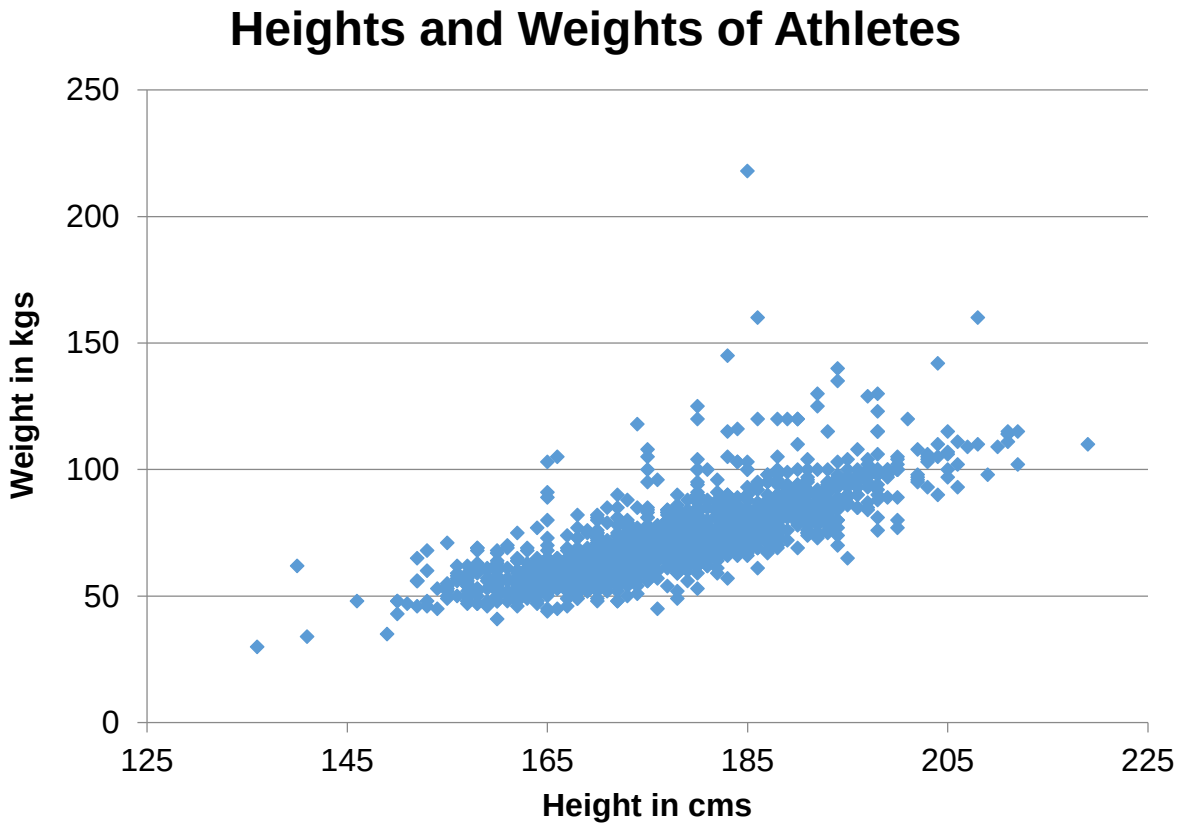
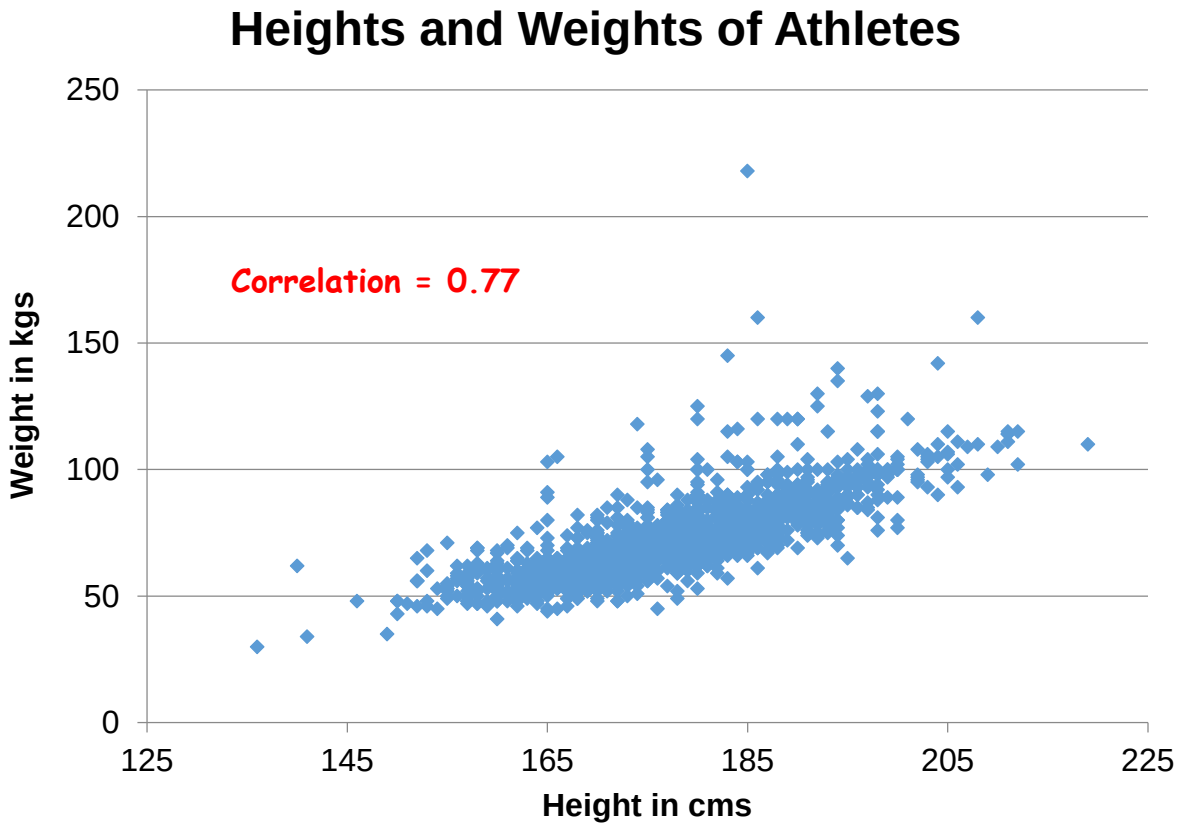
Measures of Association

Covariance

Correlation


Heights and Weights of Athletes
250
200
150
100
50
0
Weight in kgs
125
145
165
185
205
225
Height in cms


Heights and Weights of Athletes
Correlation = 0.77
Weight in kgs
250
200
150
100
50
0
125
145
165
185
205
225
Height in cms

Does Weight cause Height ?

