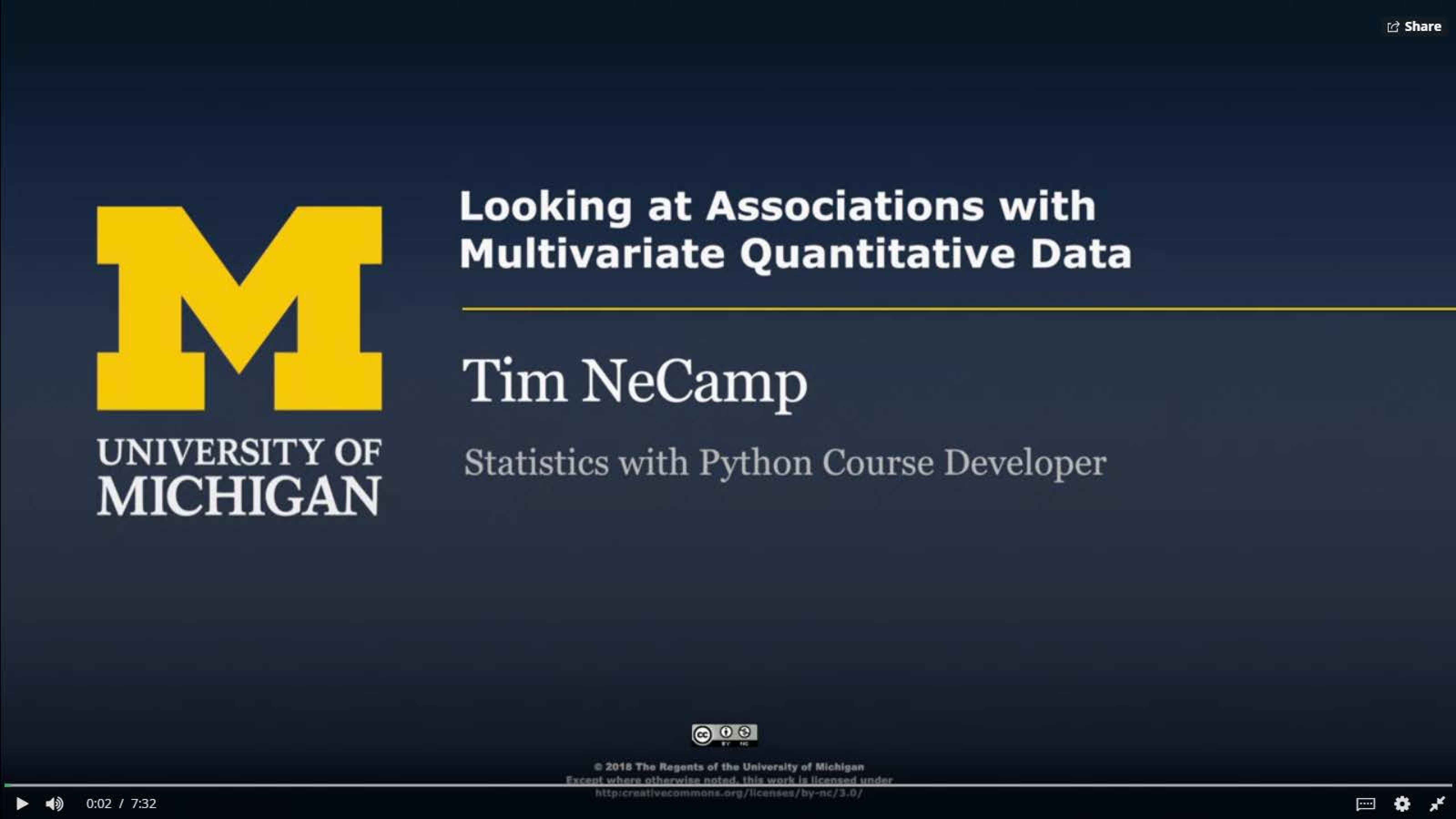
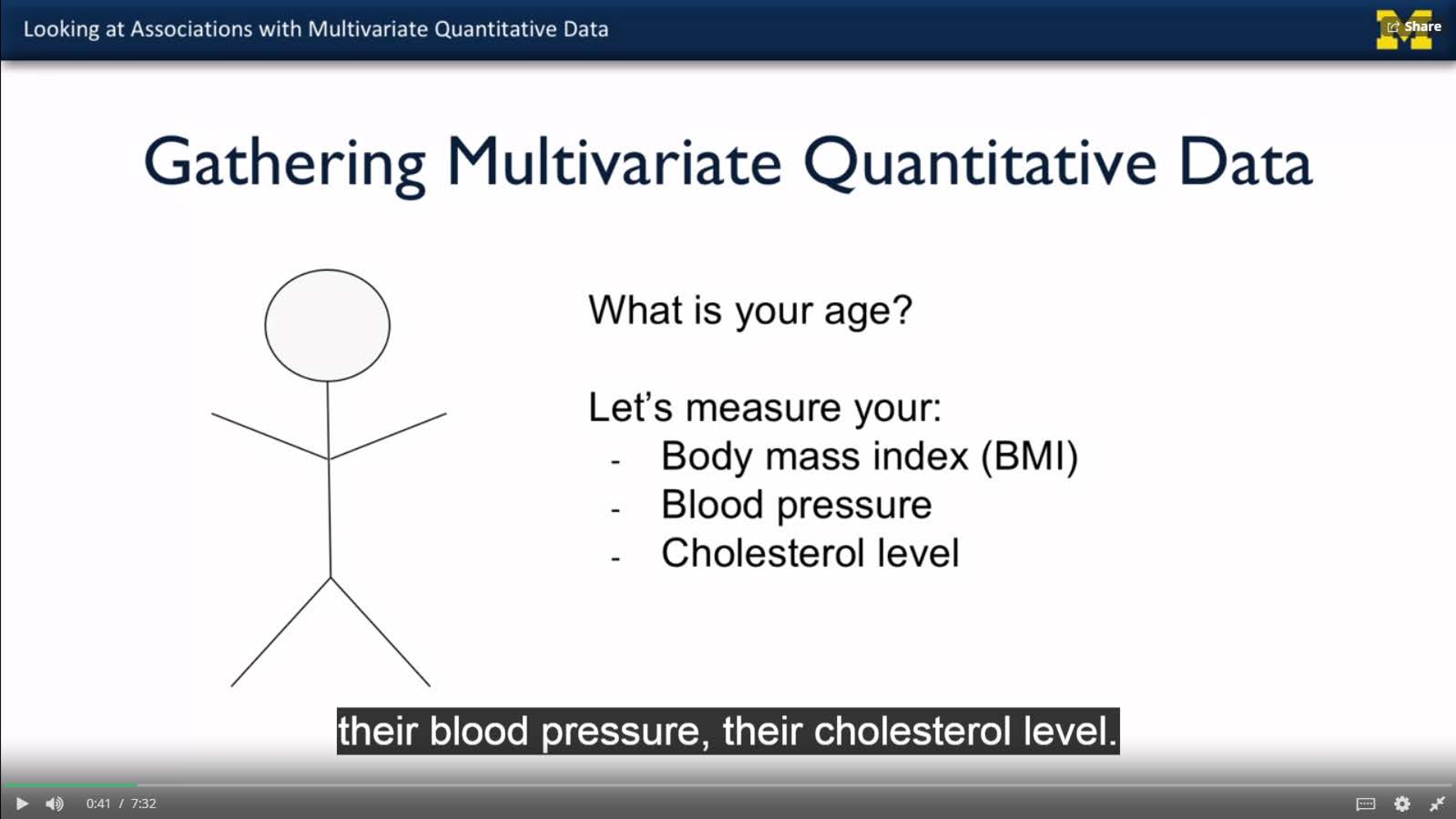


