Hypothesis Testing Assignment

Group 4

Team members:

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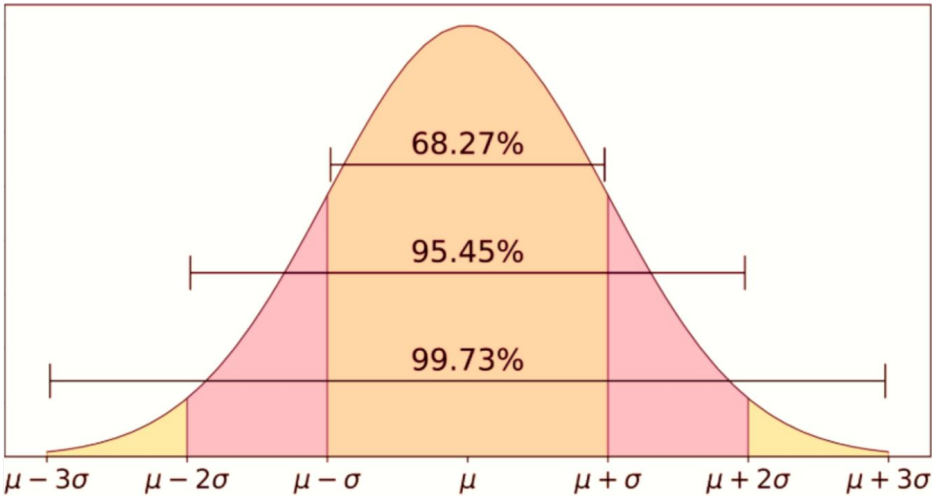
Confidence Level

- 95% of confidence
- Assume a Null Hypothesis (H0)
- Alternative Hypothesis (Ha)
- Examine by test statistic (P-value)
- Reject or Accept H0

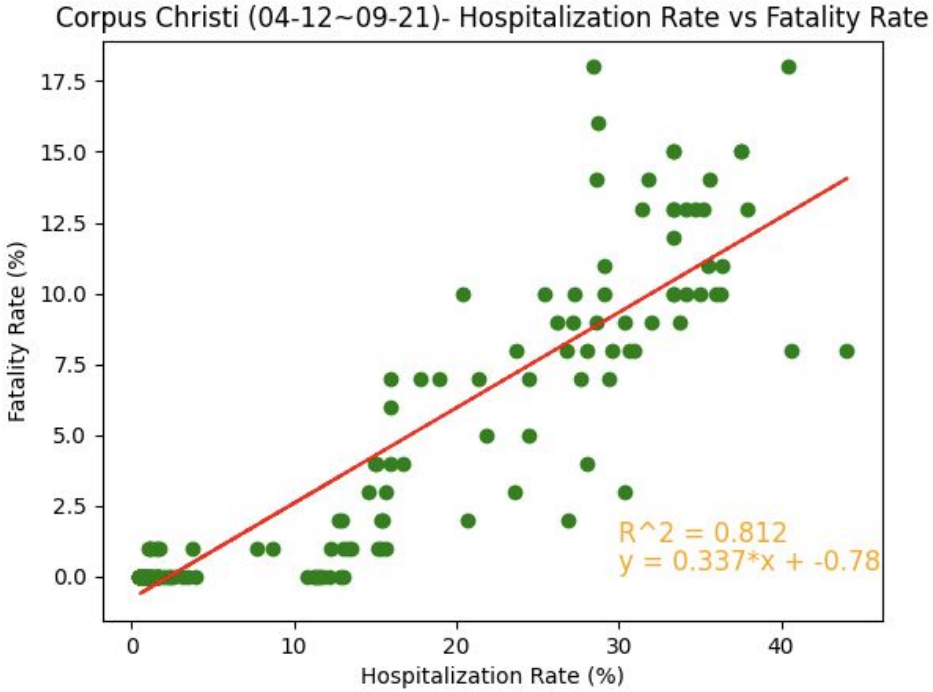


Hypothesis 1

Question	A higher hospitalization rate gives a higher fatality rate?
H0	Fatality Rate = (slope) * (Hospitalization Rate) + intercept slope = 0
Ha	slope ≠ 0
Test	Linear regression t-test

Corpus Christi (TSA area)

- slope = 0.037
- Confidence Level = 99.9%



Hypothesis 1

Question	A higher hospitalization rate gives a higher fatality rate?
H0	Fatality Rate = (slope) * (Hospitalization Rate) + intercept slope = 0
Ha	slope ≠ 0
Test	Linear regression t-test

