Section 1.1 The Structure of Data

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Math 260 Applied Statistics

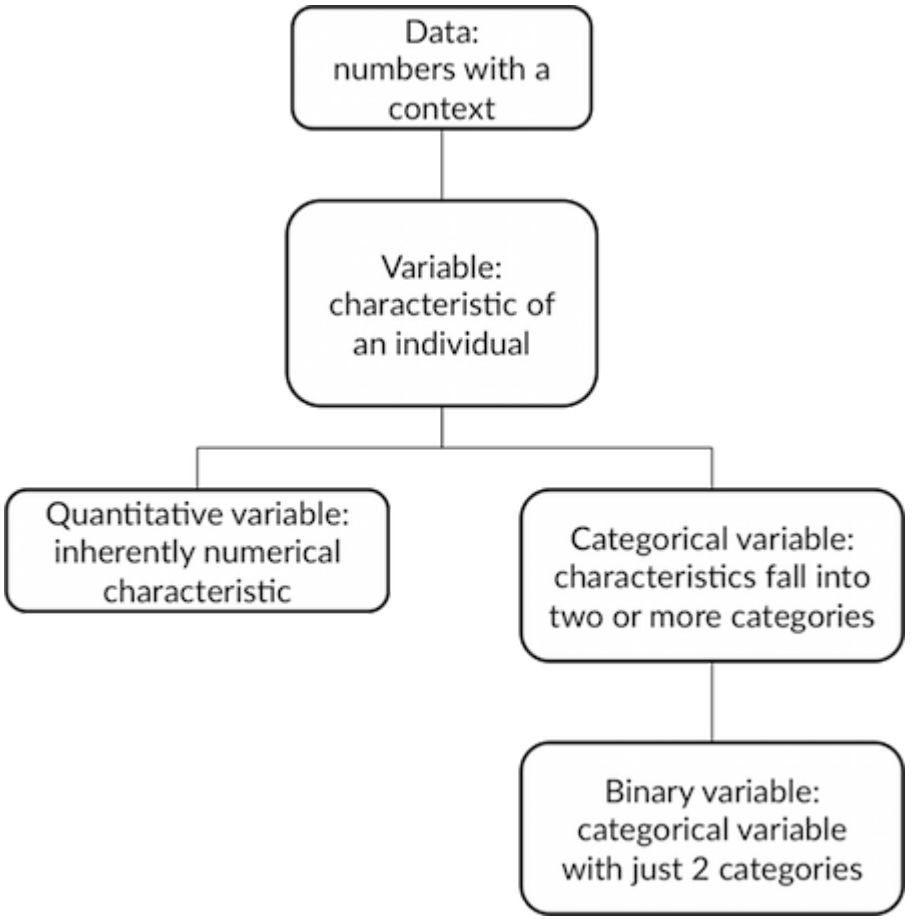
Outline

- Data
- Cases and variables
- Categorical and quantitative variables
- Explanatory and response variables
- Using data to answer a question

Data

- Data are a set of measurements taken on a set of individual units
- Data is typically stored and presented in a *dataset*, comprised of variables measured on cases

The Data Family Tree



Cautions

- Race is a social construct
  $\Rightarrow$ How to measure the effects of systemic racism?
  $\Rightarrow$ How to study disease risk factors?