UNIVERSITY OF MICHIGAN

Looking at Associations with Multivariate Quantitative Data

Tim NeCamp

Statistics with Python Course Developer



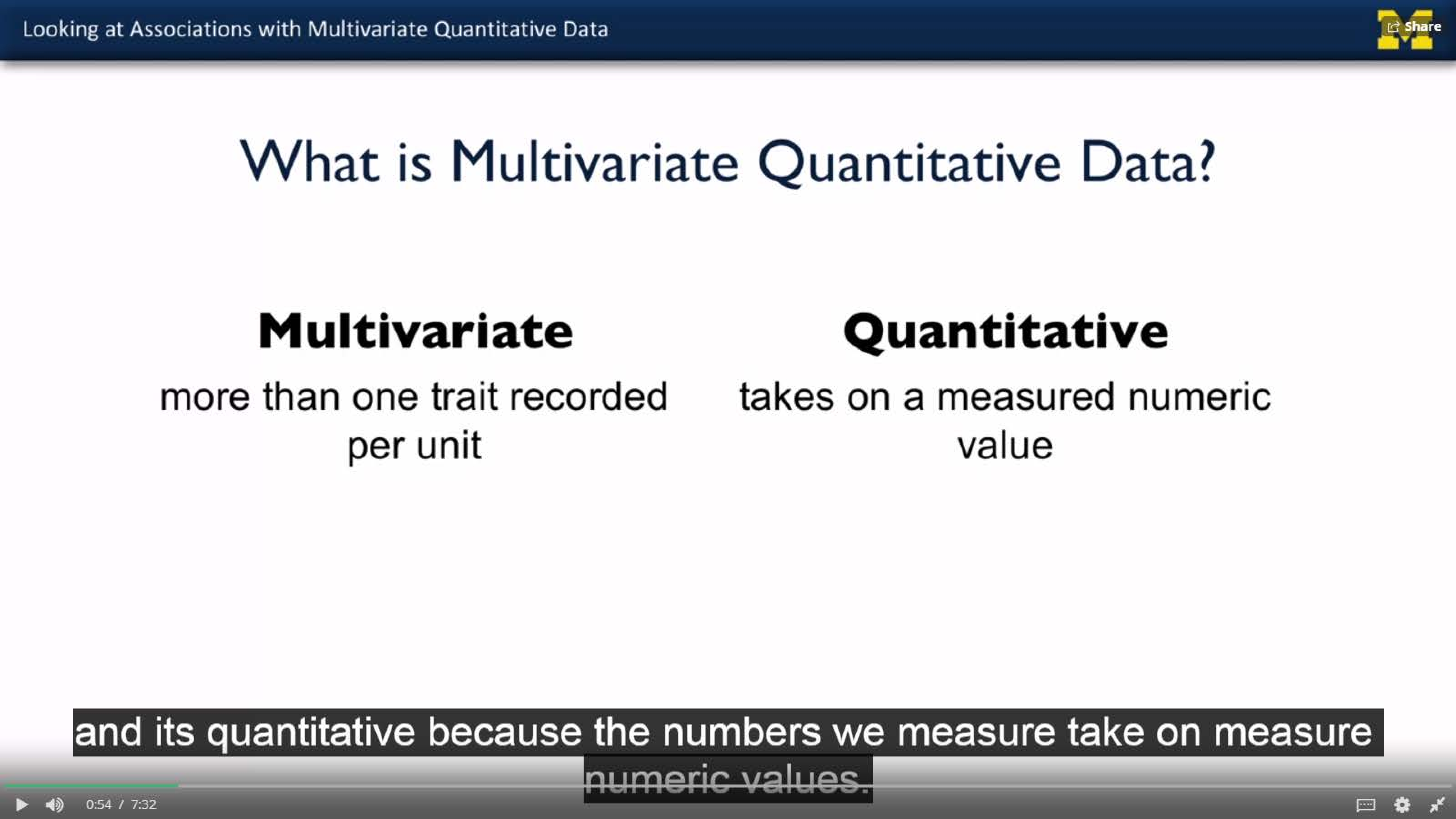
Gathering Multivariate Quantitative Data

What is your age?

Let's measure your:

- Body mass index (BMI)
- Blood pressure
- Cholesterol level

their blood pressure, their cholesterol level.



Looking at Associations with Multivariate Quantitative Data

What is Multivariate Quantitative Data?

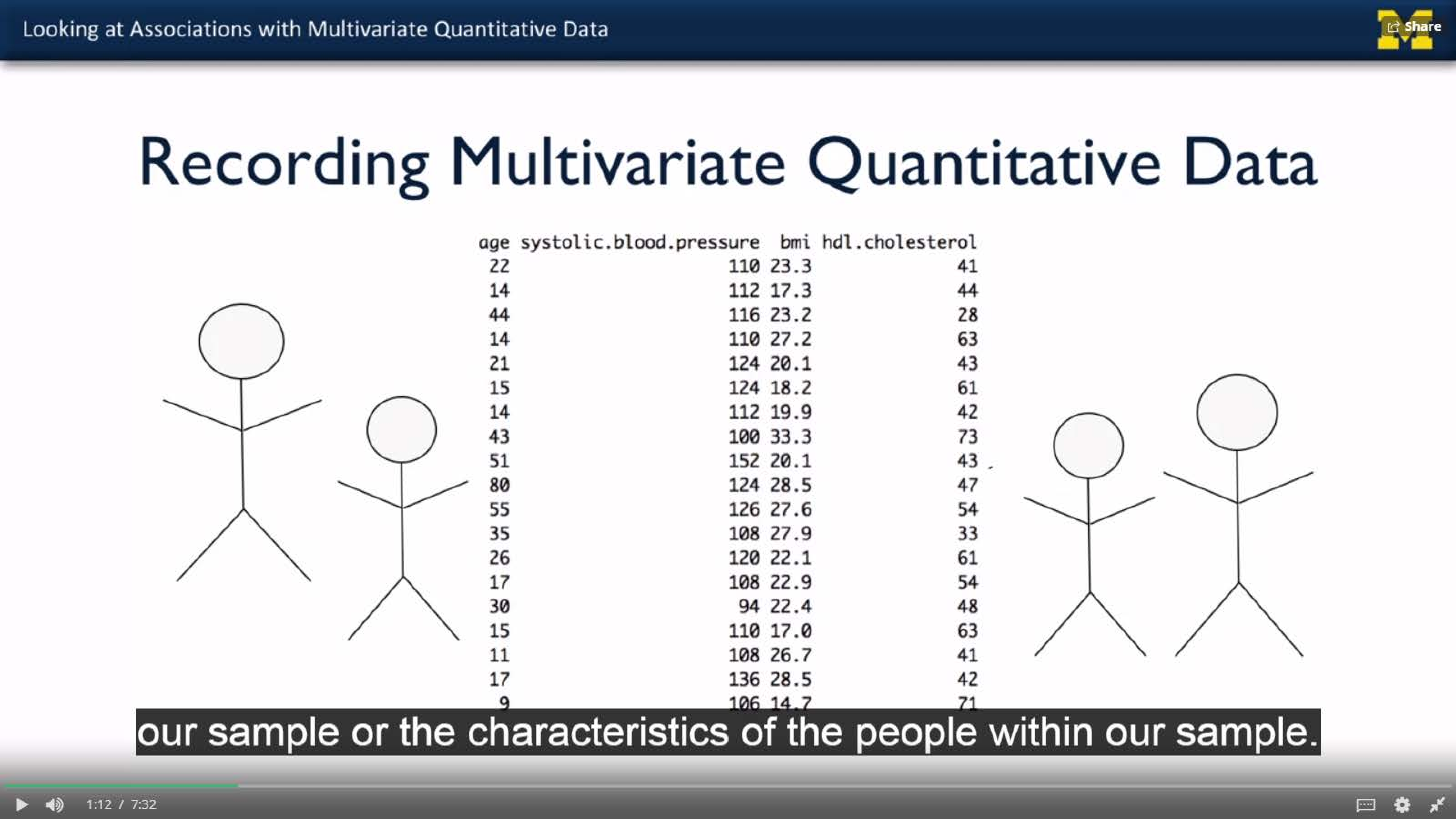
Multivariate

more than one trait recorded per unit

Quantitative

takes on a measured numeric value

and its quantitative because the numbers we measure take on measure numeric values.



