Chapter 3 Homework

1. One function of the World Health Organization is to provide data on world health problems to member countries.

a. Describe three ways in which health data are used to improve world health.
b. Discuss the challenges of obtaining health data in the developing world.
c. What is the goal of the '3 by 5' initiative of the WHO? Why is this important in developing countries? Describe how collection of health data is important in assessing whether the WHO has met their goal.

2. Incidence and prevalence:

a. Explain the difference between *incidence* and *prevalence* of a disease.
b. Which would you expect to be higher: the *incidence* of the flu or the *prevalence* of the flu? Why?
c. Which would you expect to be higher: the *incidence* of HIV/AIDS or the *prevalence* of HIV/AIDS? Why?

3. The software Gapminder can be found at: http://tools.google.com/gapminder/ and provides a useful graphical tool to explore trends in health and demographic data throughout the world.

a. Watch the video: http://www.gapminder.org/video/talks/ted-2007---the-seemingly-impossible-is-possible.html
b. Using Gapminder, build a graph that shows the relationship between life expectancy at birth and per capita income from 1975 to 2004.
c. Compare trends in life expectance and income over time in the US, China, Botswana, Malawi, Lesotho and Swaziland. What do you think is responsible for the differences that you observe?

4. Use the data in the chart to answer the following questions.

Country	GDP per capita	Life expectancy at birth for males	Total health expenditures per capita	Total health expenditures as % of GDP
United States	$34,637	74.3	$4,499	13%
Canada	$27,956	76.6 years	$2,534	9.1%
India	$1,461	60 years	$71	4.9%
Angola	$1,457	34.1 years	$52	3.6%

a. Make a graph that shows the life expectancy at birth for males vs. the total health expenditures as a percentage of the GDP for these four countries. Include a title and axis labels.
b. List three reasons that life expectancy is lower in Angola than in Canada and the US.
c. HAART is a highly effective treatment for HIV infection. Do you think that a poor citizen living in each of these four countries would have access to HAART? Why or why not?

5. Use the information in the chart to answer the questions that follow.

Country	Population	Gross Domestic Product (GDP) Per Capita	Total Health Expenditure Per Capita	Estimated annual incidence rate of tuberculosis per 100,000 population
Brazil	172,558,000	$7,548	$631	64
India	1,025,095,000	$1,461	$71	178
Uganda	24,022,000	$932	$36	324

a. For each of the three countries shown, calculate the approximate number of new cases of tuberculosis each year.
b. Make a graph that shows estimated annual incidence rate of tuberculosis (per 100,000 population) vs. total health expenditure per capita for these three countries. Include a title and labels.
c. For each of the three countries shown, calculate the percentage of the gross domestic product (GDP) that is spent on health expenditures.
d. Make a graph that shows percentage of GDP spent on health expenditures vs. GDP per capita for these three countries. Include a title and labels. Based on your knowledge of the U.S. health care system, describe where you think the United States would lie on this graph.

6. In December 2003 an earthquake with magnitude of 6.7 on the Richter scale hit the city of Bam, Iran. More than 41,000 people are believed to have died. The earthquake destroyed approximately 20,000 homes and almost completely destroyed health facilities in the area. Immediately following the earthquake, the WHO cited the danger of outbreak of endemic diseases such as cholera, typhoid fever, malaria and leishmaniasis as a critical priority. Before the earthquake, the total population of Bam District was 240,000. The point prevalence of cholera was 3 per 100,000 population. The point prevalence of malaria was 109.1 per 100,000 population.

a. Calculate the approximate number of cases of cholera and malaria in Bam District before the earthquake.
b. Suppose a survey after the earthquake finds 43 cases of cholera in Bam District. How many times greater is the point prevalence of cholera compared to pre-earthquake levels? Include the change in population in your calculation.
c. In a post-earthquake survey, how many cases of malaria in Bam District would it take to represent a ten-fold increase in the point prevalence of malaria compared to pre-earthquake levels? Include the change in population in your calculation.

7. In 1994, the WHO published estimates of the expected number of new cases of TB as well as deaths due to TB expected throughout the world in 1990, 1995 and 2000. In addition, the WHO published estimates of the fraction of these cases and deaths that were attributed to HIV co-infection. The tables below summarize some of these data.