Does Height cause Weight ?

Causation versus Correlation

Causation versus Correlation

What is Causation and how do we establish it?

Causation versus Correlation

What is Causation and how do we establish it?

- Correlation

Causation versus Correlation

What is Causation and how do we establish it?

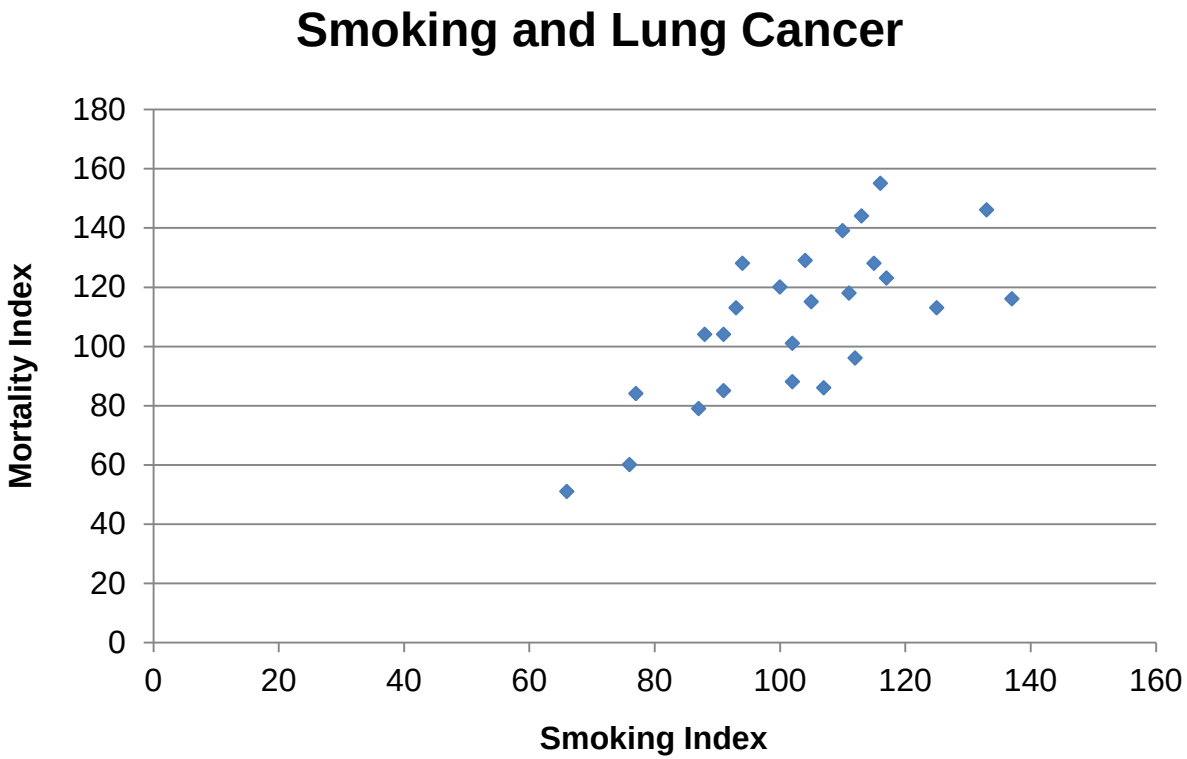
- Correlation
- Temporal distinction between the ***caused*** and the ***causing*** variable