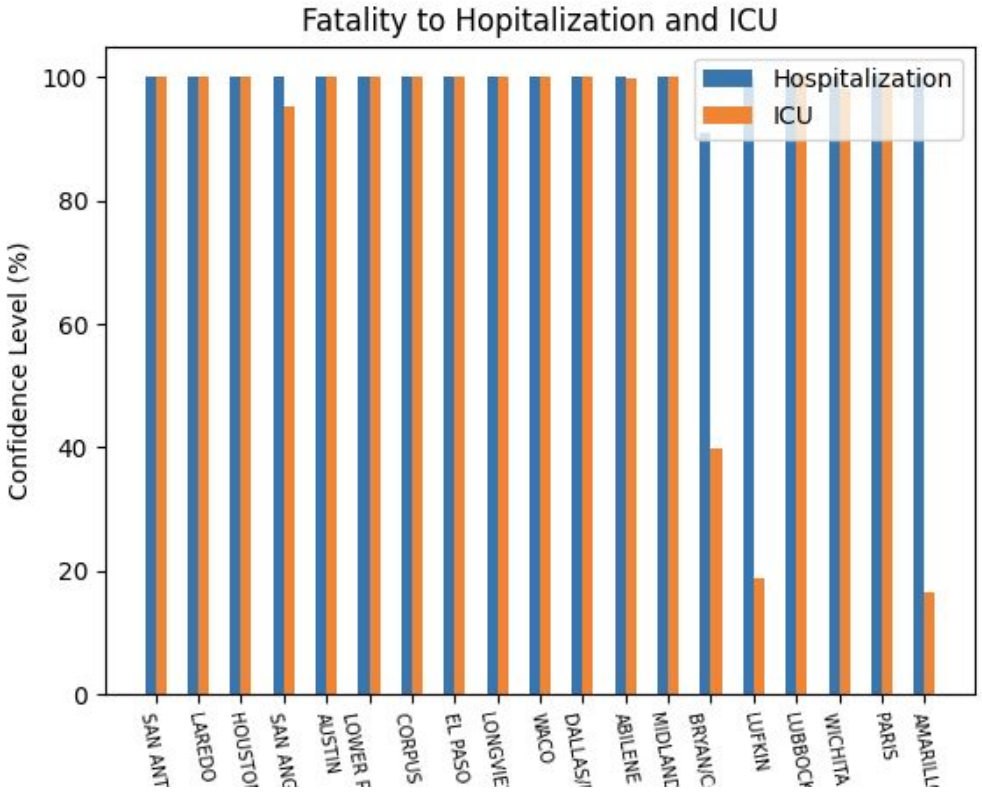
REJECTED

A higher hospitalization rate gives a higher fatality rate

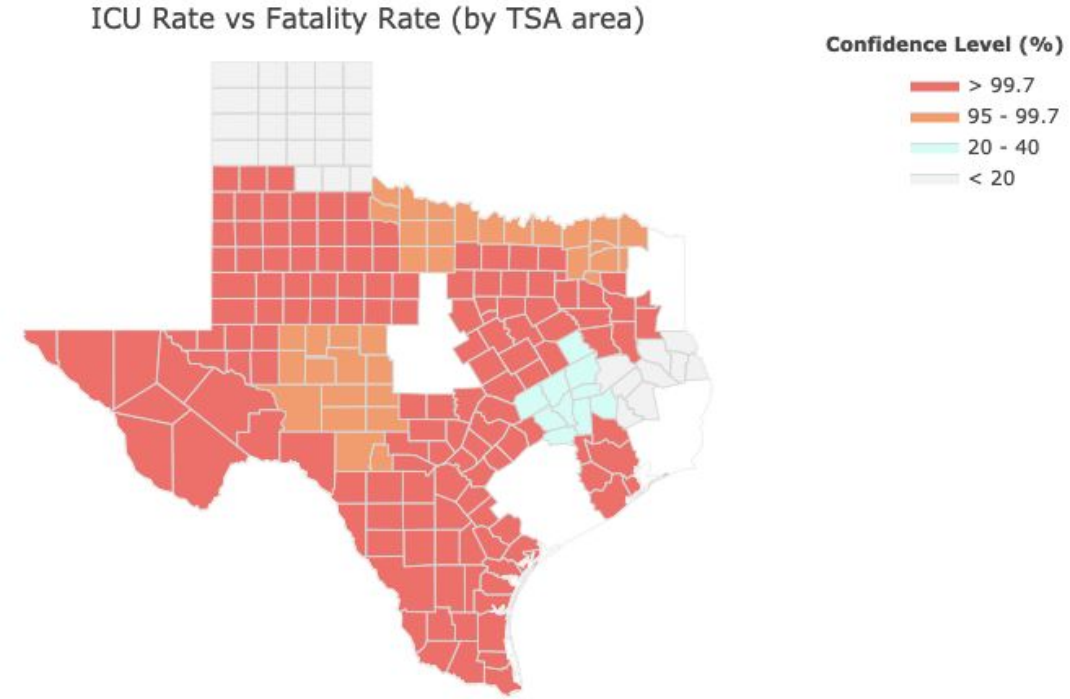
Hypothesis 2

Question	A higher ICU rate gives a higher fatality rate?
H0	Fatality Rate = (slope) * (ICU Rate) + intercept slope = 0
Ha	slope ≠ 0
Test	Linear regression t-test