TB Cases and Deaths in Africa

Year	New Cases of TB	Incidence Rate per 100,000 population	New HIV Attributed TB cases	Deaths due to TB	HIV Attributed TB Deaths
1990	992,000	191	194,000	393,000	77,000
1995	1,467,000	242	380,000	581,000	150,000
2000	2,079,000	293	604,000	823,000	239,000

TB Cases and Deaths in Industrialized Countries

Year	New Cases of TB	Incidence Rate per 100,000 population	New HIV Attributed TB cases	Deaths due to TB	HIV Attributed TB Deaths
1990	196,000	23	6,000	14,000	500
2000	211,000	24	26,000	15,000	2,000

a. Compare the trends predicted in the incidence rate of TB in Africa to that seen in industrialized countries between 1990 and 2000.
b. Calculate the predicted mortality rate of TB per 100,000 population in Africa in 1990 and 2000. Compare that to the mortality rate of TB predicted in industrialized countries in the same period.
c. Do you think that increases predicted in the number of new cases of TB in Africa represent demographic changes or epidemiologic changes? Justify your answer.

8. Recent violence in the Darfur region of Sudan has displaced large numbers of people, resulting in a major humanitarian crisis. The table below, from the United Nations Office for the Coordination of Humanitarian Affairs, lists mortality cases among internally displaced persons (IDPs) in one particular refugee camp in Sudan during April 2004, when the camp had a population of approximately 17,750 internally displaced persons.

Mortality Cases amongst IDPs in Kalma Camp during April 2004

April	Total deaths	Age group				Cause of death				
		< 1 yr.	< 5 yr.	5-15 yr.	> 15 yr.	ADD	Measles	Malaria	MN	ARI
Total	**114**	**11**	**74**	**21**	**8**	**78**	**7**	**10**	**8**	**11**

ADD: Acute Diarrhoea Diseases, ARI: Acute Respiratory Infections, MN: Malnutrition
http://www.reliefweb.int/rw/rwb.nsf/AllDocsByUNID/32e427b169a1004085256e8a004f2a1f

a. Calculate the mortality rate in Kalma Camp during April 2004. Express your answer as "number of deaths per 1,000 population per month."
b. At the current rate, how many times higher is the mortality rate in Kalma Camp than the baseline annual mortality rate in Sudan (9.59 deaths per 1,000 population per year)?
c. At the current rate, how many times higher is the mortality rate in Kalma Camp than the baseline annual mortality rate in the United States (8.44 deaths per 1,000 population per year)?
d. Current estimates indicate that there are one million internally displaced persons in the region. Based on the statistics for Kalma Camp, estimate how many of these people can be expected to die of acute diarrhoea diseases in the next three months.
e. Calculate the point prevalence of malaria in Kalma Camp in April 2004.

9. The table below shows the number of new cases of Polio reported for several countries from 2000-2004.

Country or territory	**Wild virus confirmed cases**								
	Total					01 Jan – 08 Feb		Under investigation (2004)	Date of most recent confirmed case
	2000	2001	2002	2003	2004	2004	2005		
Pakistan	199	119	90	103	53	0	1		06-Jan-05
Sudan	4	1	0	0	123	0	1		01-Jan-05
India	265	268	1600	225	133	0	0		22-Dec-04
Saudi Arabia	0	0	0	0	2	0	0		17-Dec-04
Nigeria	28	56	202	355	782	0	0	3	10-Dec-04
Cameroon	0	0	0	2	13	0	0		25-Nov-04
CAR	3	0	0	1	30	0	0		21-Nov-04
Afghanistan	27	11	10	8	4	0	0		14-Nov-04
Guinea	0	0	0	0	5	0	0		08-Nov-04

http://www.polioeradication.org/content/general/casecount.pdf

a. Calculate the incidence of Polio in India, Afghanistan and Nigeria in 2002. At that time the population of India was 1,045,845,226, that of Afghanistan was 28,513,677, and that of Nigeria was 129,934,911. Report the incidence as the number of cases per 100,000 population per year. Which country had the highest incidence rate of Polio in 2002?

b. Make a graph comparing the incidence of Polio per year in Nigeria and Afghanistan from 2000-2004. Be sure to label both axes and include a title. Assume that the population did not change over this time period. Discuss any trends you observe in the data. Give some possible explanations for the trends that you see.

10. Using the data in the following two pages, answer the questions below.

a. Calculate the point prevalence of HIV/AIDS in the following countries: United States, Canada, India, Angola, Botswana.

b. Using data from all twelve countries, make a graph of life expectancy vs. health expenditure per capita. Include a title and labels.

c. Using data from all twelve countries, make a graph of infant mortality rate vs. health expenditure per capita. Include a title and labels.

d. Discuss any relationships or trends you observe in your graphs for parts b and c. Do you observe any other trends in the data listed for the twelve countries?

11. The data in the table below were adapted from the WHO World Health Report, 2005. Based on the provided information for each area/region calculate:

a. The total under 5 mortality rates for each region

b. The under five mortality rate due to neonatal causes for each region

c. The percentage of under 5 deaths are due to each of the six causes listed for each region (don't worry if they don't sum to 100%).