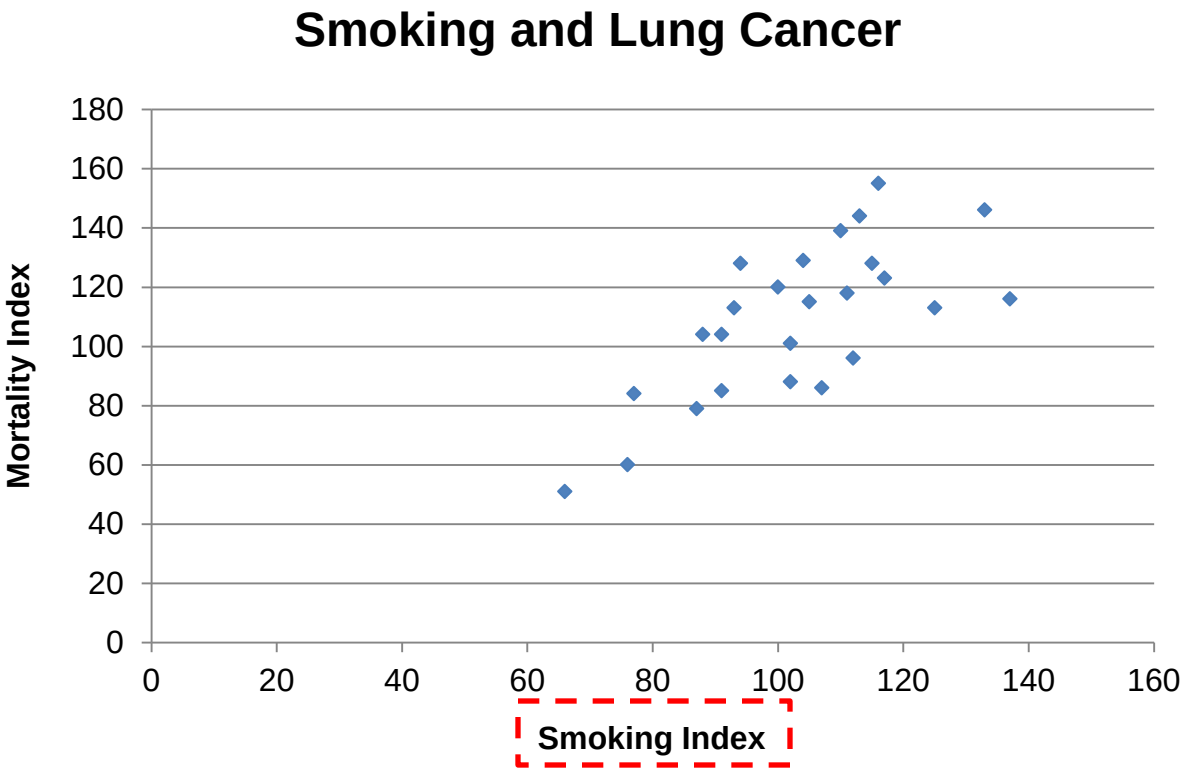
Causation versus Correlation

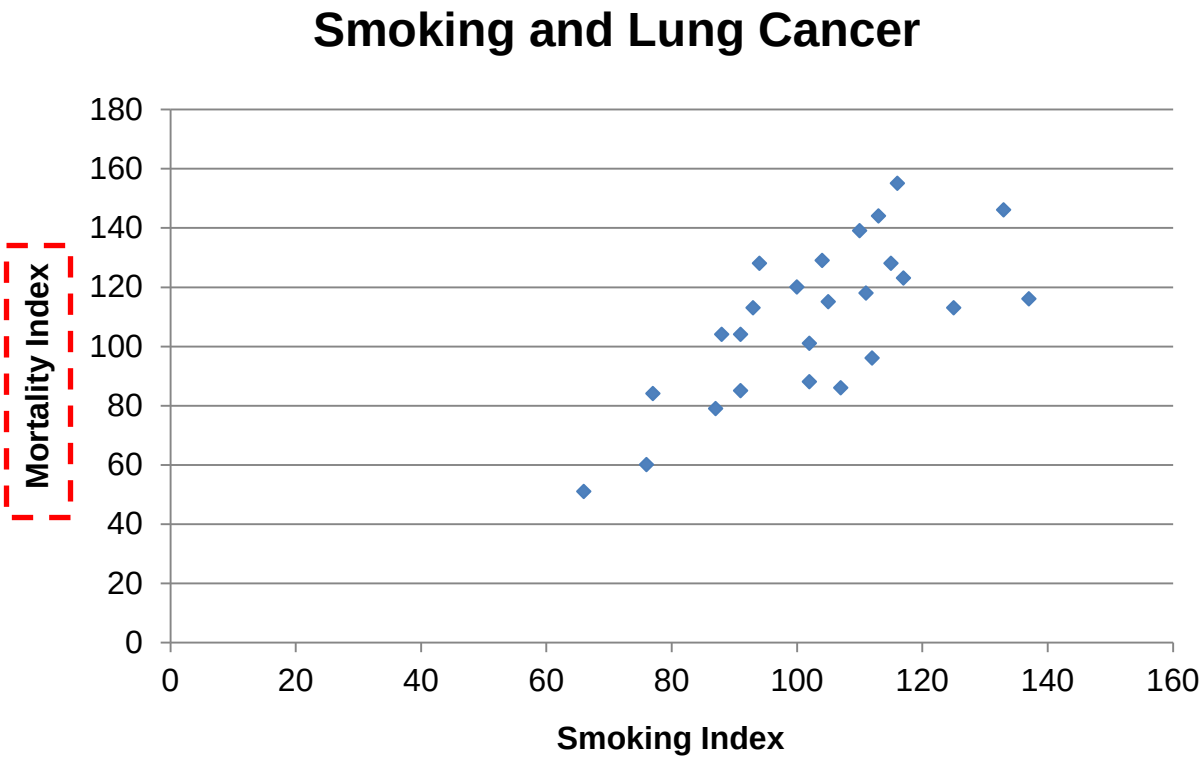
What is Causation and how do we establish it?

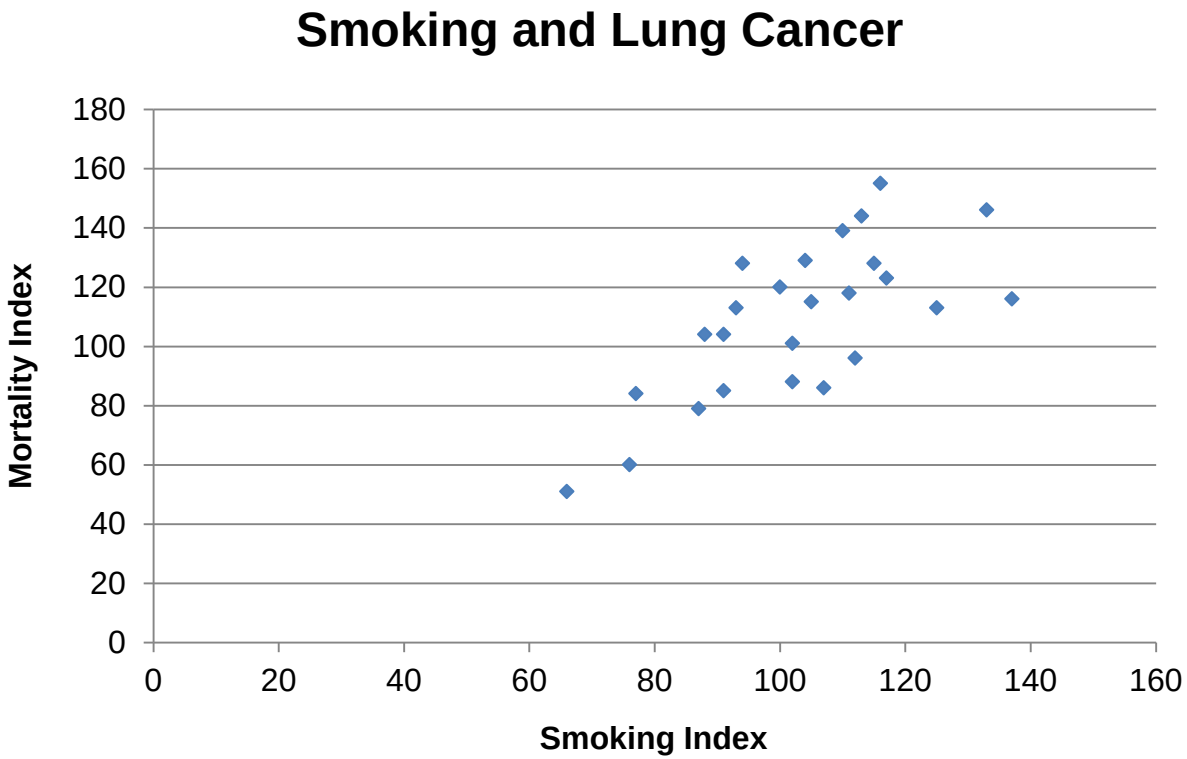
- Correlation
- Temporal distinction between the ***caused*** and the ***causing*** variable
- Control for other variables that may cause the focal variable