Looking at Associations with Multivariate Quantitative Data

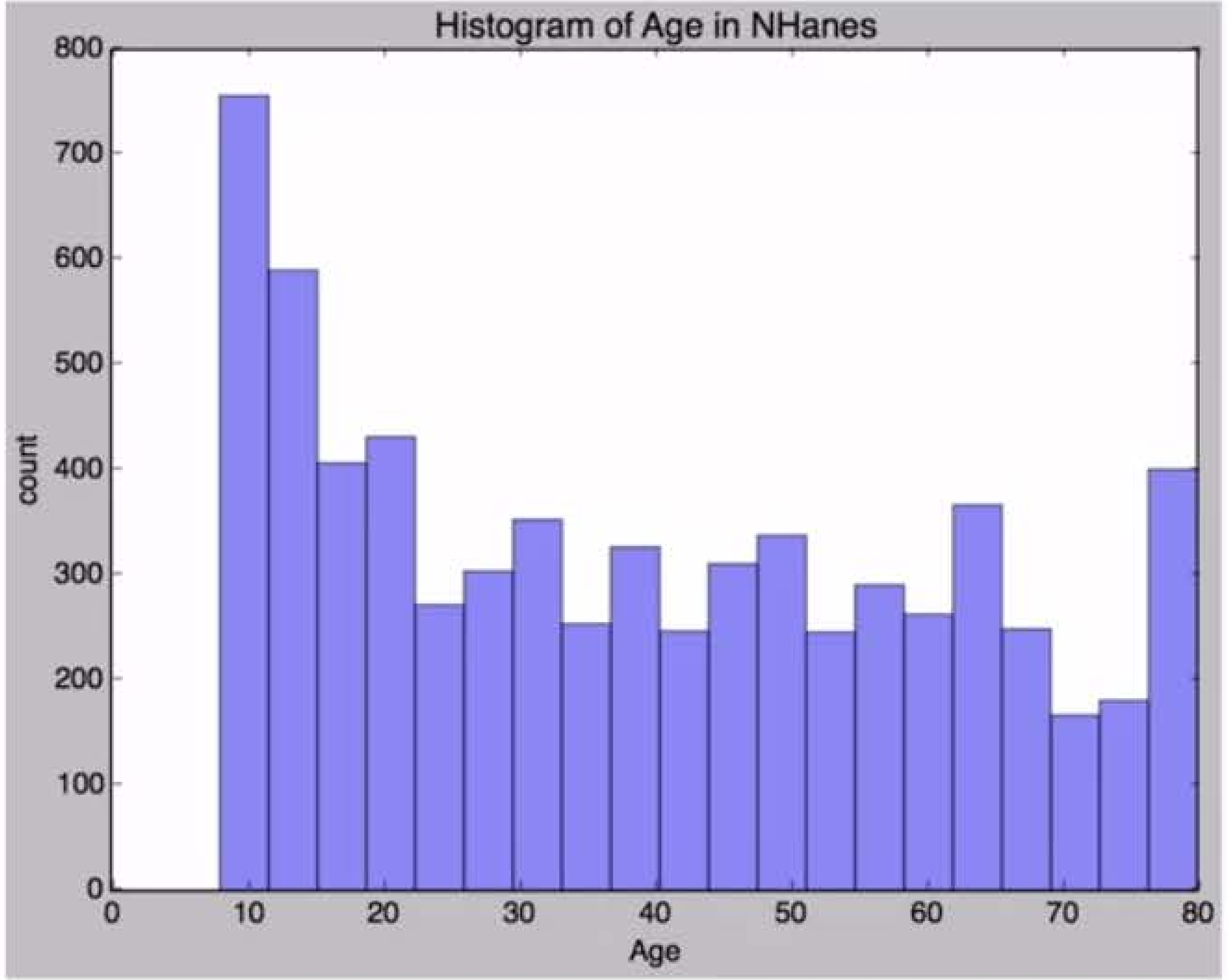
Recording Multivariate Quantitative Data

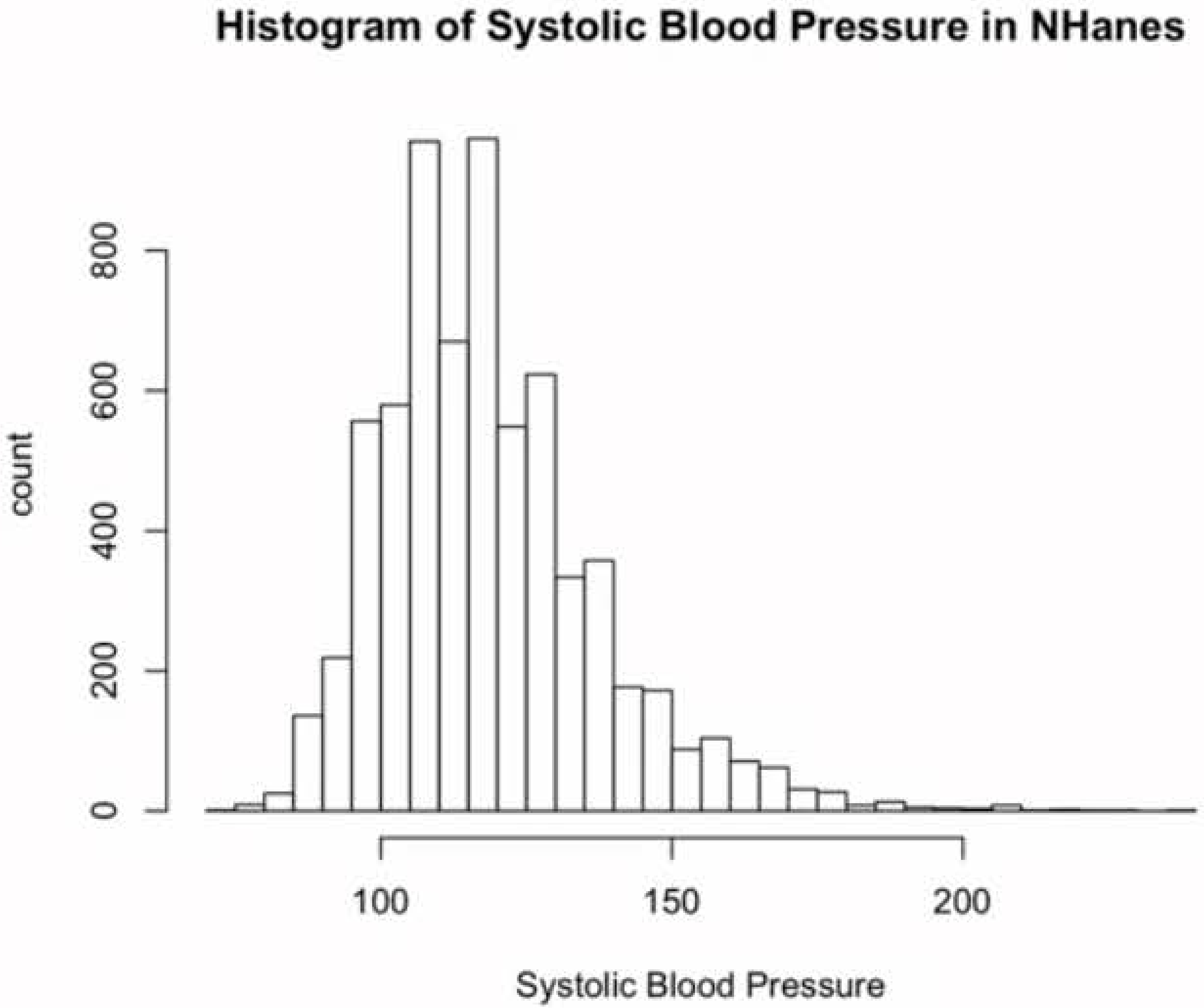
```
age systolic.blood.pressure  bmi hdl.cholesterol
 22                     110 23.3              41
 14                     112 17.3              44
 44                     116 23.2              28
 14                     110 27.2              63
 21                     124 20.1              43
 15                     124 18.2              61
 14                     112 19.9              42
 43                     100 33.3              73
 51                     152 20.1              43
 80                     124 28.5              47
 55                     126 27.6              54
 35                     108 27.9              33
 26                     120 22.1              61
 17                     108 22.9              54
 30                      94 22.4              48
 15                     110 17.0              63
 11                     108 26.7              41
 17                     136 28.5              42
  9                     106 14.7              71
```

our sample or the characteristics of the people within our sample.

