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N442 Population and Global Health

Rate Calculation Work Sheet

Rate: is a measure of the frequency of a health event in "a defined population, usually in a specified period of time." (Porta, 2009, p 207) It is a ratio of one number to another, but it is not a proportion (percentage), because the denominator is a function of both the population size and the dimension of time, whereas the numerator is the number of events (Stanhope & Lancaster, 2016, p262)

Three categories:

Crude: Rates computed for a population as a whole

Specific: Rates calculated for subgroups of a population

Adjusted: Rates calculated to compare populations with different distributions of a factor known to affect the health condition of interest.

Two types of rates are especially important in epidemiology. These are morbidity (illness) and mortality (death) rates. There are several specialized rates in each of these two broad categories.

Some examples of these specialized **mortality (death) rates** are:

1. **Crude death rate:** the proportion of the population that has died from **any** cause irrespective of age.

Example: $\frac{\# \text{ of deaths in Illinois}}{\text{Total estimated mid-year Population of Illinois}} \times 100,000 = \text{crude death rate}$

2. **Age-specific rate:** the number of deaths among persons of a **given age group**.

Example: $\frac{\# \text{ of deaths of persons 18-30 years old in Illinois}}{\# \text{ total estimated mid-year Population of Illinois}} \times 100,000 = \text{Age specific death rate}$

3. **Cause-specific rate:** the number of deaths from a **specific cause**

Example: Cancer $\frac{\# \text{ of deaths for cancer from Illinois}}{\# \text{ Total Population}} \times 100,000 = \text{rate}$

4. **Case-fatality rate:** number of deaths from a **specific cause** within a **given period**.

$\frac{\# \text{ of deaths from breast cancer in Illinois}}{\text{Among all individuals diagnosed with the disease over a certain period of time}} \times 100,000 = \text{rate}$

Note: Case fatality rate typically is used as a measure of disease severity and is often used for prognosis (predicting disease course or outcome), where comparatively high rates are indicative of relatively poor outcomes.

EPIDEMIOLOGY EXERCISES
 INFANT MORTALITY, CHICAGO COMMUNITY AREAS

TABLE 1

	COMMUNITY AREA	# of LIVE BIRTHS	DEATHS UNDER ONE YEAR	
			#	RATE PER 1000 BIRTHS
				12.3
01.	Rogers Park	1,054	13	5.1
02.	West Ridge	966	5	19.4
03.	Uptown	1,340	26	17.1
04.	Lincoln Square	760	13	11.5
05.	North Center	610	7	29.0
27.	East Garfield Park	763	19	25.4
28.	Near West Park	1,338	34	27.4
36.	Oakland	295	8	20.0
39.	Grand Boulevard	1,209	24	23.1
40.	Washington Park	735	17	20.7
68.	Englewood	1,303	27	33.5
73.	Washington Heights	507	17	16.6
	CHICAGO	55,216	914	12.5
	UNITED STATES	--	--	

A. Fill in the blank columns in Table 1 using the formula to calculate infant mortality rate. Use 1,000 as your multiplier and round the answer to the nearest tenth.

B. Compare the infant mortality rate you calculated for Lincoln Square with that of East Garfield Park. Are they the same or different?

*They are different.
 East Garfield Park is higher.*

C. What general trends, if any, are apparent from these data?

NO trend?

D. Compare the infant mortality rate of the City of Chicago with that of the United States. Are the rates the same or different? What factors may account between Chicago and the United States affect these rates?

The City of Chicago is higher than the United States. The lack of available health care for people in poverty may be a factor.

Calculate the following rates using the information provided.

1. The total death in County Z last year was 6,092. The population of County Z last year was 524,263. What was the crude death rate? Use 100,000 as the multiplier. Round to the nearest whole number.

$$\frac{6,092}{524,263} \times 100,000 \approx 1,162$$

2. There were 4,953 deaths from neoplasms in City B during the past year. The year-end population was 3,495,678. What was the specific cancer death rate for last year? Use 100,000 as the multiplier. Round to the nearest whole number.

$$\frac{4,953}{3,495,678} \times 100,000 = 142$$

3. The population of the US in 2000 was 99,421,906. The number of deaths from heart disease in the US in 2000 was 710,760. The total number of deaths in the US in 2000 was 2,403,351.

- a Calculate the percentage (%) of heart disease deaths for the US in 2000. Round to the nearest whole number.

$$\frac{710,760}{2,403,351} \times 100 = 30\%$$

- b Calculate the rate of heart disease deaths in the US in 2000 for the US. Use 100,000 as the multiplier. Round to the nearest whole number.

$$\frac{710,760}{99,421,906} \times 100,000 = 715$$

4. In Illinois in 2000, the population was 12,419,293. The number of Salmonella cases in 2000 was 1,502 in Illinois. Calculate the incidence rate for Salmonella for Illinois in 2000. Use 100,000 as the multiplier. Round to the nearest whole number.

$$\frac{1,502}{12,419,293} \times 100,000 = 12.09 \approx 12$$

5. There were 45,238 neonatal deaths out of 5,672,000 live births in City F. Calculate the neonatal mortality (death) rate. Use 1,000 as the multiplier. Round to the nearest whole number.

$$\frac{45,238}{5,672,000} \times 1,000 = 8$$

6. The population in Sangamon county in 2000 was 188,951
- a The number of live births in Sangamon County in 2000 was 2,646. Figure the Live Birth rate for Sangamon country for 2000. Use 1,000 as the multiplier. Round to the nearest whole number.

$$\frac{2,646}{188,951} \times 1,000 = 14$$

- b The number of infant deaths in Sangamon County in 2000 was 18. Figure the infant mortality rate for Sangamon country for 2000. Use 1,000 as the multiplier. Round to the nearest whole number.

$$\frac{18}{2,646} \times 1,000 = 7$$

7. A city has a population of 250,000. Of these, 10,000 have disease X, which is incurable. There are 1,000 new cases and 400 deaths each year from this disease. There are 2,500 deaths per year from all causes. What is the prevalence rate based on a multiplier 100,000. Round to the nearest whole number.

$$\frac{10,000}{250,000} \times 100,000 = 4,000$$

	Quintile of CRP Level				
	1	2	3	4	5
	0-0.49 mg/dL	>0.49-1.08 mg/dL	>1.08-2.09 mg/dL	>2.09-4.19 mg/dL	>4.19 mg/dL
Relative Risk	1.0	1.8	2.3	3.2	4.5
Number of women	6000	6000	6000	6000	6000

8. Based on the relative risk data above, one can conclude:
- a There is no risk of heart attack/stroke for women with CRP levels in the first quintile.
 - b Decreasing CRP level appears to increase the risk of heart attack/stroke.
 - c Increasing CRP level appears to increase the risk of heart attack/stroke.**
 - d There appears to be no association between CRP levels and heart attack/stroke.

9. In 2020, the population of Illinois is 12.63 million. Total cases of COVID-19 is 900,370. Using 100,000 as a multiplier, what is the period prevalence rate? Round to the nearest whole number.

$$\frac{900,370}{12.63 \text{ million}} \times 100,000 = 7,129$$

↓
12,630,000

10. In 2020, the population of Illinois is 12.63 million. The total deaths from COVID-19 is 128,000. Using 100,000 as a multiplier, what is the cause-specific mortality rate? Round to the nearest whole number.

$$\frac{128,000}{12.63 \text{ mil}} \times 100,000 = 1,014$$

↓
12,630,000