Example in-class worksheet for HS326 Epidemiology

Students will practice the steps of calculating a direct age-adjustment by hand (this will be done on an exam). Students should understand the importance of crude vs. age-adjusted rates (i.e. why does age matter?) and how they are presented and interpreted in epidemiologic and public health literature and statistics.

Part 1

Conduct a Direct Age Adjustment

Feel free to copy and paste the tables into excel to use for calculations.

Table 1: Midyear population and deaths from all cancers for Colorado and Massachusetts by age group, 2008

	Midyear population		Cancer Deaths	
Age Category	Colorado	Massachusetts	Colorado	Massachusetts
<20	1,346,022	1,643,708	208	290
20-44	1,788,086	2,249,237	1,728	2,846
45-69	1,447,396	2,014,325	10,743	18,213
70+	353,709	636,305	7,421	14,735
Total	**4,935,213**	**6,543,595**	**20,100**	**36,084**

Table 2: US midyear population, mortality rates for Colorado and Massachusetts and expected deaths from all cancers by age group, 2008

	Midyear standard population	Mortality rates (per 100,000)		Expected Deaths	
Age Category		Colorado	Massachusetts	Colorado	Massachusetts
<20	77,440,166	15.45	17.63	11,966.78	13,653.33
20-44	97,287,697	96.62	126.56	93,952.45	123,103.12
45-69	83,140,909	742.40	904.29	617,530.91	752,507.86
70+	25,622,070	2,099.45	2,315.94	537,925.64	593,131.05
Total	**283,490,842**				

*Standard midyear population is an age breakdown of US population

A. Using table 1, calculate the **OVERALL crude cancer mortality rate** for Colorado and Massachusetts (Hint: Use the totals for each state).

So, the overall crude cancer mortality rate for Colorado is approximately 407.02 per 100,000, and for Massachusetts, it is approximately 551.32 per 100,000.

B. Complete the first two columns of table 2. Calculate the mortality rates for each age category for Colorado and Massachusetts. *Please round to 2 decimal points*. Note that the rates are "per 100,000 people". (The first example is done for you.)

C. Calculate the expected deaths in Table 2 for each age category for both Colorado and Massachusetts. *Please round to 2 decimal points*. (The first example is done for you.)

D. Use table 2 to calculate the age adjusted cancer mortality rates for Colorado and Massachusetts using the direct method. (Hint: Use the expected deaths and midyear standard population).

The age-adjusted cancer mortality rate for Colorado is approximately 2,954.65 per 100,000, and for Massachusetts, it is approximately 3,364.46 per 100,000 using the direct method.

E. Compare the crude rates for each state to the age-adjusted rates. What is the reason for the discrepancy between the crude and age adjusted cancer mortality rates?

Comparing the crude rates and age-adjusted rates allows us to understand how the mortality rates differ when accounting for differences in the age distribution of the populations. Here's a comparison of the crude and age-adjusted cancer mortality rates for Colorado and Massachusetts:

Crude Mortality Rate (per 100,000):

- Colorado: Approximately 407.02 per 100,000
- Massachusetts: Approximately 551.32 per 100,000

Age-Adjusted Mortality Rate (per 100,000) using the direct method:

- Colorado: Approximately 2,954.65 per 100,000
- Massachusetts: Approximately 3,364.46 per 100,000

Difference between Crude and Age-Adjusted Rates:

- For both states, the age-adjusted mortality rates are significantly higher than the crude rates.

Reasons for the Discrepancy: The discrepancy between the crude and age-adjusted mortality rates is primarily due to differences in the age distributions of the populations in Colorado and Massachusetts. The crude rate is a straightforward calculation based on the total number of cancer deaths divided by the total midyear population, without considering the age structure of the population.

However, populations with different age structures can have varying mortality rates for certain age-related diseases like cancer. Age is a significant risk factor for cancer, and older populations tend to have higher mortality rates from cancer compared to younger populations.

The age-adjusted mortality rate takes into account the age distribution of the population by using a standard population (in this case, the midyear standard population of the entire United States) as a reference. This standardizes the mortality rates for each age group to what they would be if the state had the same age distribution as the entire US population. By doing so, it allows for a more accurate comparison of mortality rates between states with different age distributions.

In this case, both Colorado and Massachusetts have higher age-adjusted mortality rates compared to their crude rates because they have older populations, and age is a significant contributing factor to cancer mortality. The age adjustment provides a more accurate picture of the cancer mortality burden by accounting for the age differences between the states.