Share

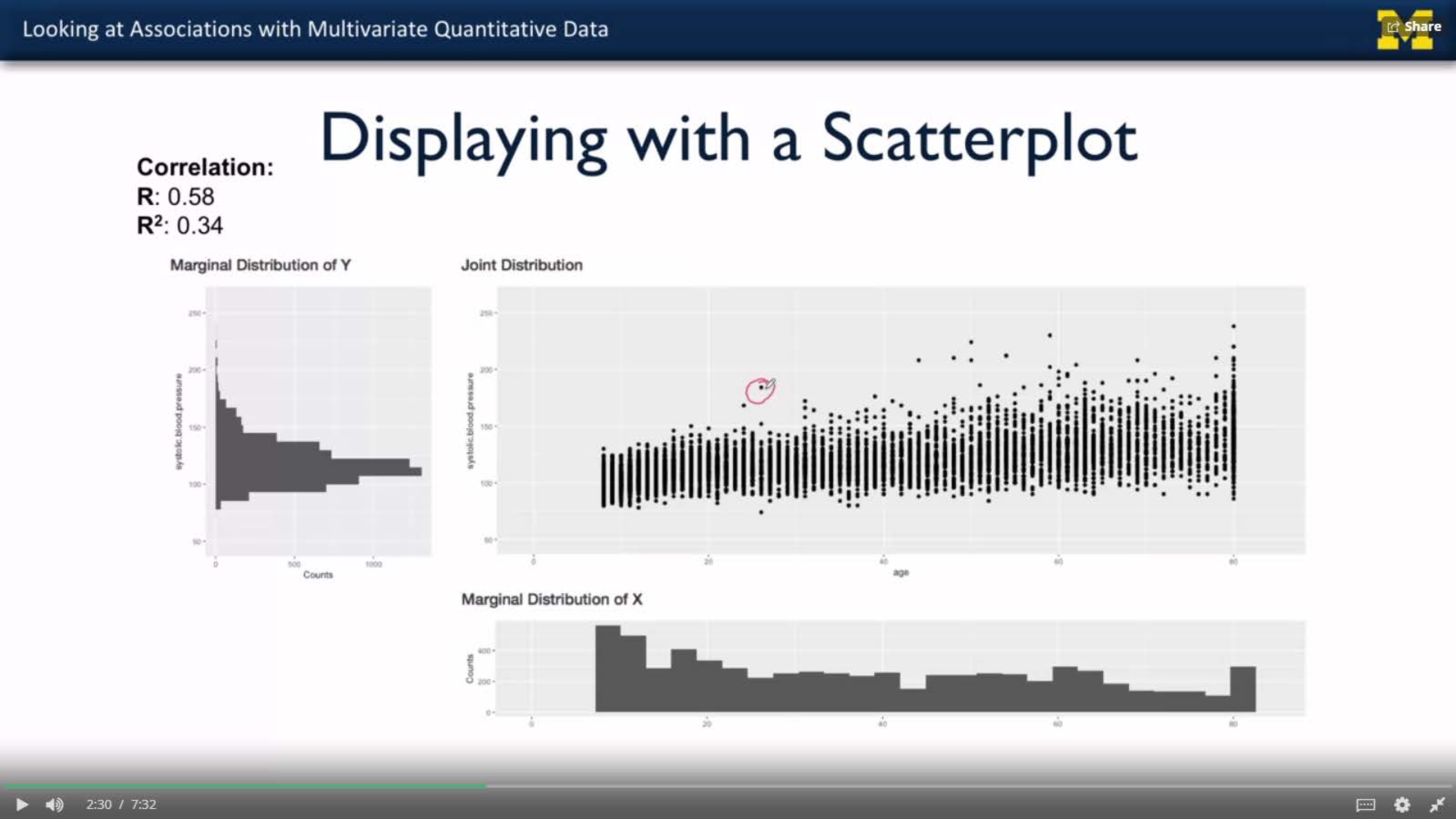
Displaying with Univariate Histograms





But what if we are interested in the association between these two variables?

