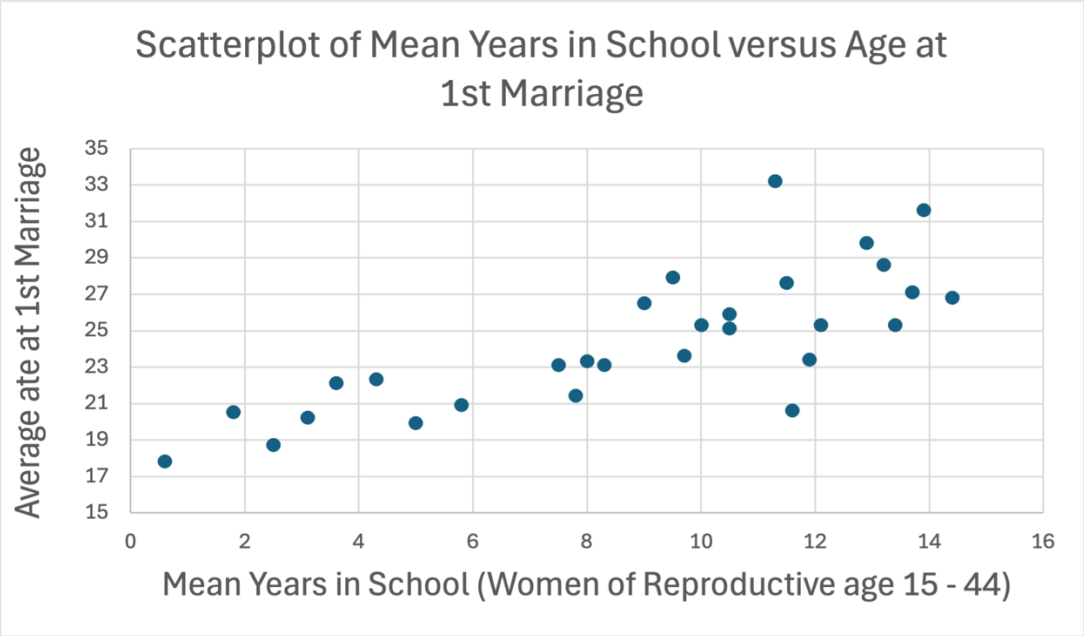
ACTIVITY 4: Worksheet Answers

On the following pages are some scatterplots of relationships found on Gapminder.org. Use your critical thinking skills to answer the questions based on the scatterplots. Make sure you use some of the new vocabulary you learned such as causation, a common response, cofounding, and lurking variable. As you answer the questions, think "big picture." Recall that each dot represents an entire country, so keep this in mind when answering the questions below.

Mean Years in School of Women of Reproductive Age 15-44 versus Average Age at 1st Marriage



1. Describe the relationship (form, direction, and strength) between the mean years in school of women of reproductive age 15 to 44 and the average age at 1st marriage.
   The relationship between mean years in school of females of reproductive age 15 to 44 and the average age at first marriage for countries is linear, positive, and moderate.