Compare Hospitalization and ICU rate



Confidence by TSA area



Hypothesis 2

Question	A higher ICU rate gives a higher fatality rate?
H0	Fatality Rate = (slope) * (ICU Rate) + intercept slope = 0
Ha	slope ≠ 0
Test	Linear regression t-test

REJECTED

A higher ICU rate gives a higher fatality rate

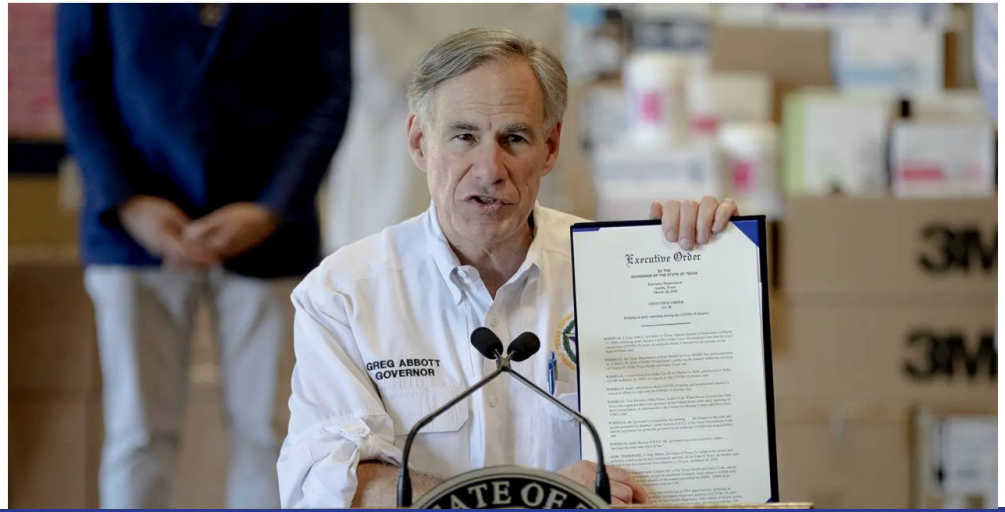
Hypothesis 3

Gov. Greg Abbott orders air travelers from New Orleans and around New York to self-quarantine

> The order aligns Texas with federal guidance announced Wednesday that aims to contain the spread of the virus outside New York, which has become the epicenter of the outbreak in the United States.

BY PATRICK SVITEK MARCH 26, 2020 UPDATED: 3 PM

COPY LINK REPUBLISH



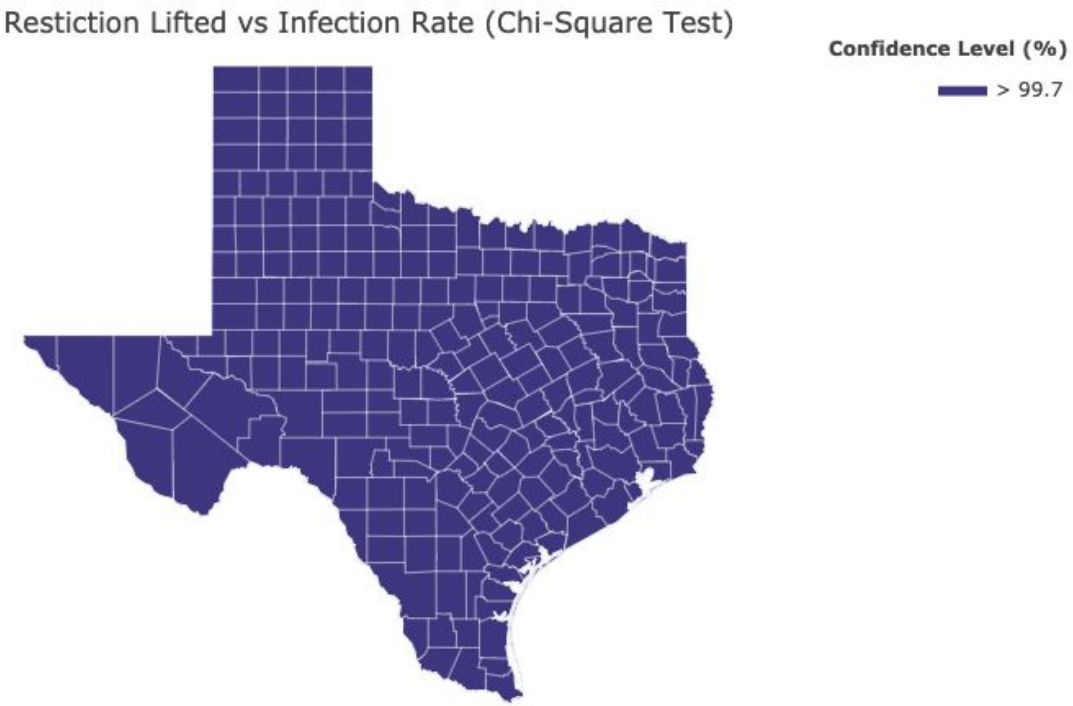
https://www.texastribune.org/2020/03/26/texas-orders-self-quarantine-air-travelers-new-york-and-new-orleans/