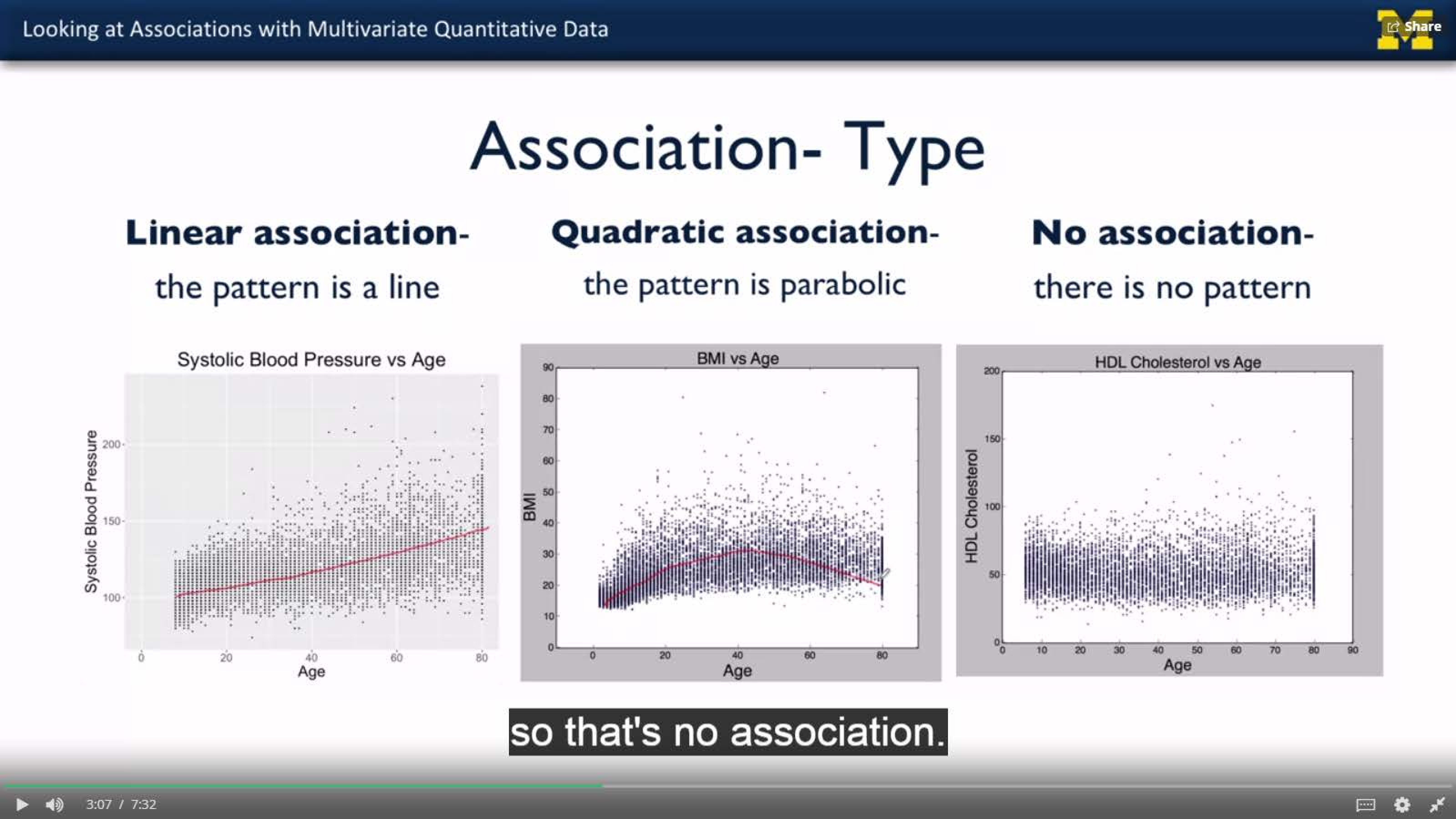
1:35 / 7:32



Looking at Associations with Multivariate Quantitative Data

Displaying with a Scatterplot

Correlation:
R: 0.58
R^2: 0.34



Looking at Associations with Multivariate Quantitative Data

Association- Type

Linear association-

the pattern is a line

Quadratic association-

the pattern is parabolic

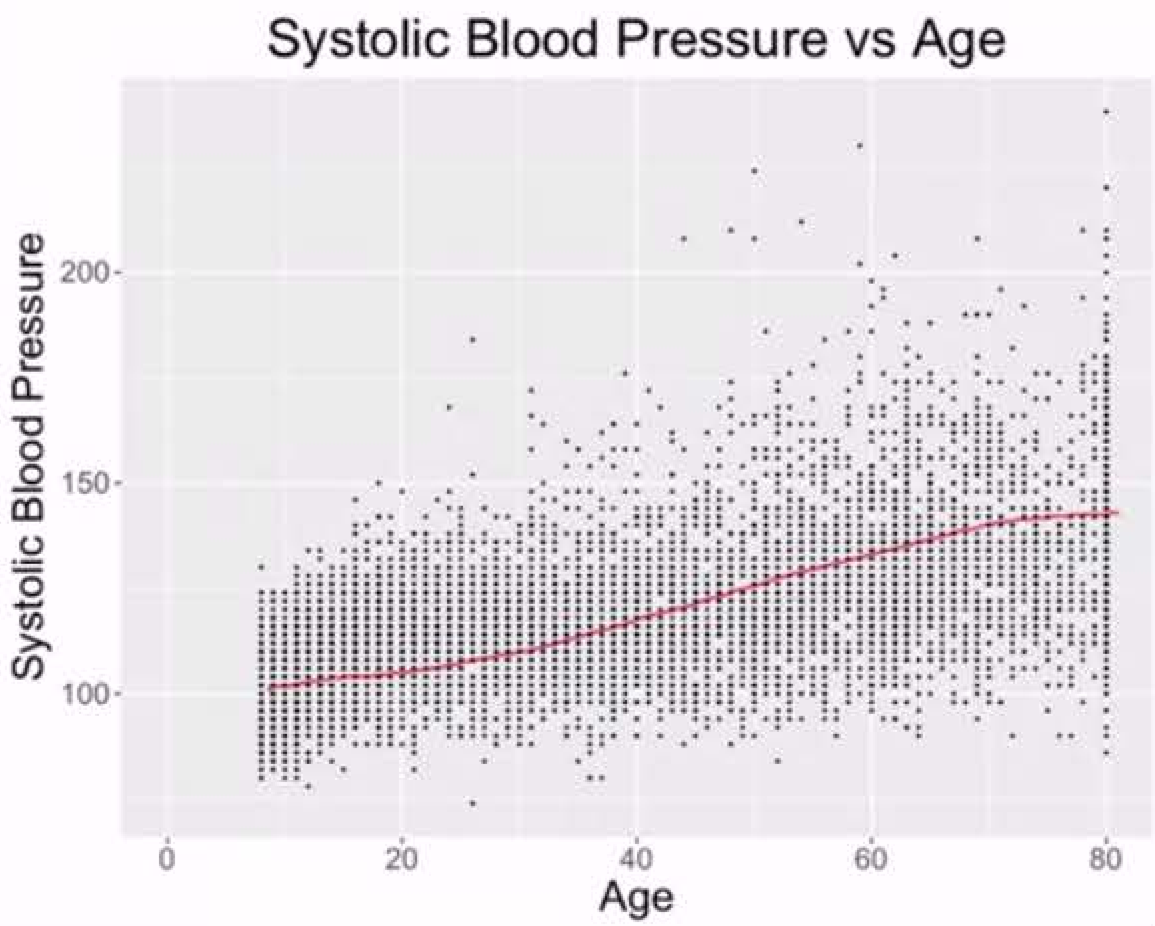
No association-

there is no pattern

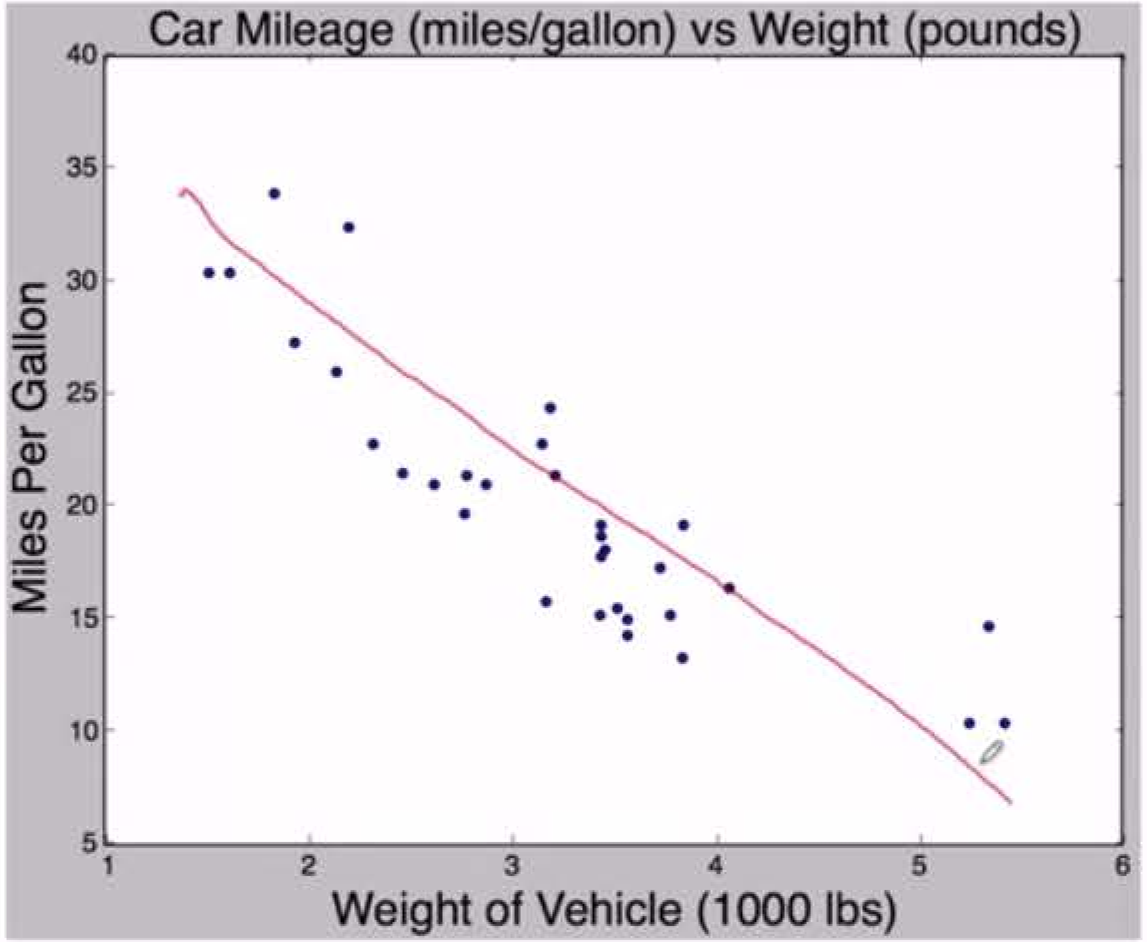
so that's no association.