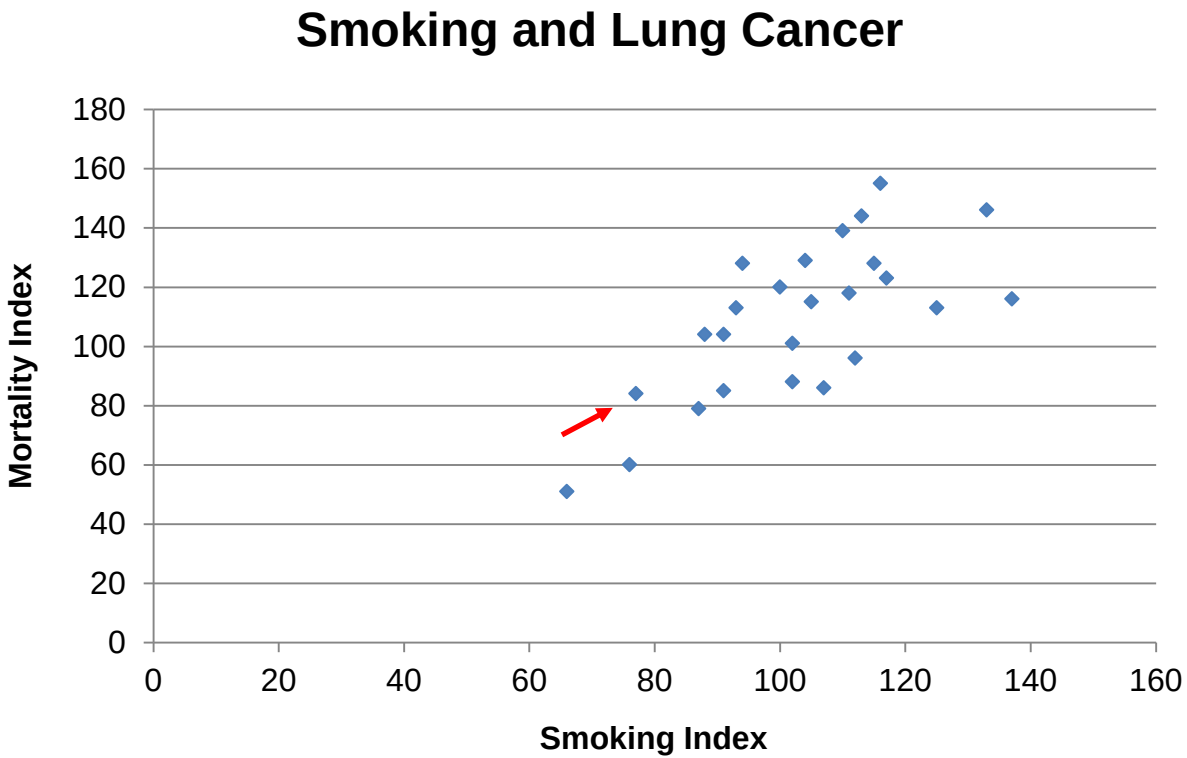
Smoking and Cancer

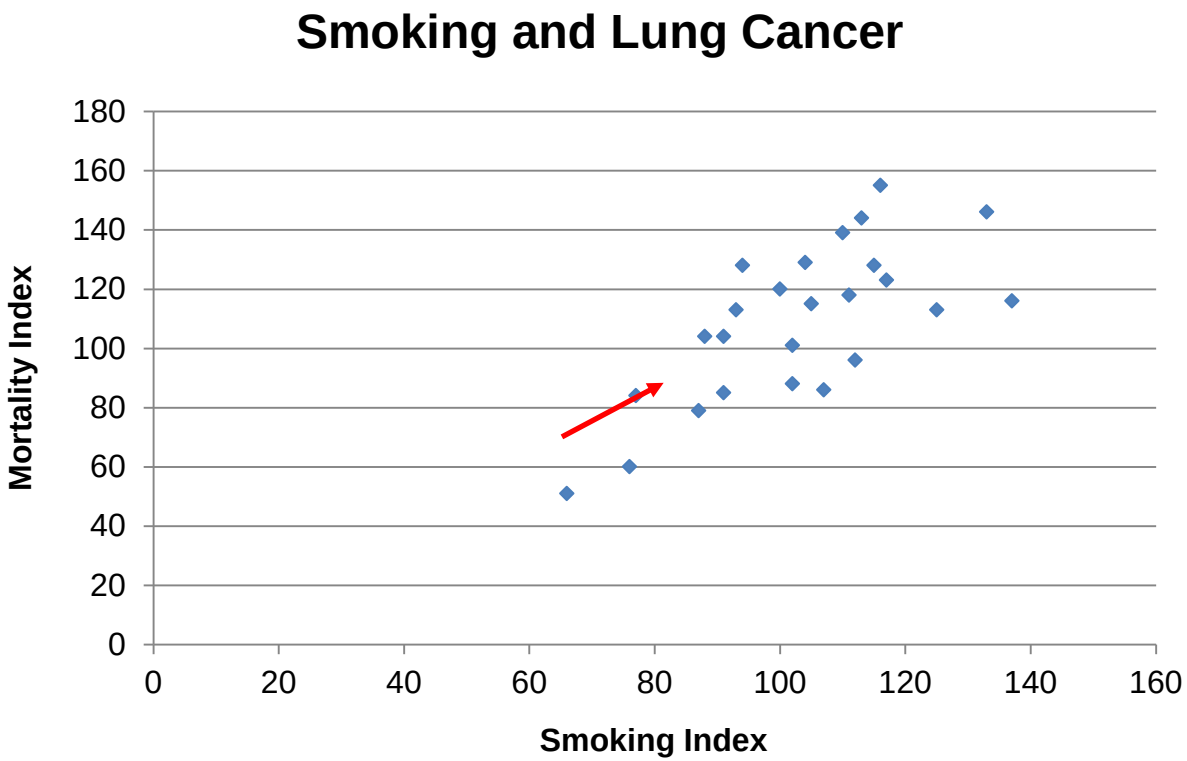

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

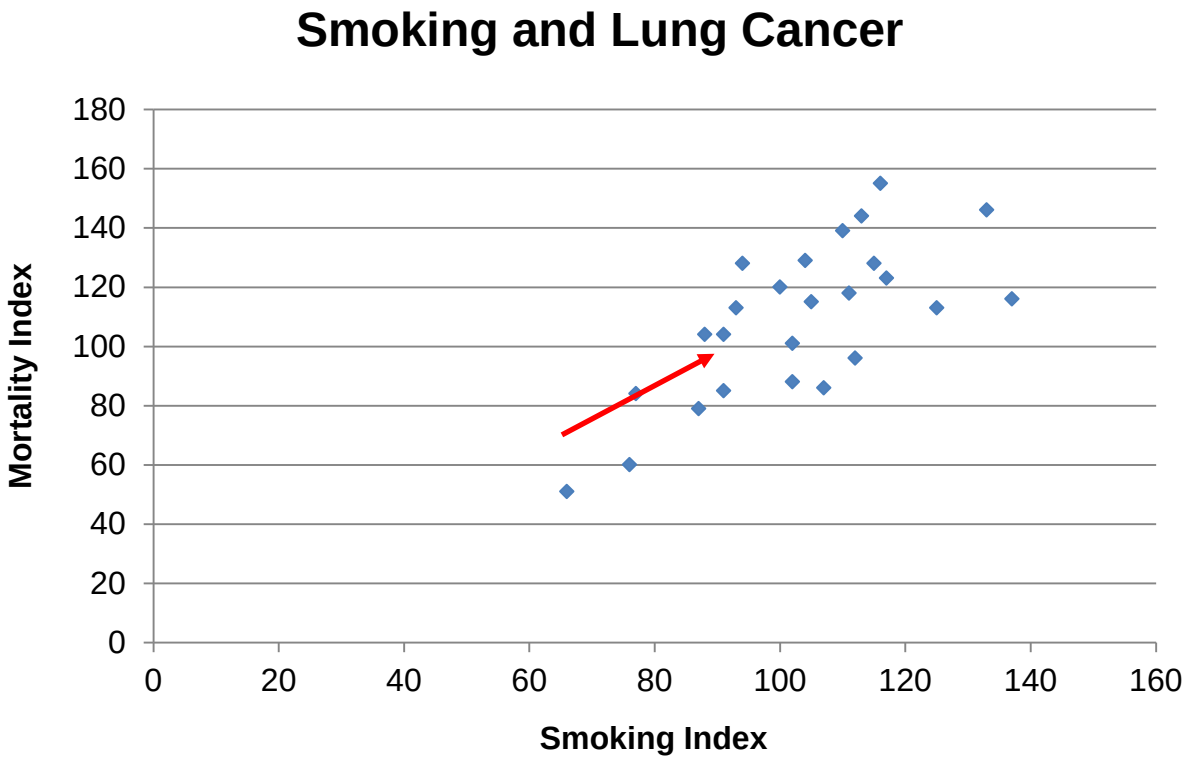

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index


Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