State	State Travel Restrictions	Resources / Links
	South Dakota Tennessee Wisconsin	
Puerto Rico	Mandated 14-day quarantine (or for the duration of their trip, whichever is shorter), including for residents of Puerto Rico.	Puerto Rico COVID-19 Resources Page
Rhode Island	Governor Raimondo issued a travel advisory requiring 14-day quarantine for anyone coming to RI from any state with a 5% or greater positivity rate. The current list of states is as follows: Alabama, Arizona, Arkansas, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kansas, Maryland, Missouri, Montana,, Nebraska, Nevada, North Dakota, Oklahoma, Oregon, Pennsylvania, Puerto Rico, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, Wyoming;	Rhode Island COVID-19 Resources Page
South Carolina	The quarantine requirement for out-of-state travelers expired May 1, 2020.	South Carolina COVID-19 Resource Page
South Dakota	The state has not issued any orders or recommendations at this time.	South Dakota COVID-19 Resources Page
Tennessee	There are no statewide restrictions at this time.	Tennessee Covid-19 Resource Page
Texas	**May 21, 2020**: Gov. Greg Abbott (R) ended quarantine requirements for out-of-state travelers	Texas COVID-19 Resource Page
Utah	The requirement that out-of-state visitors fill out a travel declaration upon entry expired. Travelers to parts of Utah in the "moderate risk" phase of the reopening plan who have come from a high-risk area or situation are required to self-quarantine for 14-days	Utah COVID-19 Resources Page

https://www.lockheedmartin.com/content/dam/lockheed-martin/documents/suppliers/news-coronavirus-us...

Hypothesis 3

Question	As restriction lifted with Open Texas the **rate of infection** increased, with a slight delay?
H0	R1 = Rate (3/26~05/21) R2 = Rate (05/21~07/25) R1 = R2
Ha	R1 ≠ R2
Test	**Chi-test** when we expect something


Restiction Lifted vs Infection Rate (Chi-Square Test)
Confidence Level (%)
> 99.7

Hypothesis 3

Question	As restriction lifted with Open Texas the **rate of infection** increased, with a slight delay?
H0	R1 = Rate (3/26~05/21) R2 = Rate (05/21~07/25) R1 = R2
Ha	R1 ≠ R2
Test	**Chi-test** when we expect something

