1	1	72					
19	71	15	86	12	0	74	4	78	7	6	4	21	13	10	12	1	0	1	0	1	1	1	78					
20	74	17	91	16	0	75	1	76	6	4	7	20	12	12	12	1	1	0	0	0	1	0	76					
21	75	11	86	13	0	73	0	73	5	4	5	19	11	12	10	0	2	1	0	2	1	1	73					
22	73	10	83	16	0	67	0	67	6	5	6	14	9	11	9	1	1	1	0	1	1	2	67					
23	67	9	76	10	1	66	3	69	7	4	5	12	8	12	12	2	0	2	0	2	1	2	69					
24	66	5	71	12	0	59	2	61	6	5	4	10	10	11	10	1	1	0	0	2	1	0	61					
25	59	14	73	15	0	58	1	59	4	3	5	9	9	13	11	1	1	1	0	0	1	1	59					
26	58	15	73	11	0	62	5	67	4	4	6	12	8	12	14	1	2	1	0	1	1	1	67					
27	62	10	72	11	0	61	2	63	5	2	7	9	7	15	11	0	1	2	0	1	1	2	63					
28	61	9	70	9	0	61	3	64	3	4	6	13	9	13	9	1	1	1	0	2	1	1	64					
Total for Month	1644	333	1977	317	6	1660	48	1708	122	92	160	361	280	268	275	25	23	21	3	23	28	27	1708					
	1	2		3	4		5		6	7	8	9	10	11	12	13	14	15	16	17	18	19						
 Ministry of Health and Long-Term Care									Beds Staffed and in Operation																			
									8	7	9	23	15	15		2	2	2	2	2	2	2	2	2	2	2	2	91
Effective: 2004.03.11									Version: 1.3.2																			
Revised: 2004.04.21																												

Appendix 2 – Dunchurch Hospital census summary (Newborns Census) and more.

(D) Movement of Newborn								(E) Newborn Days					(F) Paediatric Days in Nursery			
In Residence at start of day	Admitted during day	Total Newborn under care	Discharged during day (no A&D)	Died during day	In Residence at end of day	Total Admitted and Discharged or died	Total Newborn days	In Regular and Special Nursery			Not In Regular and Special Nursery	Total Newborn days	In Regular and Special Nursery			Total Paediatric days in Nursery
								Level I - General	Level II - Intermediate	Level III - ICU neonatal			Level I - General	Level II - Intermediate	Level III - ICU neonatal	
								7*2 50 60*7*2 50 80 20 7*250.00	7*2 50 80 40	7*2 40 50			7*2 50 60*7*2 50 80 20 7*250.00	7*2 50 80 40	7*2 40 50	11
(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
5	2	7	3	0	4	1	5	3	1	0	1	5				0
4	3	7	1	0	6	0	6	3	2	1	0	6				0
6	1	7	1	0	6	0	6	4	1	1	0	6				0
6	2	8	3	0	5	1	6	4	0	1	1	6				0
5	1	6	2	0	4	0	4	3	0	1	0	4				0
4	3	7	2	0	5	0	5	3	1	1	0	5				0
5	1	6	3	0	3	0	3	2	0	1	0	3				0
3	0	3	2	0	1	0	1	0	0	1	0	1				0
1	2	3	0	0	3	0	3	2	0	1	0	3				0
3	3	6	4	0	2	0	2	1	0	1	0	2				0
2	3	5	1	0	4	1	5	3	0	1	1	5				0
4	1	5	0	0	5	1	6	4	0	1	1	6				0
5	2	7	1	0	6	2	8	5	1	0	2	8				0
6	0	6	0	0	6	0	6	5	1	0	0	6				0
6	1	7	1	1	6	2	8	6	0	0	2	8				0
6	1	7	1	0	6	0	6	4	2	0	0	6				0
6	3	9	3	0	6	1	7	5	1	0	1	7				0
6	1	7	4	0	3	1	4	3	0	0	1	4				0
3	4	7	2	0	5	0	5	4	1	0	0	5				0
5	1	6	2	0	4	3	7	2	1	1	3	7				0
4	3	7	4	0	3	0	3	2	0	1	0	3				0
3	4	7	3	0	4	0	4	3	0	1	0	4				0
4	2	6	2	0	4	1	5	2	0	2	1	5				0
4	4	8	3	0	5	1	6	3	0	2	1	6				0
5	3	8	1	0	7	0	7	5	0	2	0	7				0
7	2	9	4	0	5	0	5	4	0	1	0	5				0
5	4	9	3	0	6	0	6	5	0	1	0	6				0
6	4	10	4	0	6	0	6	5	0	1	0	6				0
					0											0
					0											0
					0											0
129	61	190	60	1	130	15	145	95	12	23	15	145	0	0	0	0
20	21		22	23		24		26	27	28	29		30	31	32	
								Bassinets Staffed and in Operation:	7	3	3		13			

HOSPITAL INFORMATION	
Hospital Name	Dunchurch Hospital
Facility Number	171
Master Number	2208
Address (Street)	717 Wabash Road
Address (Location)	Dunchurch ,Ontario
Address (Postal Code)	H2I 7L7
Type of Unit	Acute
Month	11 February
Fiscal Year	2008/2009
Completed by	
Telephone Number	
E-mail Address	
Authorized by	
ADDITIONAL INFORMATION	
Average Length of Stay:	
Adults and Paediat	5.388012618
Newborns	2.41666667
Number of LOA patients:	
(> 3 and <91 days)	0
Number of Stillborns	0