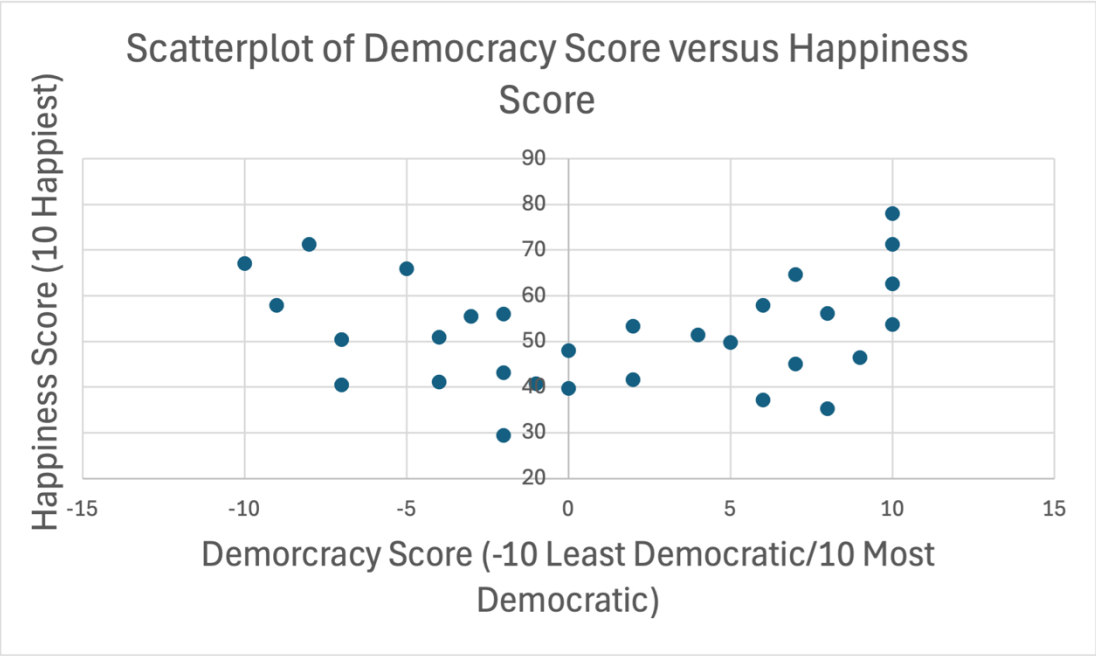
2. What happens to the average age at 1st marriage as the mean years in school for women of reproductive age 15 to 44 increases?
   As the mean years in school of females of reproductive age 15 to 44 increases, the age at 1st marriage also increases for countries.

3. Do you think the mean years in school for females of reproductive age 15 to 44 directly impacts the average age at first marriage within a country? Explain using the appropriate vocabulary.
   Yes, I believe there is some causation going on. In countries that have a higher mean number of years in school for women of reproductive age 15 to 44, the women are likely going to marry later (on average) as they will have more of an opportunity to pursue an education and career. An education and career afford women the opportunity to live independently. Conversely, in countries that lack educational and career opportunities for women, to survive, women must marry.

4. What other variables would impact the average age at first marriage within a country and thus weaken the relationship? Explain using the vocabulary and give at least two of these potential variables. Feel free to explore some of the other variables on gapminder.org. Make sure you explain your reasoning for each variable.

Other variables that impact the average age at 1st marriage would be considered lurking variables and include cultural norms, religious beliefs, poverty, and laws. Cultural norms such as arranged marriages can lower the age of first marriage. Likewise, religious beliefs such as abstinence before marriage can encourage couples to marry younger. Laws setting a minimum age of marriage can prevent women from marrying too young. Lastly, countries living in poverty tend to have a younger age of marriage as women are looking for a means to escape their poverty. Each of these lurking variables can have an impact on the average age of first marriage in addition to the average years of education for women. This is what would be considered confounding.

Democracy Score (-10 Least Democratic to 10 Most Democratic) versus Happiness Score (Higher Percentage Corresponds to Happier)

