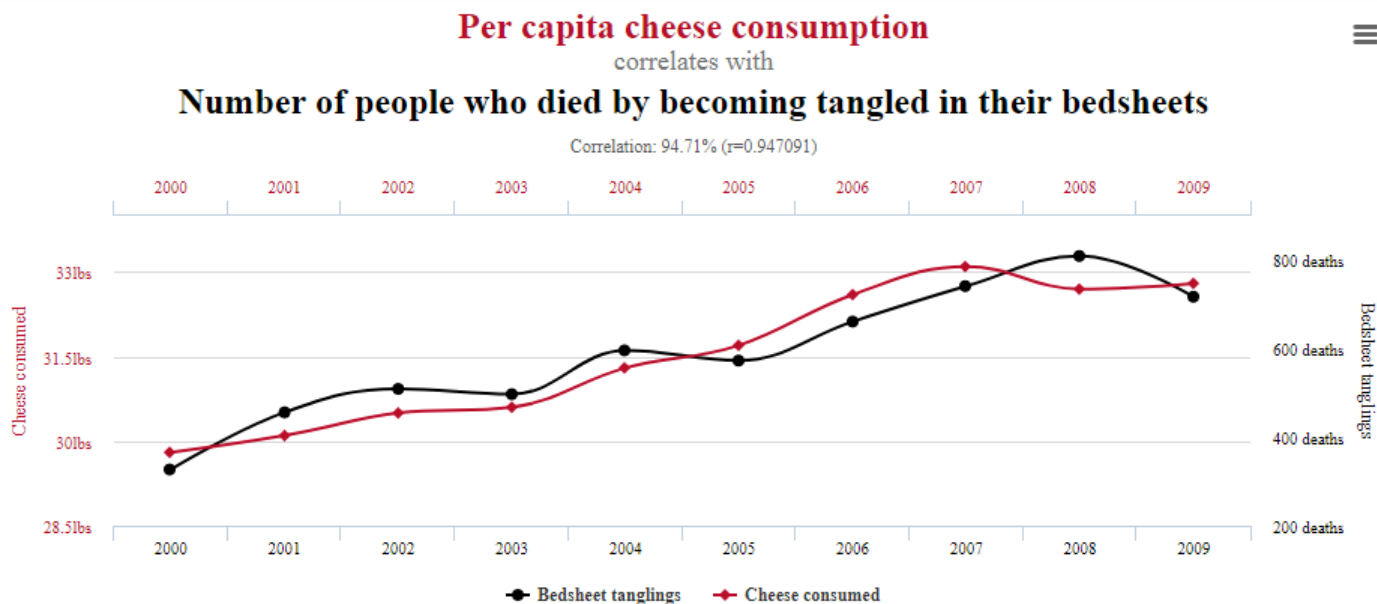


Data Analysis: The effect of smoking on health

Necessary background information:

- 1) Calculating percent change
- 2) Correlation verses causation (justification lesson)

A correlation in science is a relationship between two variable factors. The relationship between smoking and cancer is an example of a correlation. There are two types of correlation. With a positive correlation, when one factor increases the other one also increases; they also decrease together. With a negative correlation, when one factor increases the other decreases. Some correlations reflect causation. In other words, a change in the independent variable induces a change in the dependent variable. Often times, however, correlations are just coincidences. For example, eating cheese does not cause people to become tangled in their bed sheets and die, but it does correlate with bedsheet induced death.



It is important in science to distinguish between a correlation and a causation. Finding that there is a positive correlation between smoking and cancer does not prove that smoking causes cancer. Cigarette smoke contains many different chemical substances. Twenty of these have been shown in experiments to cause tumors in the lungs of laboratory animals or humans. There is evidence that at least forty other chemicals in cigarette smoke are carcinogenic.

One of the largest ever studies of the effect of smoking on health involved 34,439 male British doctors. Information was collected on how much they smoked from 1951 to 2001 and the cause of death was recorded for each of the doctors who died during this period. The table below shows some of the results. The figures given are the number of deaths per hundred thousand men per year.

Cause of death between 1951 and 2001 (Sample size: 34,439 male doctors in Britain)	Mortality rate per 100,000 men/year				
	Lifelong non-smokers	Former cigarette smokers	Current smokers (cigarettes/day)		
			1-14	15-24	≥25
All cancers	360	466	588	747	1,061
Lung cancer	17	68	131	233	417
Cancer of mouth, pharynx, larynx and esophagus	9	26	36	47	106
All other cancers	334	372	421	467	538

▲ Table 1 from British Medical Journal 328(7455) June 24 2004

- 1) How might quitting smoking affect the probability of getting cancer?
- 2) Explain your answer to the last question.
- 3) How much more likely are you to get *All cancers* if you smoke 1-14 cigarettes per day than if have never smoked? Show your work!
- 4) How much less likely are you to get lung cancer if you quit smoking than if you smoke 1-14 cigarettes per day? Show your work!
- 5) What type of cancer are you most likely to get if you smoke?
- 6) What kind of relationship between cancer and smoking does Table 1 show?

7) Is the relationship stated for the last question causal?

8) Justify your answer to the last question. Justifications have 3 components: 1) theory or established knowledge, 2) data from your analysis related to the theory or knowledge, and 3) an explanation of the HOW the data supports the theory or knowledge.

Type of disease	Non-smokers	1–14 cigarettes per day	15–24 cigarettes per day	>25 cigarettes per day
Respiratory (diseases of the lungs and airways)	107	237	310	471
Circulatory (diseases of the heart and blood vessels)	1,037	1,447	1,671	1,938
Stomach and duodenal ulcers	8	11	33	34
Cirrhosis of the liver	6	13	22	68
Parkinson's disease	20	22	6	18

9) Deduce whether there is a positive correlation between smoking and the mortality rate due to all types of disease. Justify your answer. Justifications have 3 components: 1) theory or established knowledge, 2) data from your analysis related to the theory or knowledge, and 3) an explanation of the HOW the data supports the theory or knowledge.

10) Using the data in the table, discuss whether the threat to health from smoking is greater with respiratory or with circulatory diseases.

11) Discuss whether the data suggests that smoking a small number of cigarettes is safe.

12) Discuss whether the data proves that smoking is a cause of cirrhosis of the liver.

13) The survey showed that five types of cancer are linked with smoking. Suggest a type of cancer, other than lung cancer, that you would expect smoking to cause. Justify your answer. Justifications have 3 components: 1) theory or established knowledge, 2) data related to the theory or knowledge, and 3) an explanation of the HOW the data supports the theory or knowledge.