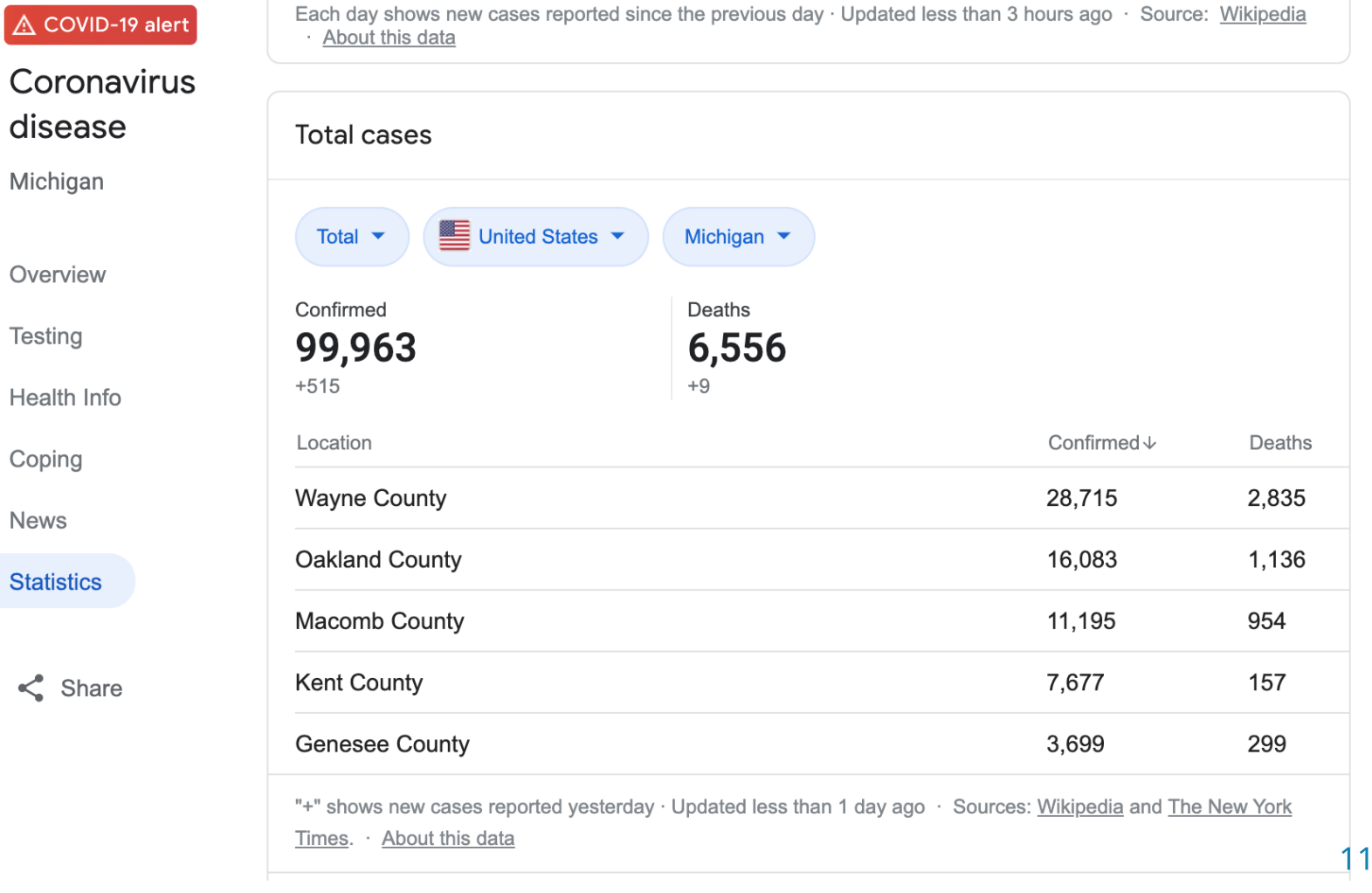
- The Gender Unicorn
  $\Rightarrow$ How to measure salary discrimination by sex/gender?
  $\Rightarrow$ Estimate incidence of cancer?

The American Community Survey

Sex	Age	Married	Income	HoursWk	Race	USCitizen	HealthInsurance	Language
0	58	1	35.4	40	white	1	1	1
1	73	1	23.0	49	white	1	1	1
1	22	0	36.0	53	black	1	1	1
0	61	1	42.0	40	white	1	1	1
1	65	1	70.0	45	white	1	1	1
1	43	1	14.4	40	other	0	1	0
0	55	0	24.0	25	white	1	1	1
1	33	1	30.0	43	white	1	1	1
1	27	0	35.0	60	white	1	0	0
0	35	0	30.2	38	white	1	1	0
0	34	1	20.0	20	other	0	1	0
0	32	0	18.0	36	asian	0	1	0
0	31	0	12.0	50	other	1	1	1