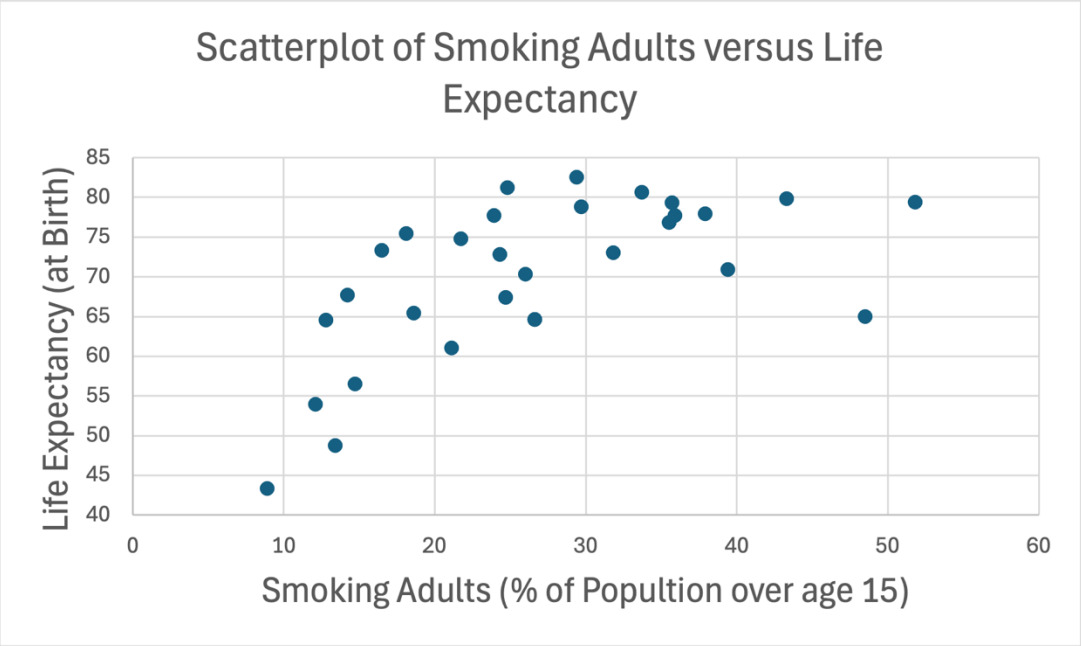


5. The democracy score has to do with the amount of freedom in a country. Based on the data above, does it appear that in countries that have more freedom, the population will generally be happier? Explain!
There appears to be no relationship between the democracy score and happiness. The points are just randomly scattered without a general direction.

6. Do you think having greater freedom in a country should impact the overall happiness score of the country? Explain!
I would expect that having greater freedom in a country would impact the happiness score of the country. In free countries, people can pursue their dreams, fewer people are oppressed, and they can express their opinions without sensors.

7. Why do you think no relationship was found between these two variables? Hint: Many of the countries with lower happiness scores were found in Africa. Make sure you use the appropriate vocabulary in your response.
There are too many lurking variables that impact the happiness score of a country. A lot of countries with lower happiness scores are in Africa and unfortunately, many countries in Africa grapple with poverty, lack of opportunity, and often civil unrest. Each of those lurking variables will have a greater impact on the happiness of a country than the amount of freedom within the country. This would be considered confounding.

Smoking Adults (%) versus Average Life Expectancy



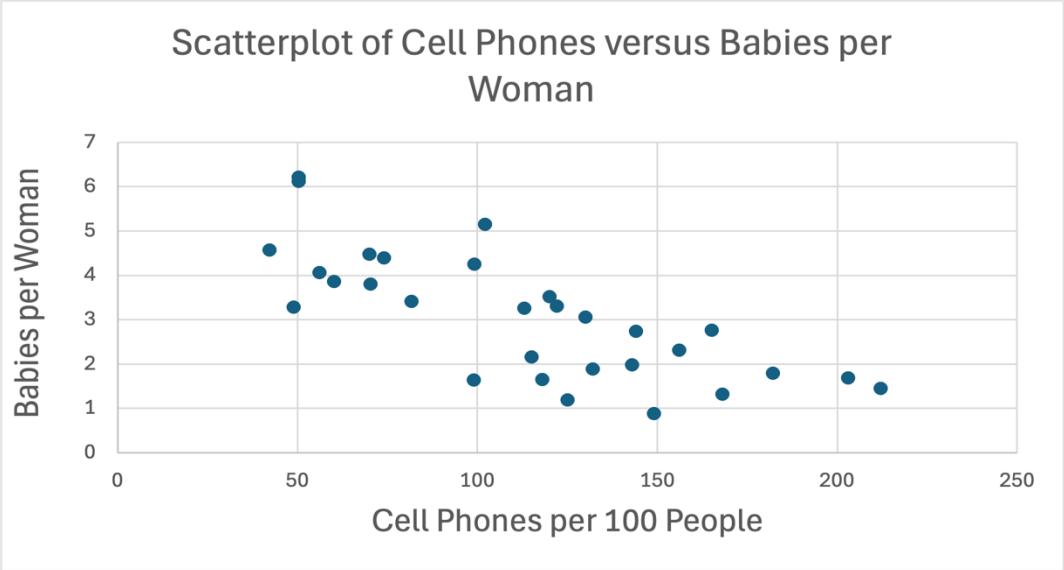
8. Explain the relationship (form, direction, and strength) between the percentage of the population over age 15 smoking and the average life expectancy within countries.
The relationship between the percentage of the population over age 15 smoking and the average life expectancy appears to be slightly curved, positive, and moderate.

