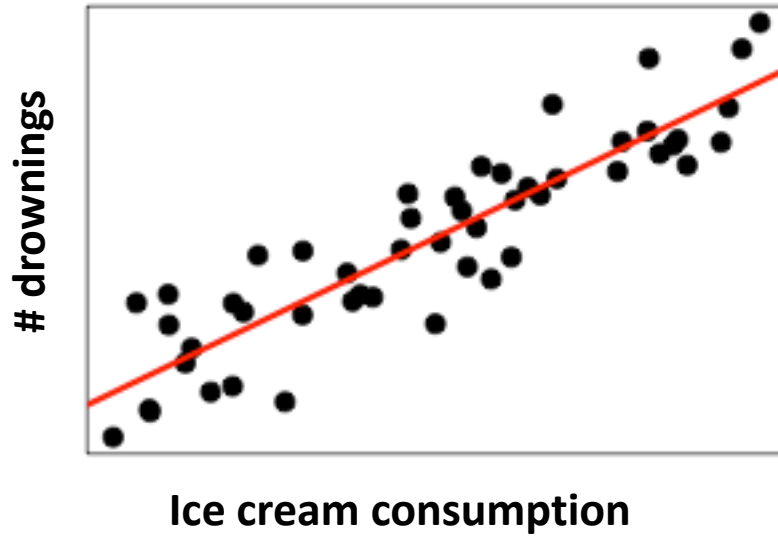
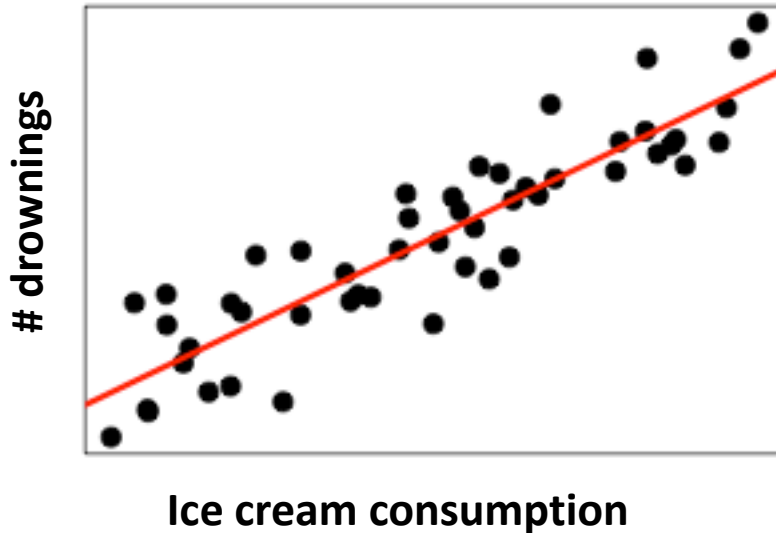


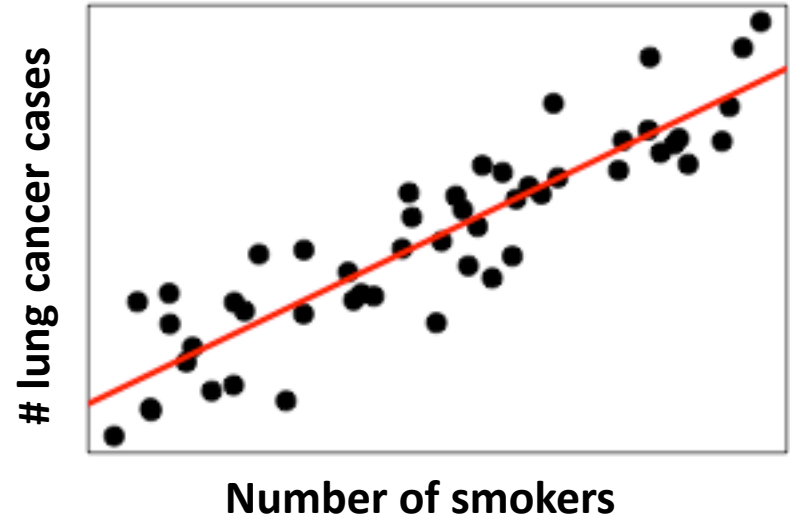
Is eating ice cream  
causing people to  
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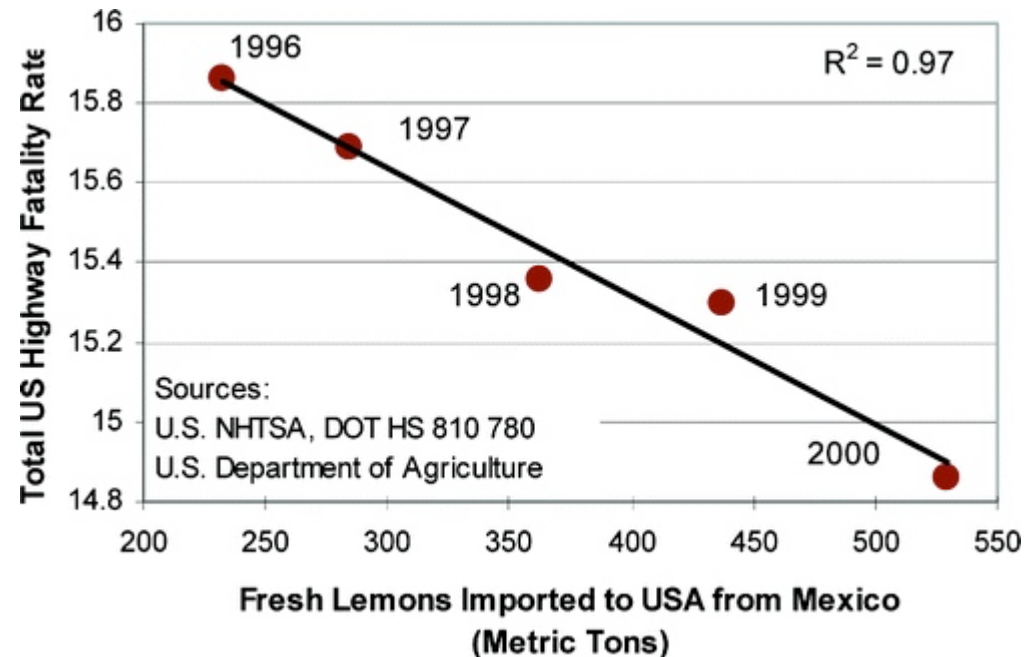
Does smoking cause  
lung cancer?



- From the above data alone, we should not conclude that there is a cause-and-effect relationship
- Correlation does not imply causation! (NEVER!)
  - It could be true that A causes B (smoking example), but even if the relationship is causative, it could also be true that B causes A
  - Both A and B may be caused by a third, underlying (extraneous) variable (ice cream example)
  - The relationship between A and B may be due to chance
- It depends on *how* the data was collected

# More examples - Correlation does not imply causation

- Children who get tutored have worse grades, on average, than children who are not
  - Is tutoring *bad* for students?
- A survey of ~50,000 nurses revealed that hormone replacement therapy (HRT) was associated with >40% reduction in coronary heart disease (CHD).
  - Does HRT reduce the risk of CHD?
  - No – a subsequent clinical trial found that HRT actually increases CHD<sup>1</sup>



1. <https://academic.oup.com/ije/article/33/3/464/716652/Commentary-The-hormone-replacement-coronary-heart>