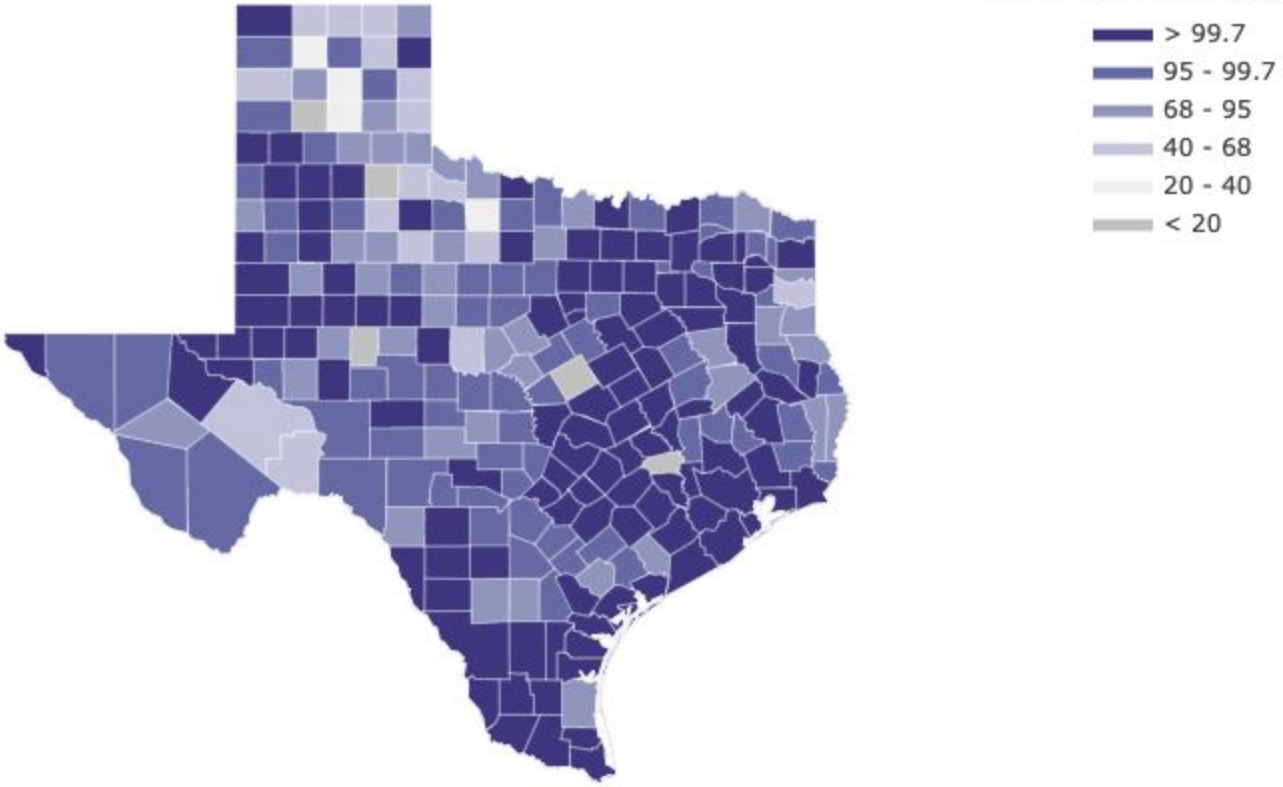
REJECTED

As restriction lifted, the rate of infection increased

Hypothesis 3

Question	As restriction lifted with Open Texas the **rate of infection** increased, with a slight delay?
H0	R1 = R2
Ha	R1 ≠ R2
Test	**Paired test** when we have the same population

Restiction Lifted vs Infection Rate (paired T-test)



Hypothesis 3

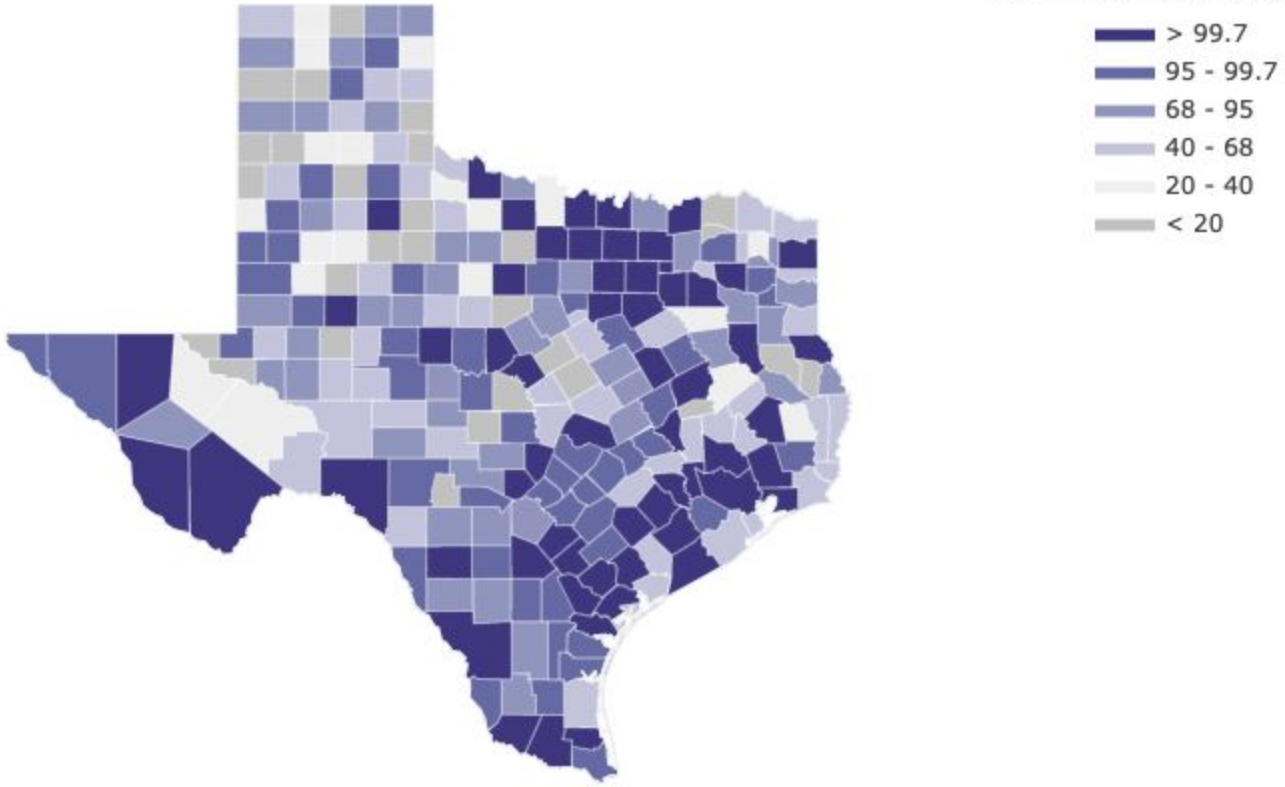
Question	As restriction lifted with Open Texas the **rate of infection** increased, with a slight delay?
H0	R1 = R2 REJECTED
Ha	R1 ≠ R2
Test	**Paired test** when we have the same population