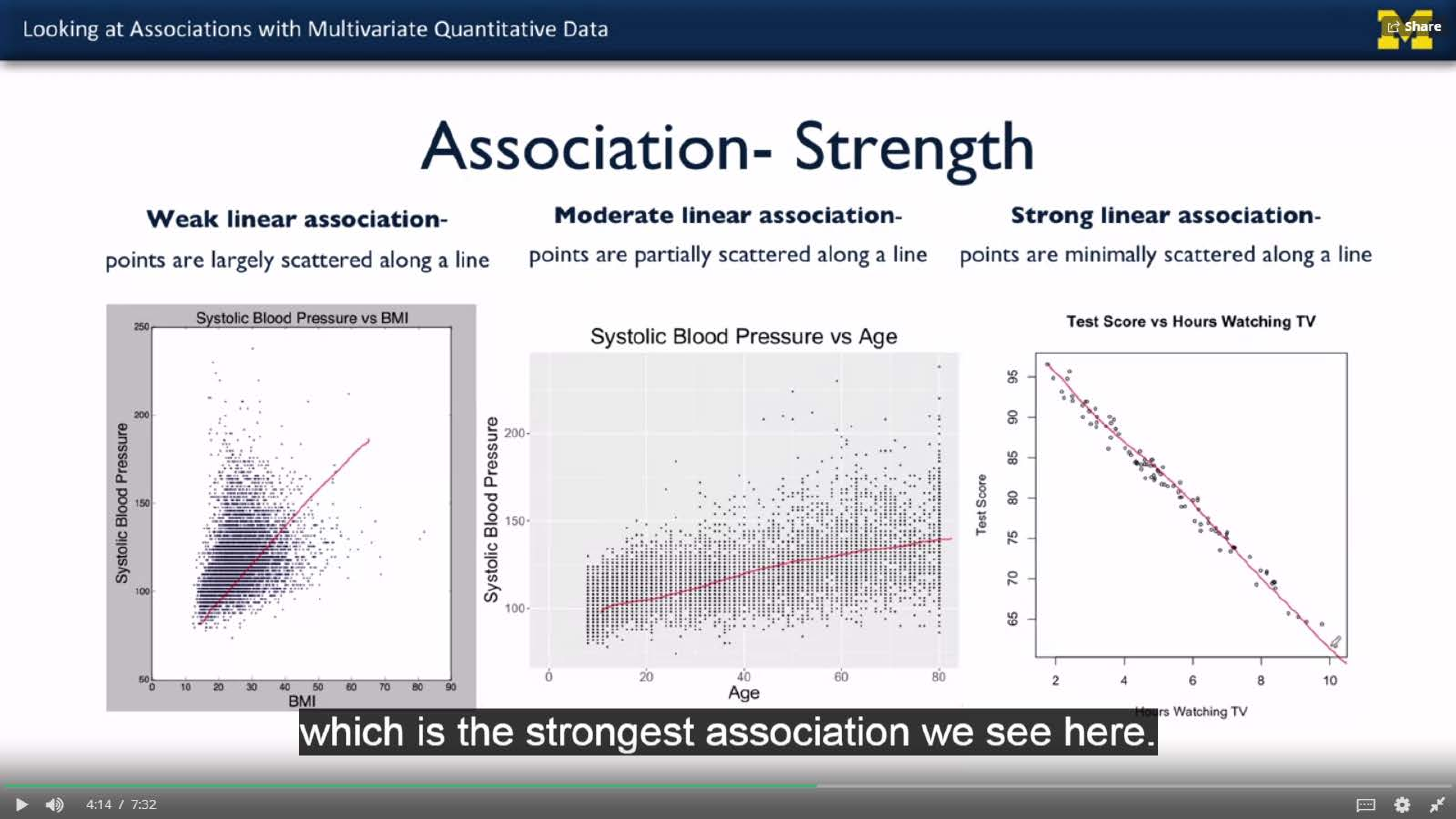
Association- Direction

Positive linear association - pattern has a positive slope, when x increases, y increases



Negative linear association - pattern has a negative slope, when x increases, y decreases





Looking at Associations with Multivariate Quantitative Data

Association- Strength

Weak linear association-

points are largely scattered along a line

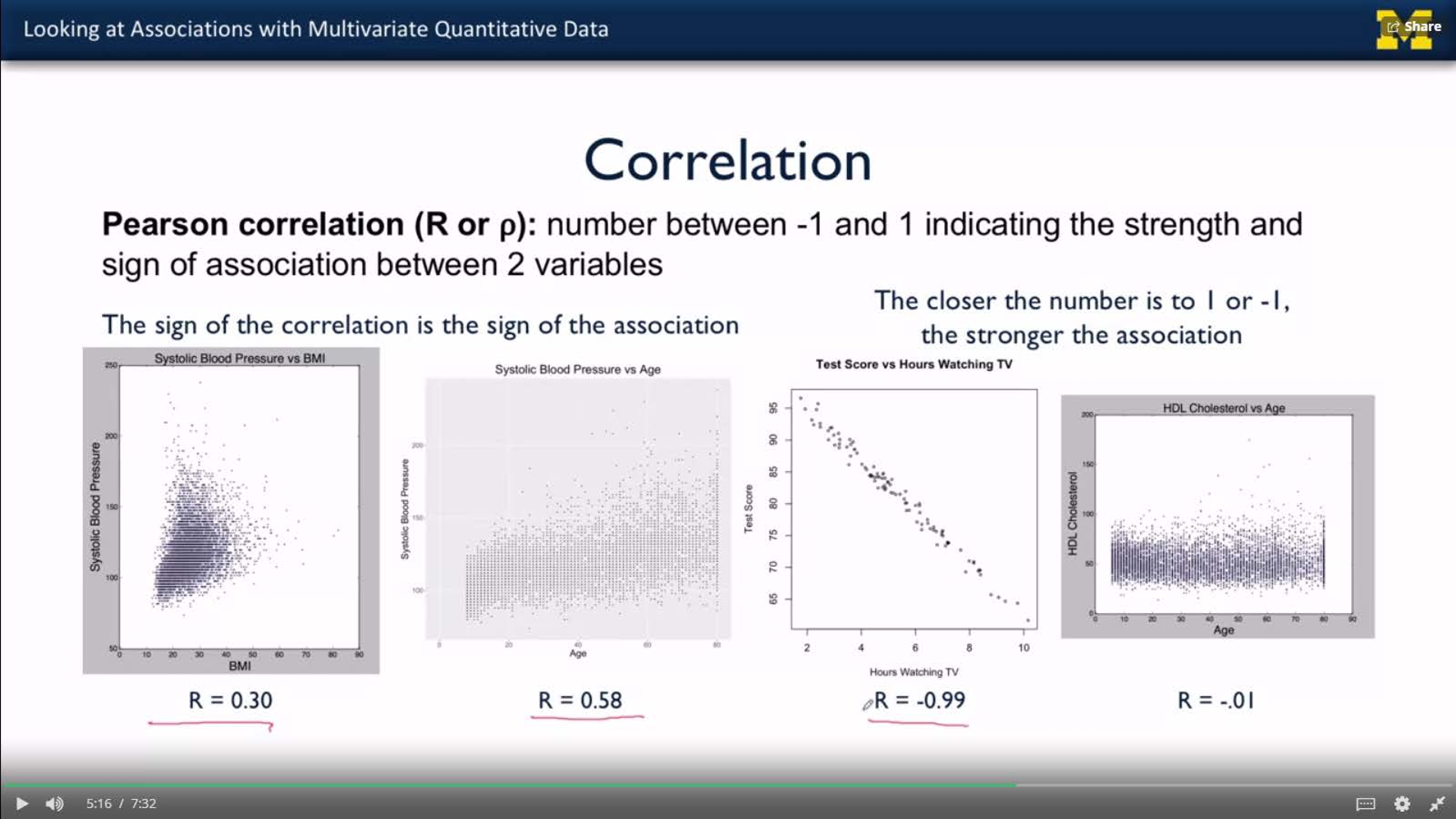
Moderate linear association-

points are partially scattered along a line

Strong linear association-

points are minimally scattered along a line

which is the strongest association we see here.



