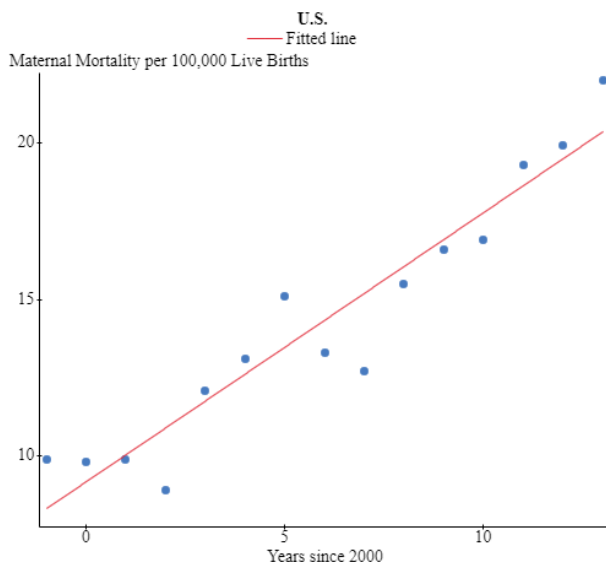


MA 207 Least Squares Regression Line

Name: _____ Date: _____ Time: _____

1. In the U.S. there is a roughly linear relationship between the number of years since 2000 and the Maternal Mortality Rate (maternal deaths per 100,000 live births) approximated by $\hat{y} = 9.19 + 0.86x$. $r^2 = .90$ **Always include units (f-k).**



- Identify the explanatory variable. **Years since 2000**
- Identify the response variable. **Maternal Mortality per 100,000 live births**
- Give the shape, strength, and association. **Approx. linear, strong, positive**
- Are there any striking deviations from the overall pattern? **No**
- True or false: The regression line proves that the passing of time **causes** MMR to increase.
False. Association is not the same as causation. Only experiments can establish causation.
- Use the equation of the regression line (show your work) to predict the MMR for the year 2040. Is this extrapolation? Does this prediction make sense in the context given? Why or why not? **$x = 40$ years since 2000**

$$\hat{y} = 9.19 + 0.86(40) = 43.59 \text{ maternal deaths per 100,000 live births}$$
This is extrapolation because the value for x is 26 greater than the x-values observed. This is an abuse of the data and doesn't provide meaningful results. Lots of factors could change in that many years.
- Use the equation of the regression line (show your work) to “predict” the year when MMR was 15 per 100,000 live births. Is this extrapolation? Does this prediction make sense in the context given? Why or why not? **$15 = 9.19 + .86x$**

$$5.81 = .86x$$

$$6.8 \approx x$$
Between 2006 and 2007. No it is not extrapolation; the x-value predicted is between the observed x-values. It does make sense. In 2006 MMR was about 13.
- Can you reasonably use the regression line to estimate MMR in 2014? Why or why not?
Yes. It is extrapolation, however it is extremely close to values observed.
- What is the y-intercept of the regression line equation? Explain what this would mean in practical terms. Does this prediction make sense in this context? Why or why not?

When $x = 0$, $\hat{y} = 9.19$. In the year 2000 the equation predicts that the maternal mortality rate was about 9 deaths per 100,000 live births. This is interpolation not extrapolation and makes a reasonable estimate.

- j. What is the slope? What does it mean in practical terms?

0.86 deaths per 100,000 live births per year. If there is an increase in one year, then the MMR will increase by 0.86

- k. What does $r^2 = .90$ mean in practical terms?

90% of the variability in MMR can be explained by the variability of time.

- l. Is r positive or negative? Find r and explain what it tells you.

The correlation r is positive because the association is positive, so we take the positive square root of $\sqrt{r^2}$ to get: $r = \sqrt{r^2} = \sqrt{0.90} \approx .95$. This indicates a strong positive association.