As restriction lifted, the rate of infection increased

Hypothesis 4

Question	More testing leads to lower transmission later?
H0	Transmission Rate = (slope) * (Testing) + intercept slope = 0
Ha	slope ≠ 0
Test	**Linear regression t-test**

Testing vs Transmission Rate



Hypothesis 4

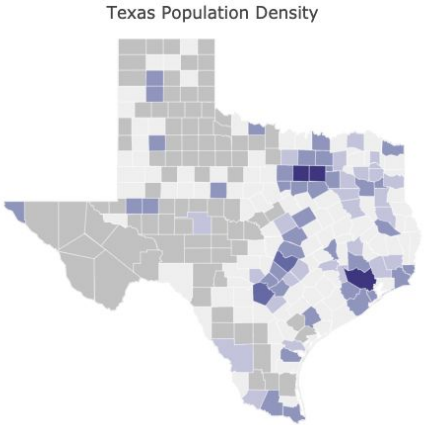
Question	More testing leads to lower transmission later?
H0	Transmission Rate = (slope) * (Testing) + intercept slope = 0
Ha	slope ≠ 0
Test	**Linear regression t-test**

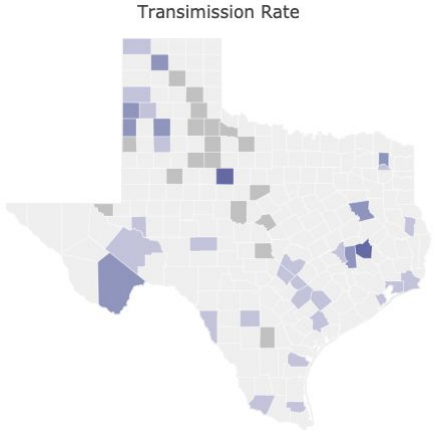
REJECTED

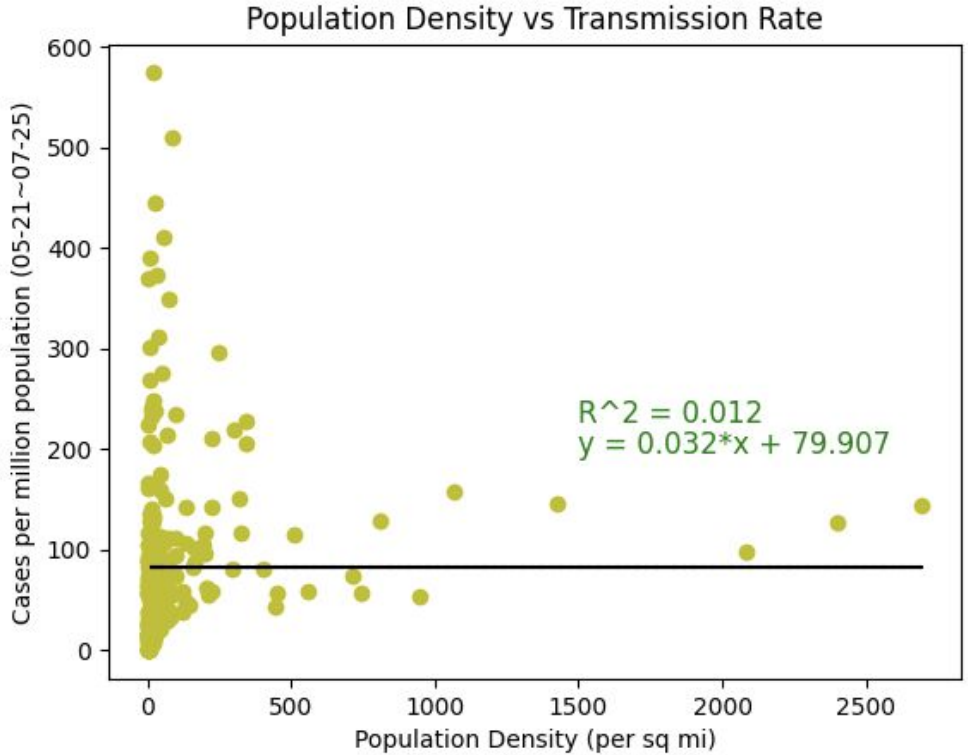
More testing leads to lower transmission later