- Rows are cases
- Columns are variables

COVID-19 Data by County



Flights Data

Source: US Bureau of Transportation Statistics

flight	tailnum	origin	month	day	distance	air_time
4626	N8EGMQ	LGA	6	6	479	74
4304	N14105	EWR	6	22	1167	147
71	N607JB	JFK	5	3	1069	154
27	N854VA	JFK	10	11	2586	338
393	N526JB	LGA	1	13	950	133
404	N374DA	JFK	12	22	1069	156

Categorical - tailnum, origin, flight

Quantitative - distance, air_time, month, day

Careful: Dates need to be handled with care and are not typical quantitative variables. Context is everything!

Flights Data Sets: Part 2

faa	name	lat	lon	alt	tz	dst	tzone
04G	Lansdowne Airport	41.13	-80.62	1044	-5	A	America/New_York
06A	Moton Field Municipal Airport	32.46	-85.68	264	-6	A	America/Chicago
06C	Schaumburg Regional	41.99	-88.10	801	-6	A	America/Chicago
06N	Randall Airport	41.43	-74.39	523	-5	A	America/New_York
09J	Jekyll Island Airport	31.07	-81.43	11	-5	A	America/New_York
0A9	Elizabethton Municipal Airport	36.37	-82.17	1593	-5	A	America/New_York

Explanatory and Reponse Variables

If we are using one variable to help us understand or predict values of another variable, we call the former the **explanatory** variable and the latter the **response** variable.

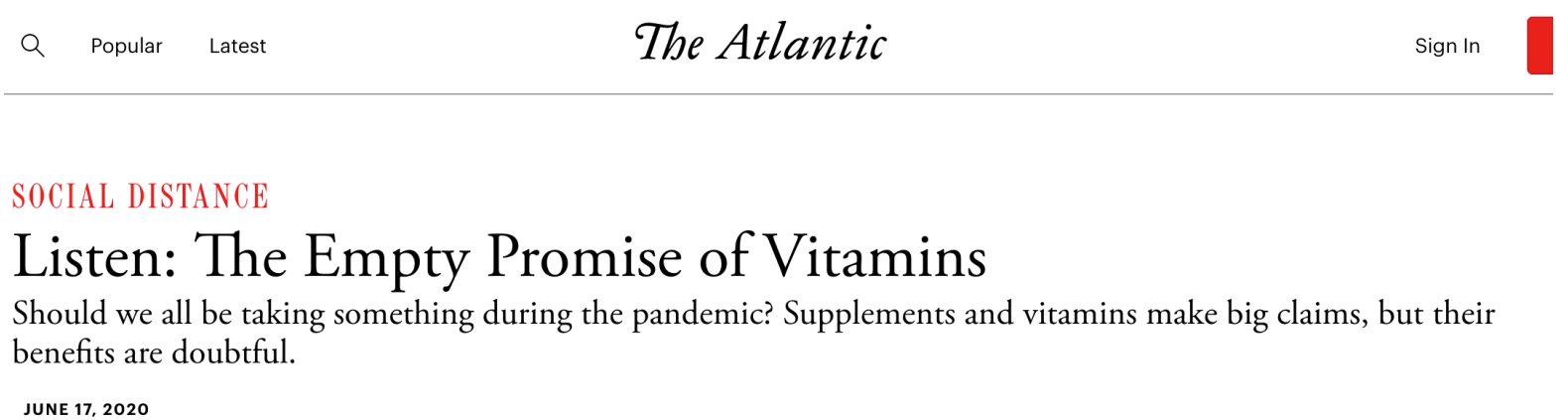
Examples:

- Does meditation help reduce stress?

Source: NPR

Explanatory and Reponse Variables

- Do multivitamin supplements increase longevity?



Data is Everywhere!

Examples

- [US News and World Report National University Rankings]https://www.usnews.com/best-colleges/rankings/national-liberal-arts-colleges)
    - No place like home
- US Government's Open Data
- CDC COVID Data Tracker