Looking at Associations with Multivariate Quantitative Data

Correlation

Pearson correlation (R or ρ): number between -1 and 1 indicating the strength and sign of association between 2 variables

The sign of the correlation is the sign of the association

The closer the number is to 1 or -1, the stronger the association

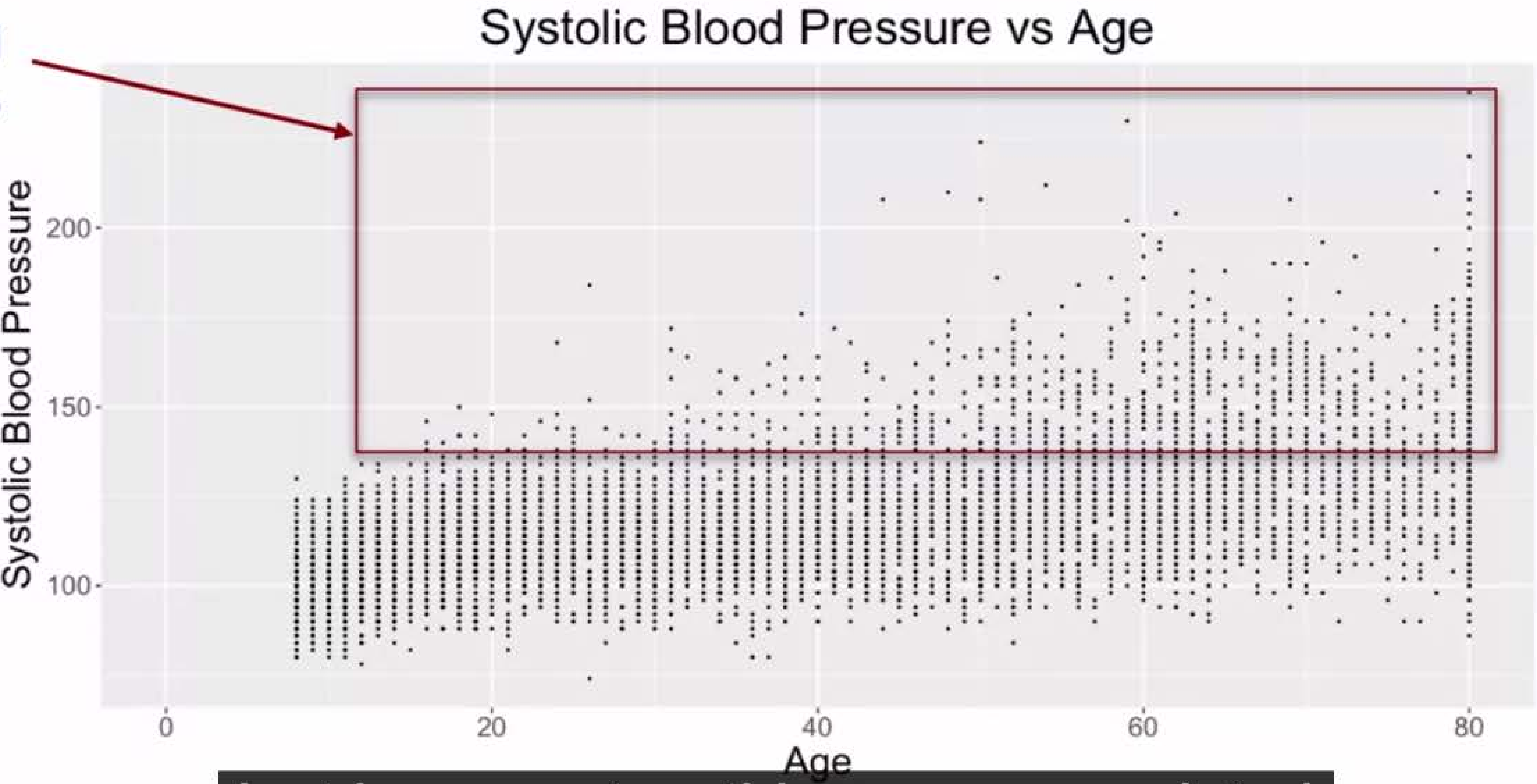
R = 0.30

R = 0.58

R = -0.99

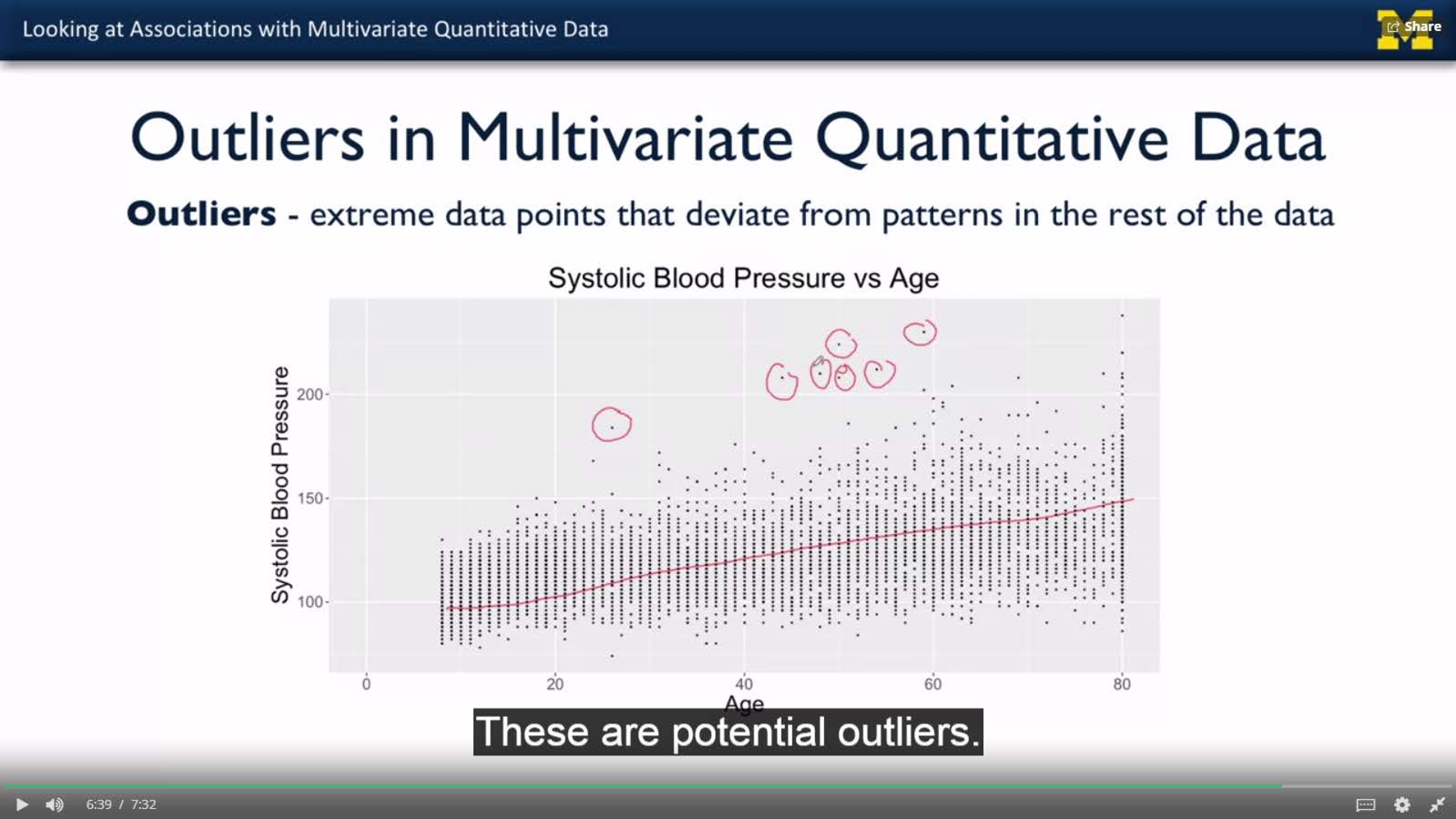
R = -.01

Correlation Does Not Imply Causation



Smoked tobacco

Just because two things are associated,



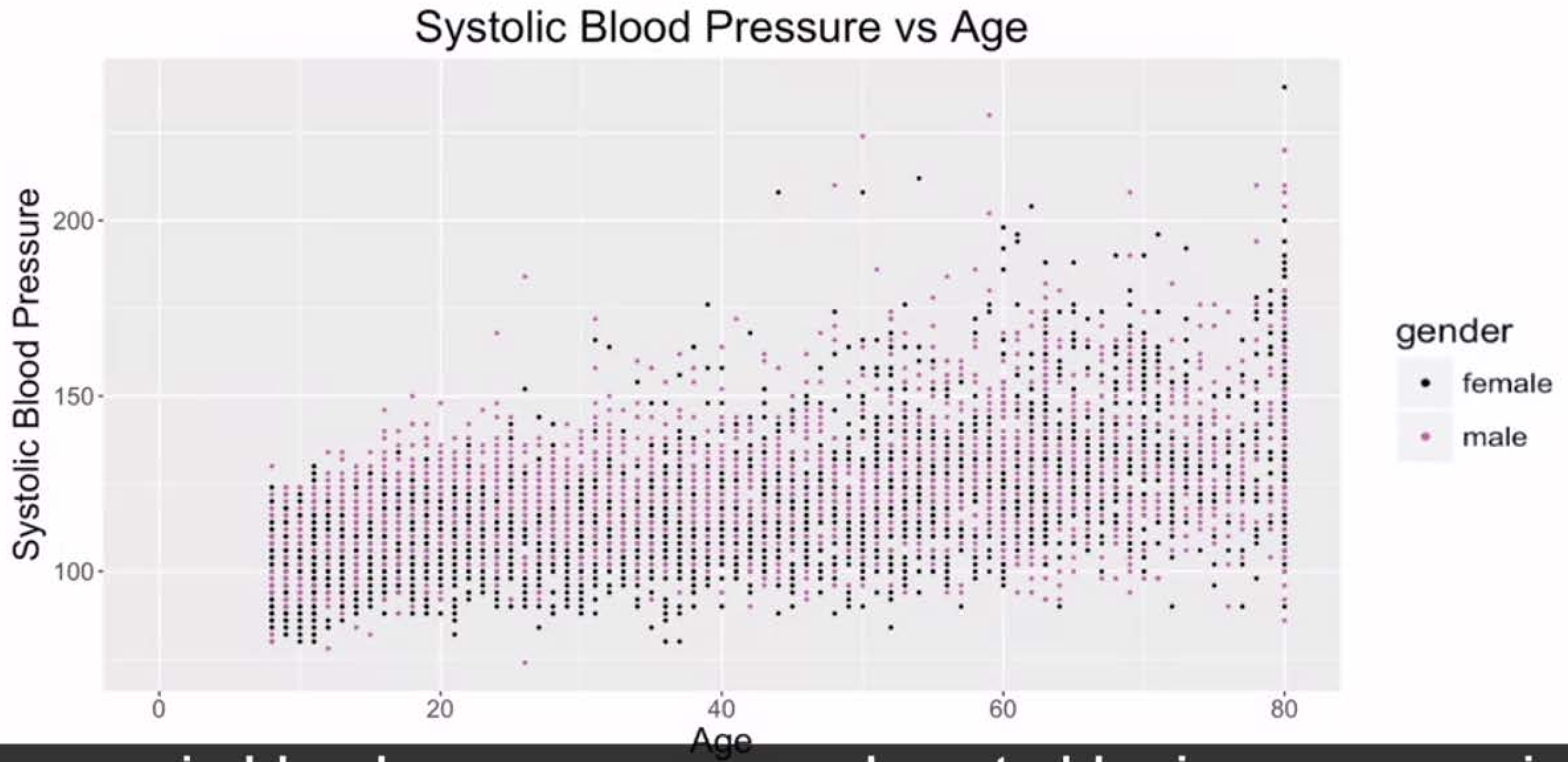
Looking at Associations with Multivariate Quantitative Data