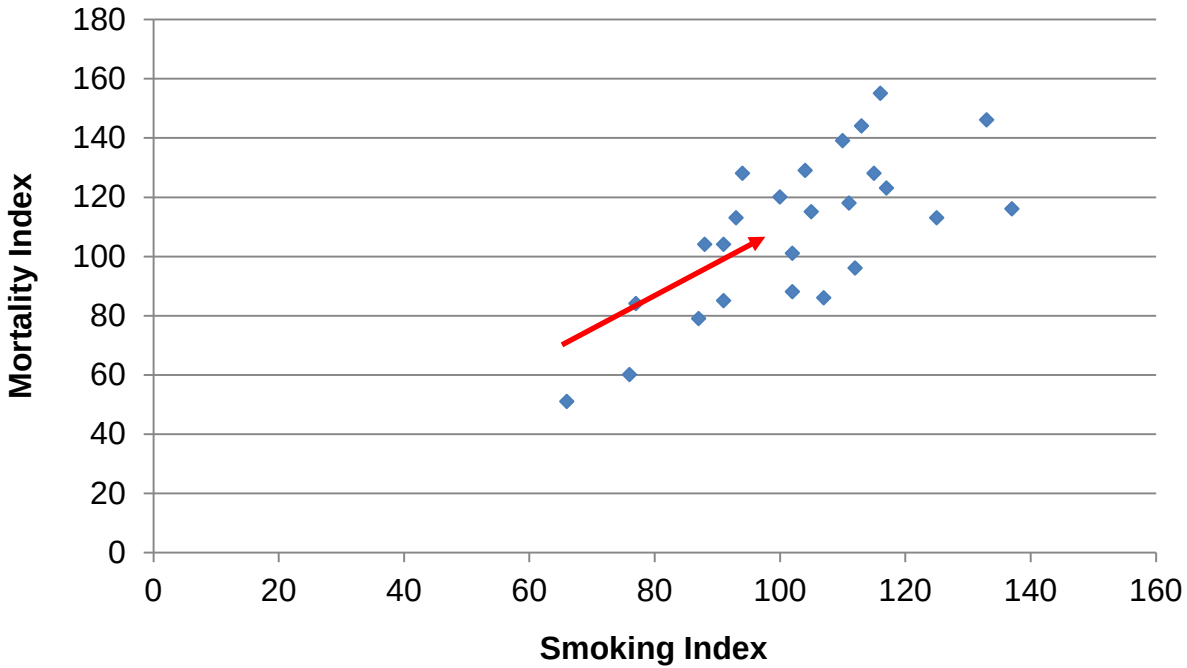

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

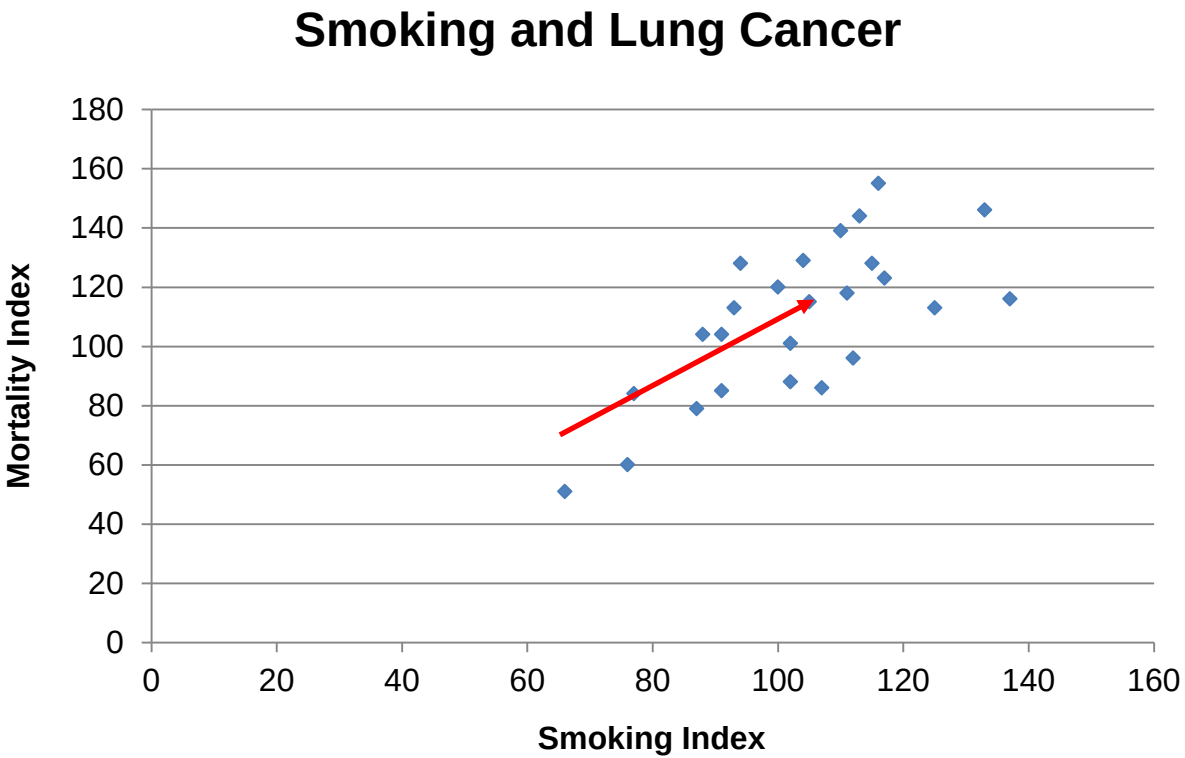

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

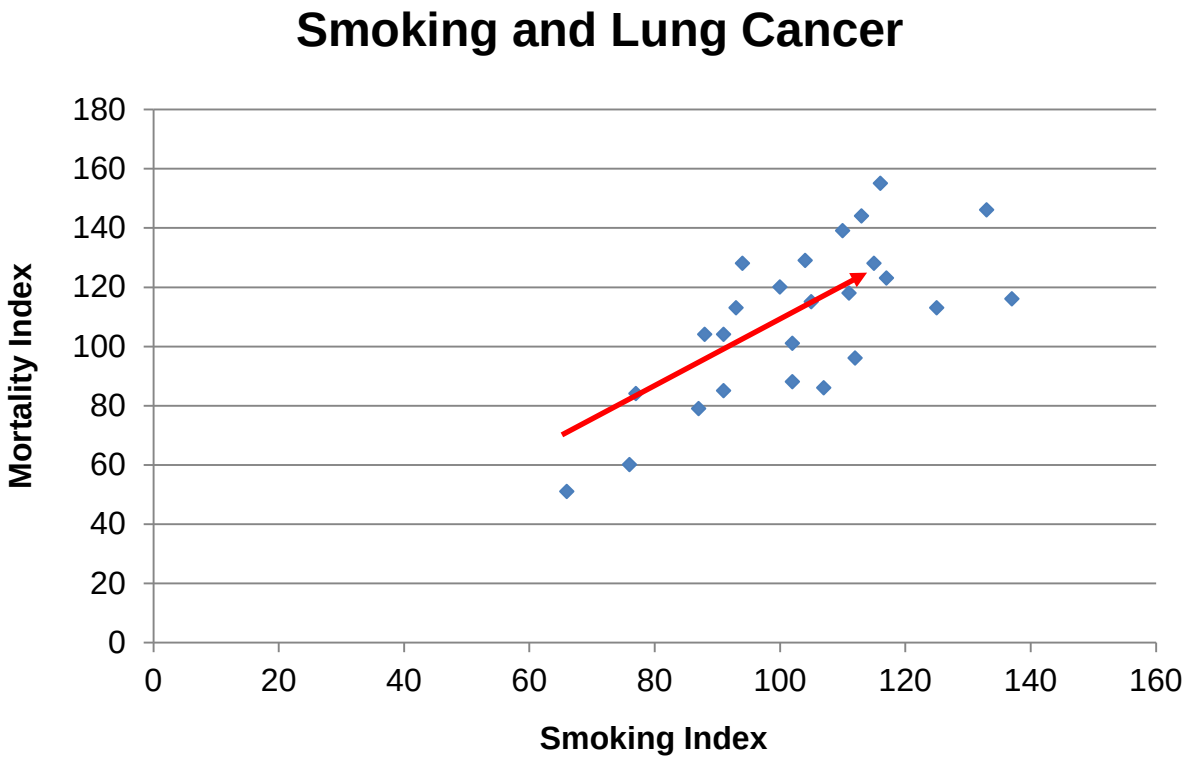

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

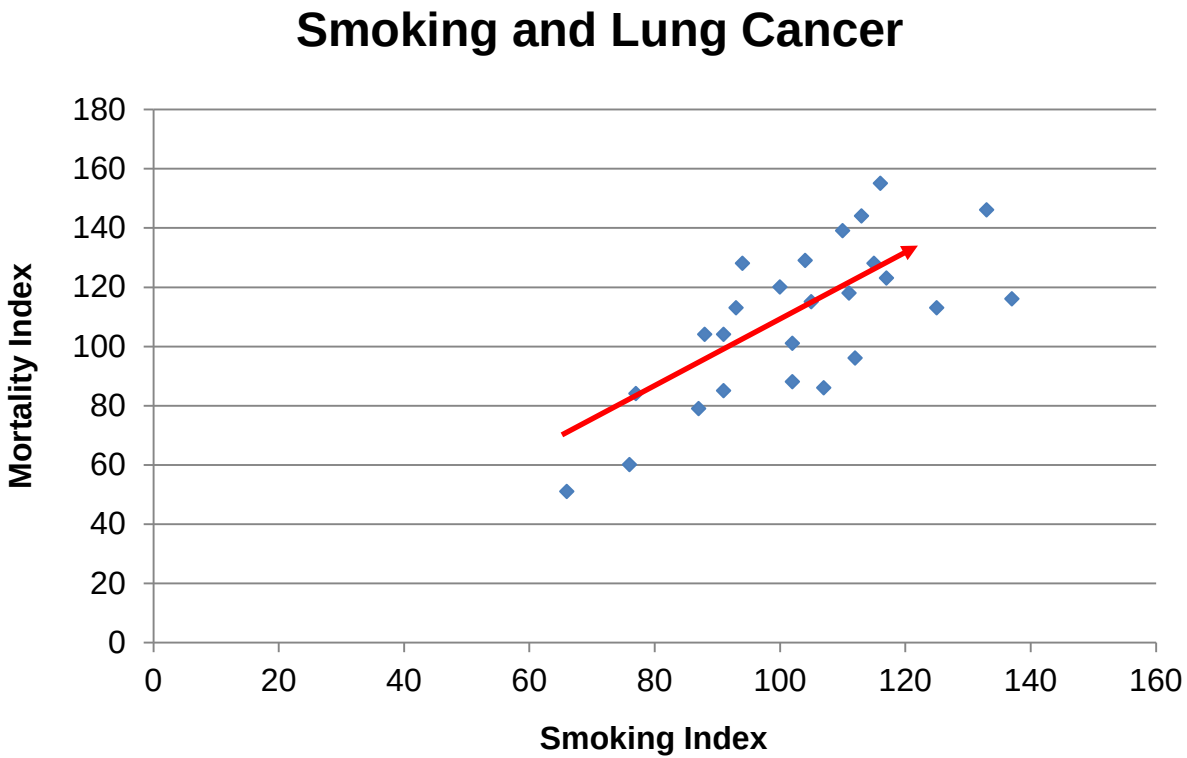

Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

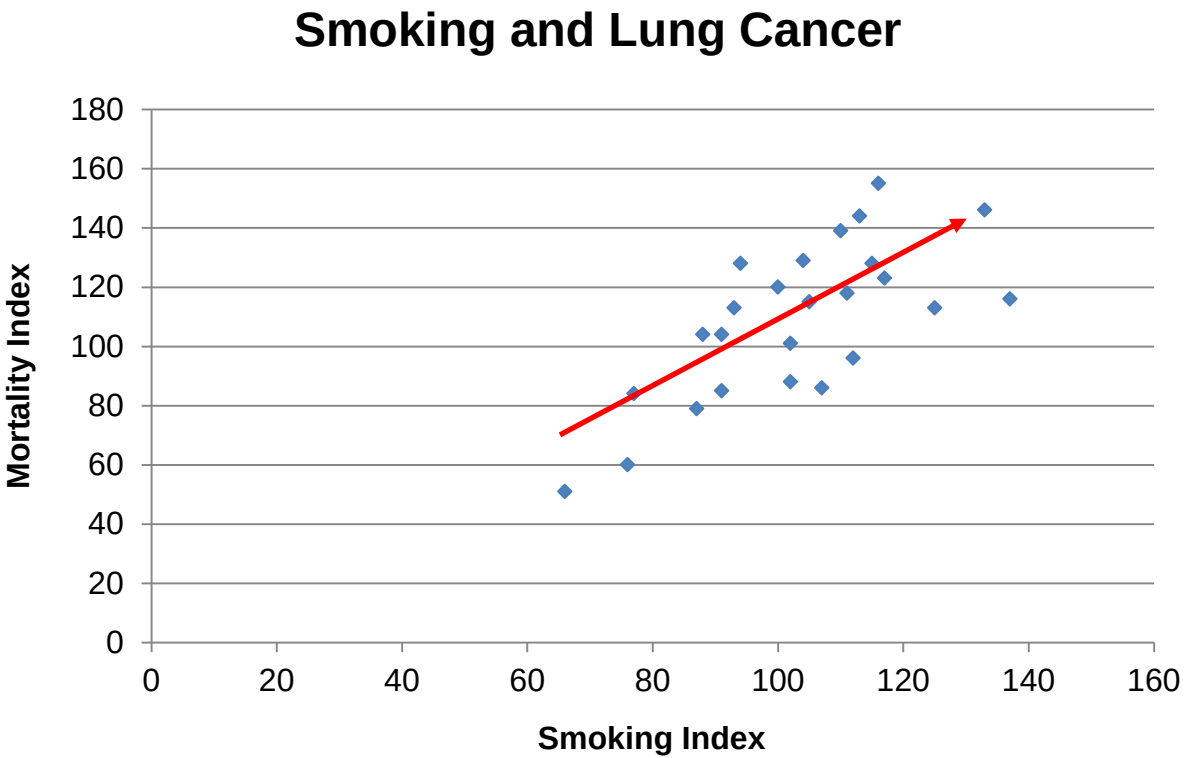
Smoking and Lung Cancer

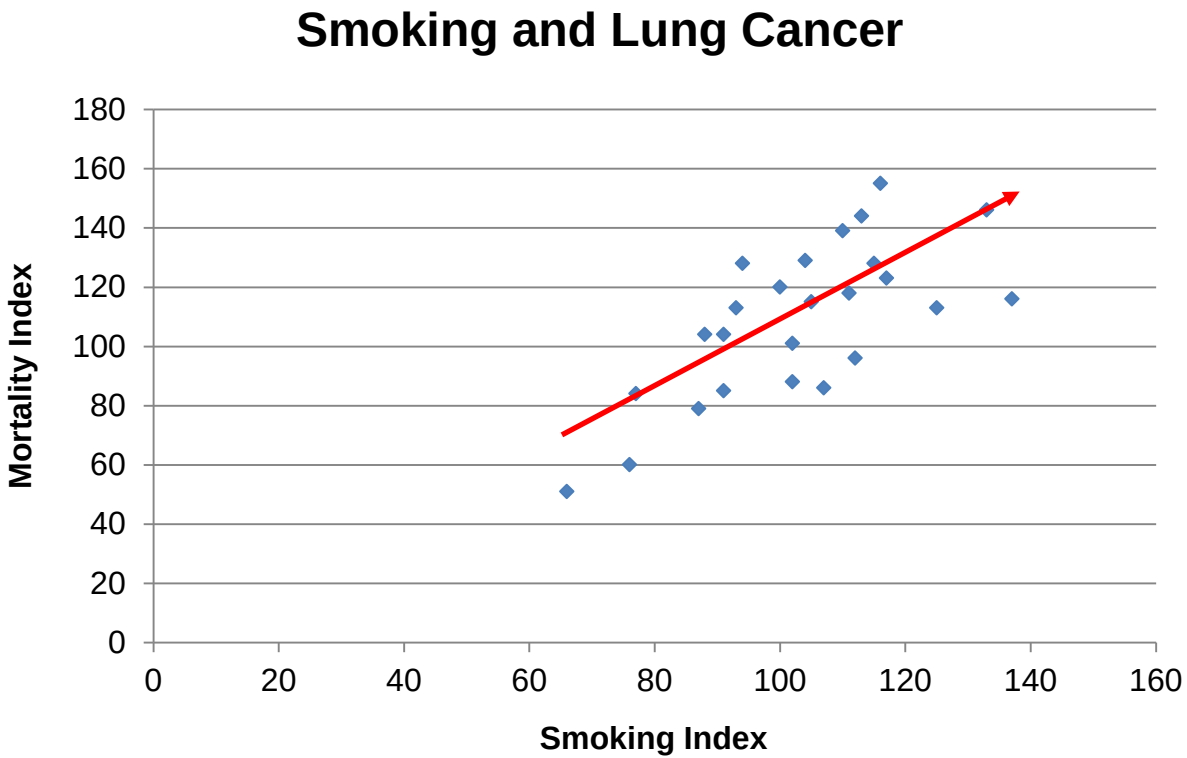



Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

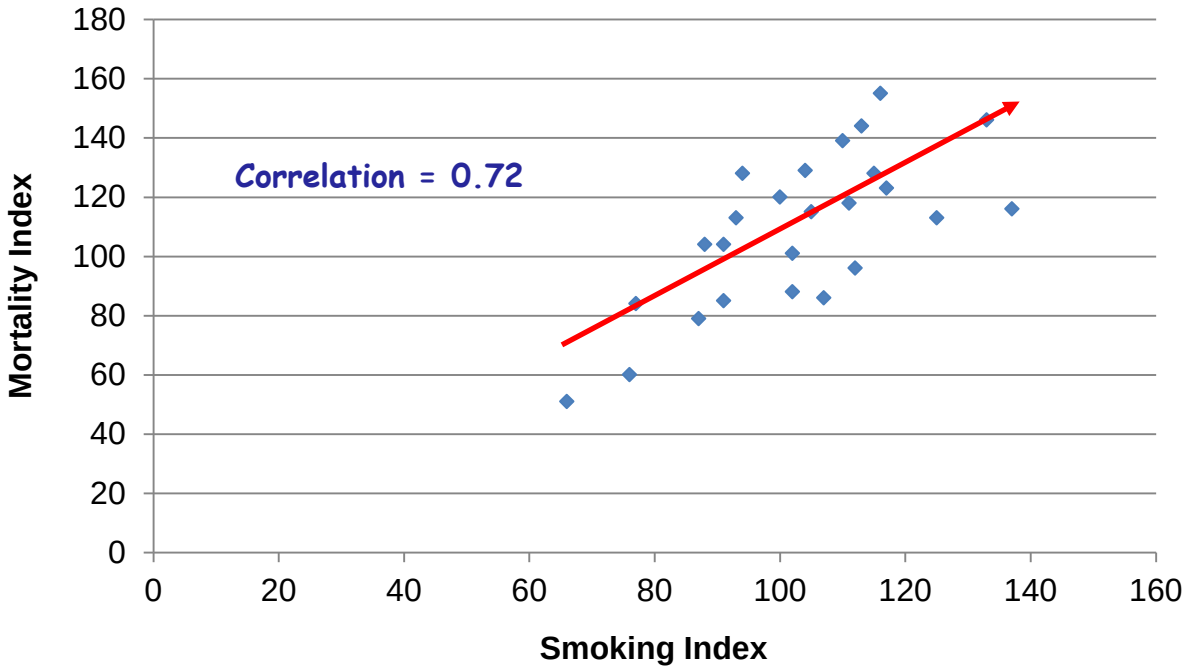

Smoking and Lung Cancer
Mortality Index