9. According to this scatterplot, in general, how does the average life expectancy within countries change as a higher percentage of the population over the age of 15 smokes?
The average life expectancy within countries appears to increase for countries as the percentage of the population over 15 who smokes increases.

10. Based on your knowledge, how will smoking impact a person's longevity on an individual level?
On an individual level, science has shown that smoking decreases longevity.

11. Do you believe that countries that have a higher percentage of smokers "causes" that country to have a greater average life expectancy? Why or why not? Make sure you use the appropriate vocabulary.
An outside lurking variable is flipping the relationship. People in wealthier countries can afford to smoke. Likewise, these countries have better healthcare and infrastructure that increases the longevity of people living in the country. This outside variable would be considered a lurking variable that is causing a common response. While smoking does have an impact on longevity on an individual level, when looking at an entire country, the wealth of the country is the driving force in the relationship.

Cell Phones per 100 People versus Babies per Woman



12. Describe the relationship (form, direction, and strength) between the number of cell phones per 100 people in a country and the number of babies per woman.
The relationship between the number of cell phones per 100 people in a country and the number of babies per woman is linear, negative, and moderate.

13. Do you think the increase in the number of cell phones per 100 people in a country "causes" a decrease in the number of babies per woman? Explain. No! Even though there is a correlation, having more cell phones per 100 people will not likely "cause" women to become infertile or unable to have more babies. Other variables are at play.

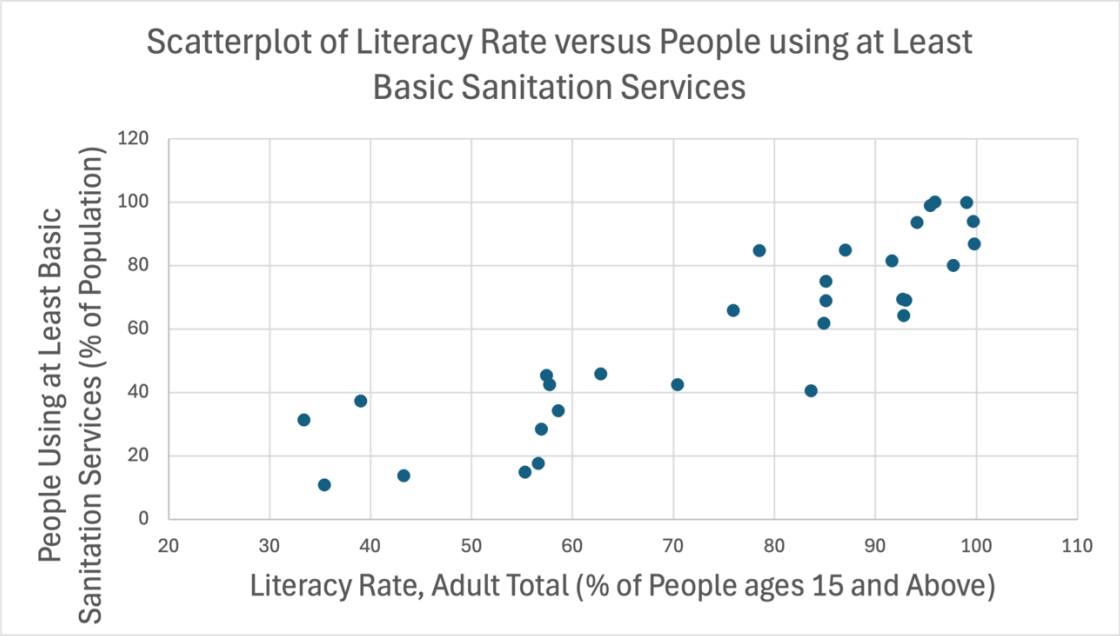
14. What variables do you think will impact the number of babies per woman in a country? Make sure you come up with at least three and explain why you think they will have an impact on the number of babies per woman.
Possible variables would include the percentage of contraceptive use, average age at first marriage, poverty, infant mortality rate, and opportunities for women.