Outliers in Multivariate Quantitative Data

Outliers - extreme data points that deviate from patterns in the rest of the data

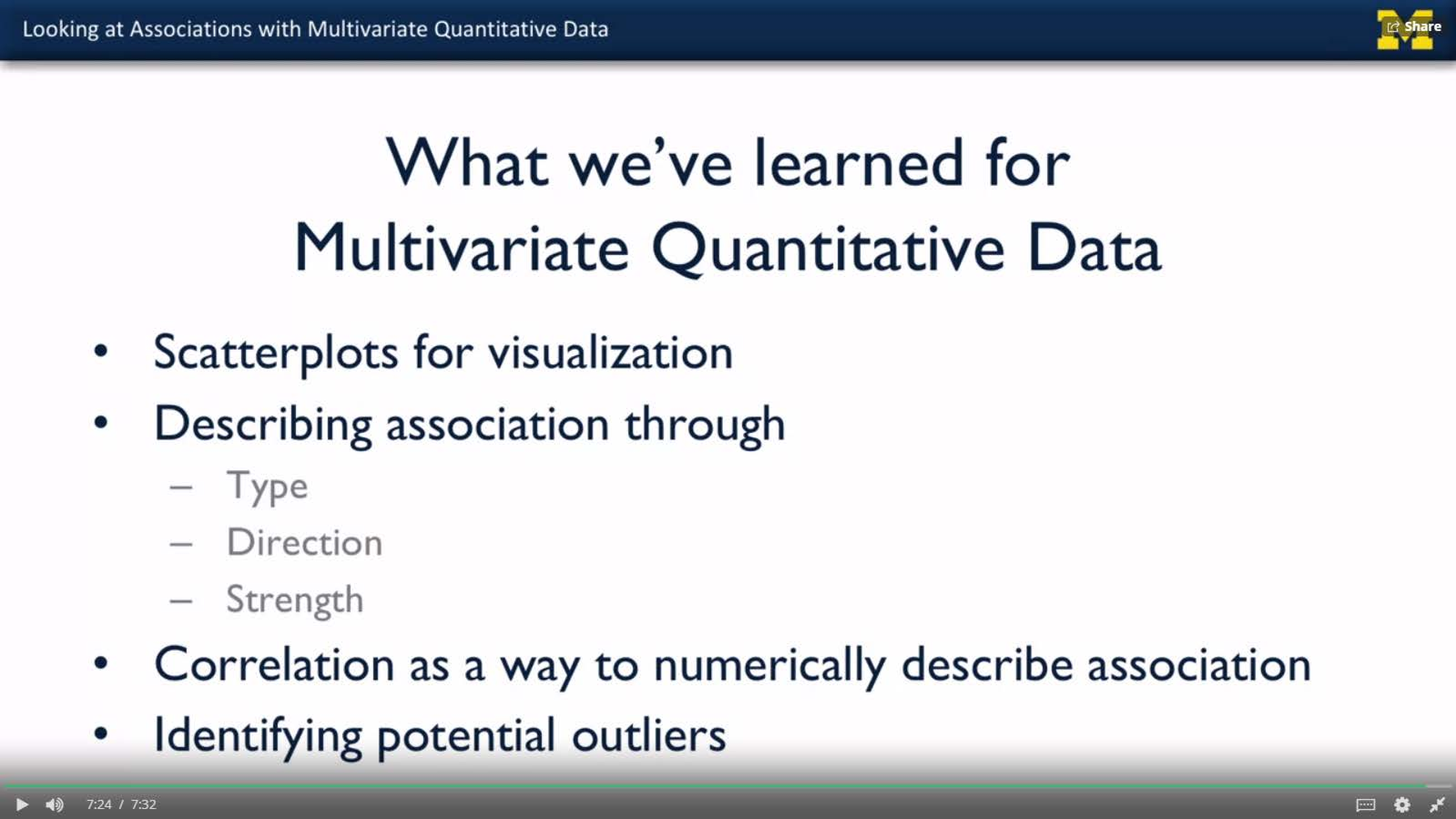
These are potential outliers.

Displaying Quantitative and Categorical Data



and the increase in blood pressure as people get older is more prominent in females.

7:11 / 7:32



Looking at Associations with Multivariate Quantitative Data

What we've learned for Multivariate Quantitative Data

- Scatterplots for visualization
- Describing association through
  - Type
  - Direction
  - Strength
- Correlation as a way to numerically describe association
- Identifying potential outliers