Smoking Index
0
20
40
60
80
100
120
140
160
180


Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index


Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index


Smoking and Lung Cancer
Mortality Index
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Smoking Index

Smoking and Lung Cancer

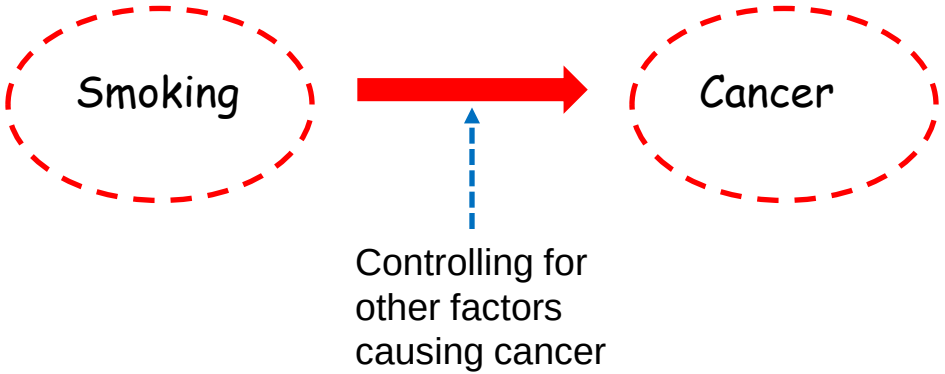


Causation versus Correlation

Studies have firmly established that smoking **causes** cancer

Causation versus Correlation

Studies have firmly established that smoking **causes** cancer



Causation versus Correlation

It is important to distinguish between

Causation and Correlation