Hypothesis 5

Question	Higher population density means higher transmission rate?
H0	Transmission Rate = (slope) * (Population Density) + intercept slope = 0
Ha	slope ≠ 0
Test	**Linear regression t-test**







Confidence Level: 91.49%

Hypothesis 5

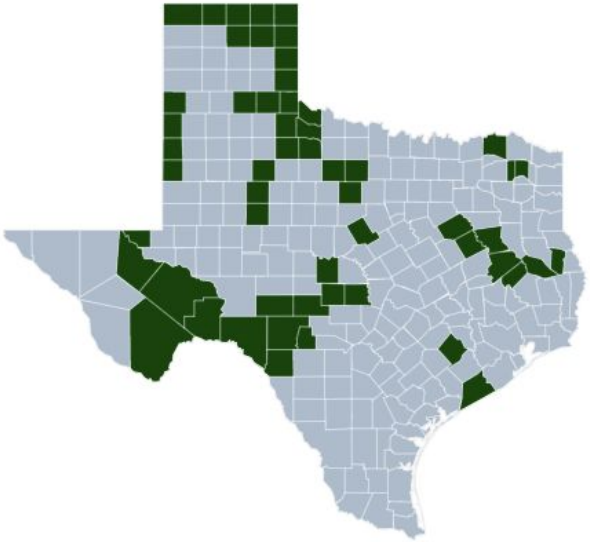
Question	Higher population density means higher transmission rate?
H0	Transmission Rate = (slope) * (Population Density) + intercept slope = 0
Ha	slope ≠ 0
Test	**Linear regression t-test**

Population density and transmission rate does not mean higher transmission rate.

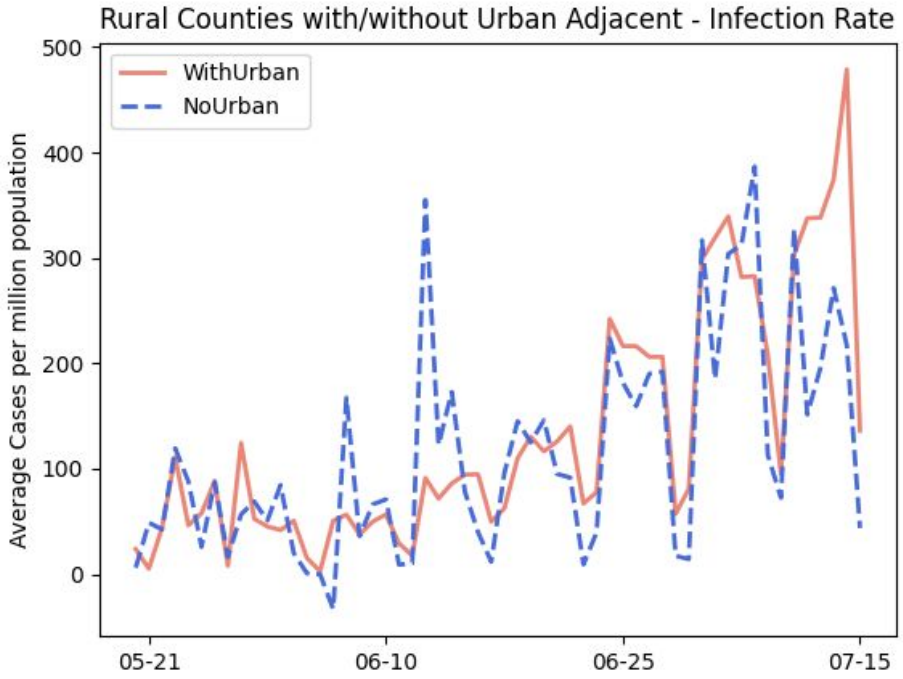
Hypothesis 6

Question	Rural counties neighboring urban areas had higher rates than rural counties not near urban areas?
H0	R1 = Rate average rural counties neighboring urban R2 = Rate average rural counties neighboring urban R1 - R2 <= 0
Ha	R1 - R2 >0
Test	**t-test**

Rural Counties without Urban Counties Adjacent

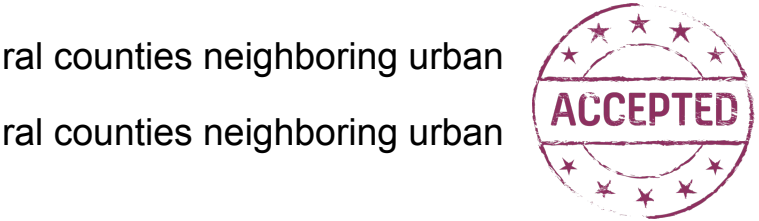


Confidence Level = 94.66%



Hypothesis 6

Question	Rural counties neighboring urban areas had higher rates than rural counties not near urban areas?
H0	R1 = Rate average rural counties neighboring urban R2 = Rate average rural counties neighboring urban R1 - R2 <=0
Ha	R1 - R2 > 0
Test	**t-test**