Area/Region	**Under 5 Population (000)**	**Total # of under 5 deaths (000)**	**# of under 5 deaths (000) due to:**					
			Measles	***Malaria***	***Diarrheal diseases***	***Neonatal Causes***	***Acute Respiratory Diseases***	***Injuries***
Africa	110,944	4,396	227	802	701	1,148	924	76
Canada and USA	22,978	50	0	0	0	29	1	5
South East Asia	178,987	3,070	103	12	552	1,362	590	71
Europe (Low mortality states)	22,050	25	0	0	0	14	0	2

12. Using data obtained by the World Health Organization below, calculate the annual incidence rate of Pertussis (whooping cough) in New Zealand in 2002 and compare it to the annual incidence rate in 2001.

New Zealand – Population data in thousands							
	2002	2001	2000	1999	1998	1990	1980
Live births	54	54	54	54	54	58	50
Female 15-49 years	968	965	963	961	960	884	763
Pop. less than 15 years	869	869	867	863	858	786	832
Pop. less than 5 years	273	275	277	281	285	274	248
Surviving infants	54	54	54	54	55	57	51
Total population	3846	3815	3784	3752	3719	3360	3113
New Zealand – Number of reported cases							
Diphtheria	1	0	0	0	1	0	1
Measles	21	65	65	106	164	-	-
Pertussis	1068	4143	4143	1046	153	91	0
Polio	0	0	0	0	0	0	0

The annual incidence rate of Pertussis in the United States in 2001 was 1 in every 100,000 people and in 2002 was 3 in every 100,000 people. How does this compare to the rate and trend in New Zealand? Suggest contributing factors that may help to explain the difference.

More information about Pertussis from the CDC can be found at http://www.cdc.gov/nip/publications/pink/pert.pdf
Sources of data for this exercise can be found at http://www.who.int/country/en/

13. Polio has been eradicated in the United States and many other countries because of immunization but is a continuing problem in India. Using the data below, calculate the incidence rate of polio in India in 2002.

India – Population data in thousands							
	2002	2001	2000	1999	1998	1990	1980
Live births	25 221	25 477	25 779	26 074	26 307	26 117	23 517
Female 15-49 years	259 828	254 534	249 253	243 992	238 764	201 498	159 836
Pop. less than 15 years	349 470	348 562	347 158	345 236	342 821	309 227	265 551
Pop. less than 5 years	119 524	120 343	120 878	121 071	120 957	115 404	96 705
Surviving infants	23 793	24 032	24 261	24 434	24 521	23 759	20 294
Total population	1 049 549	1 033 395	1 016 938	1 000 161	983 110	846 418	688 856
India - Number of reported cases							
Diphtheria	5 472	5 101	3 094	1 786	1 378	8 425	39 231
Measles	51 780	37 969	22 236	21 013	33 990	89 612	114 036
Pertussis	34 703	30 653	27 851	11 264	31 199	112 416	320 109
Polio	1 600	268	265	2 817	4 322	10 408	18 975
Tetanus (neonatal)	1 178	3 241	1 679	610	2 049	9 313	-
Tetanus (total)	-	8 880	6 694	2 125	6 705	23 356	45 948
Yellow Fever	-	0	-	-	-	-	-

14. Based on the data in problems 11 and 12, which country has a lower infant mortality rate, New Zealand or India in 2002? What information did you use to determine this? Is New Zealand's infant mortality rate really zero?

15. War creates tremendous challenge in meeting the health needs of people near the conflict. Read the article entitled "Deadly comrades: war and infectious diseases" published in The Lancet Supplement (2002, Dec)

a. According to Connolly, crude mortality rates over 60 times higher than baseline have been recorded when populations are suddenly displaced in temporary settlements due to war. Current estimates indicate as many as 900 000 displaced persons in Iraq. If the baseline adult mortality rate in Iraq according to the CIA is, 5.84 deaths/1,000, how many people could be expected to die at baseline rates out of the number who are displaced this year if the displacement has no effect on mortality? If the displacement does have an effect on mortality, use the highest rate Connolly has recorded to calculate the number of people that could be expected to die. What percent of the displaced population is the new number of possible deaths?

- Source of data for displaced persons:
http://www.who.int/disasters/country.cfm?countryID=28&DocType=2
- Source of data for baseline mortality rate:
http://www.cia.gov/cia/publications/factbook/geos/cg.html

b. If the population of Zaire in 1960 (now Democratic Republic of Congo) was 16.2 million, calculate the point prevalence of trypanosomiasis for the entire country during this war-torn period if the number of cases of this disease there were estimated at 40,000.

- Source of data for population in 1960:
http://lcweb2.loc.gov/frd/cs/zaire/zr_appen.html#table2