Countries with a higher percentage of contraceptive use will have fewer children as the use of contraceptives shows a desire to prevent having children.
In countries that have a higher average age at first marriage, the birth rate will go down. This is because the amount of time the women in those countries are fertile and can conceive will decrease.
Unfortunately, in countries with higher infant mortality rates, women will choose to have more children on average in hopes that some of them will survive to adulthood.
Countries that struggle with poverty tend to have higher birth rates as women have fewer opportunities, tend to marry younger, don't have access to more effective contraceptive measures, and see children as a way of providing for them as they age.
In countries with fewer opportunities for women, women tend to marry younger and have more children because they are not afforded the opportunity for an education or career.

15. There does appear to be a moderate correlation between the two variables. Why do you think as the number of cell phones per 100 people increases, the number of babies per woman decreases? Justify using the appropriate vocabulary.

A common response may be going on here. The lurking variable would be how developed the country is. In more developed countries, more people own cell phones. Furthermore, in more developed countries women can pursue an education and career, tend to marry later, have access to birth control, etc. All these factors make it more likely for them to have less children.

Literacy Rate versus at Least Basic Sanitation



16. Describe the relationship (form, direction, and strength) between literacy rate and the percentage of people using at least basic sanitation services.

The relationship between literacy rate and the percentage of people using at least basic sanitation services is linear, positive, and moderate.

17. Do you think that a higher literacy rate for a country "causes" a higher use of at least basic sanitation services?

You could argue that in countries with higher literacy rates, more people have the skills to develop the country. With more development, infrastructure like sanitation will be improved which would mean a higher percentage of the people in the country would have access to basic sanitation.

18. What other variables would impact the percentage of people in a country using at least basic sanitation services? Give at least two variables and for each variable, explain why you think it will have an impact. Remember to use the appropriate vocabulary!

Since there is a covariational relationship between the literacy rate for a country and at least basic sanitation services, confounding is an issue. The relationship is moderate because many other lurking variables would have an impact on the percentage of people in a country using at least basic sanitation services. Some possible lurking variables would be the wealth of the country, the stability of the country, and how corrupt the country is (how well they utilize their resources).

In wealthier countries, money is available to improve the infrastructure of the country including at least basic sanitation services.

In countries that are experiencing instability, some of the infrastructure can be destroyed in civil unrest, including sanitation.

Countries that struggle with corruption have fewer resources available to build their infrastructure, including at least basic sanitation services.

Once the class has discussed the above questions, you are ready to create your last PowerPoint slide.

Slide 5:
For Slide 5, answer the questions below in paragraph form.

1. Do you think the relationship you have been studying is a "correlation," "causation," or neither? Explain using the appropriate vocabulary.
2. Do you think you have a common response or confounding? If you feel you have a common response, mention the outside variable that is affecting the two variables making them appear correlated, and justify your answer. If you feel you have confounding, give at least three possible lurking variables that are confounding the relationship and explain why they will also affect your dependent variable.

For the example data collected in Activity 1, the following would be on Slide 5.

Slide 5:

The contraceptive prevalence rate measured as the percentage of married women or women in a union aged 15-49 using birth control would impact the birth rate for countries as contraceptive measures will decrease the chance of conception.

Confounding is a possibility in this relationship as there are lurking variables that will weaken the relationship. Some of those variables include the type of contraception used in the country, the average age at first marriage, the availability and legality of abortion, cultural norms, and infant and child mortality rates.

The type of contraceptive used will impact the birth rate for a country because some contraceptives are much more effective at preventing pregnancy.

The average age at first marriage will impact the birth rate because if the average age at first marriage is older, the window of fertility will be decreased, causing the women to have fewer children.

Countries where abortion is legal and more available provide opportunities to terminate pregnancies and thus reduce the number of babies per woman.

Cultural norms such as how long women nurse, at what age they marry, and whether they should stay home or pursue a career will impact the number of babies per woman in the country.

In countries with high infant and child mortality rates, women will have more babies to compensate for those high rates.