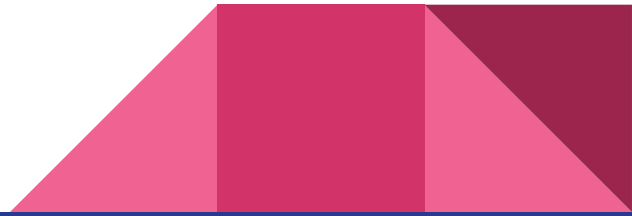


Rural counties neighboring urban areas did not have higher rates than rural counties not near urban areas

Hypothesis 7

Travel data

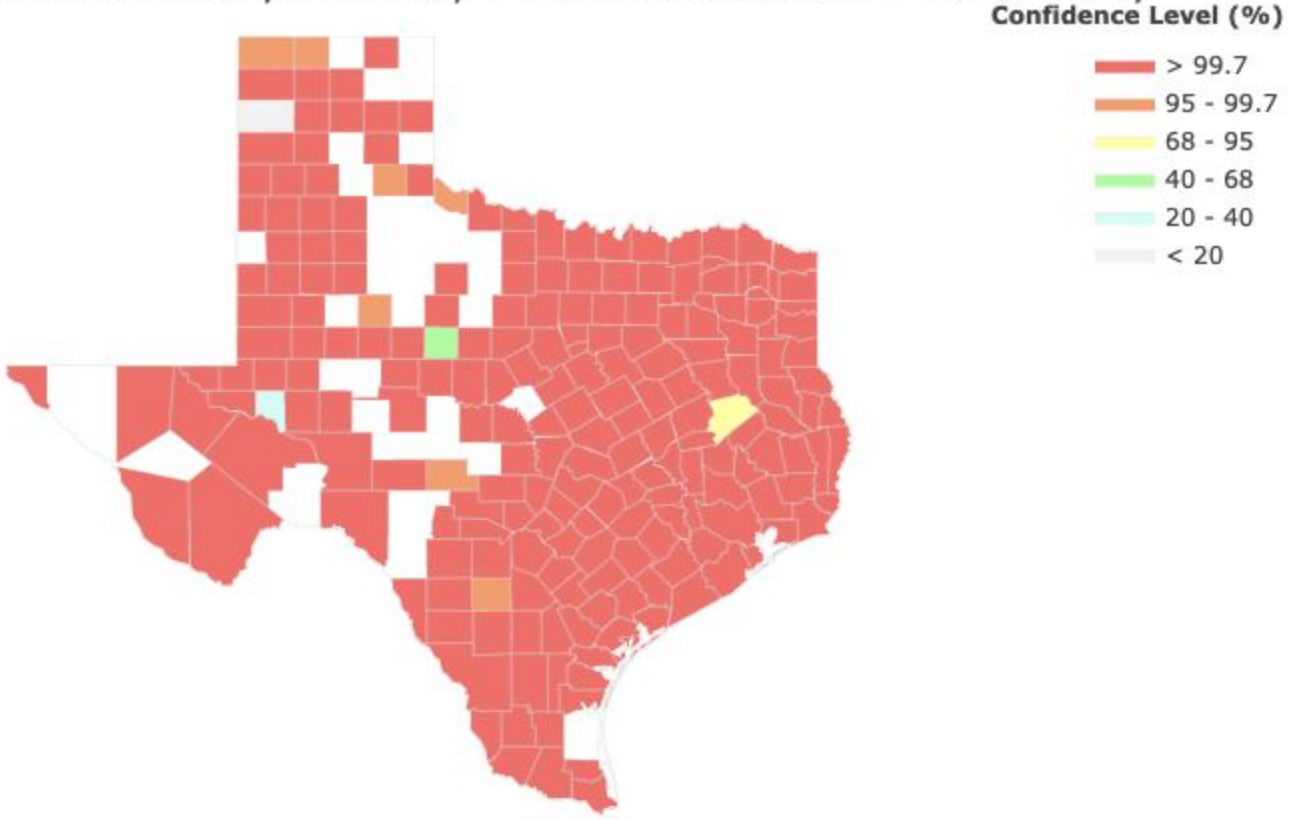
- Retail_and_recreation_percent_change_from_baseline
- Grocery_and_pharmacy_percent_change_from_baseline
- Parks_percent_change_from_baseline
- Transit_stations_percent_change_from_baseline
- Workplaces_percent_change_from_baseline
- Residential_percent_change_from_baseline

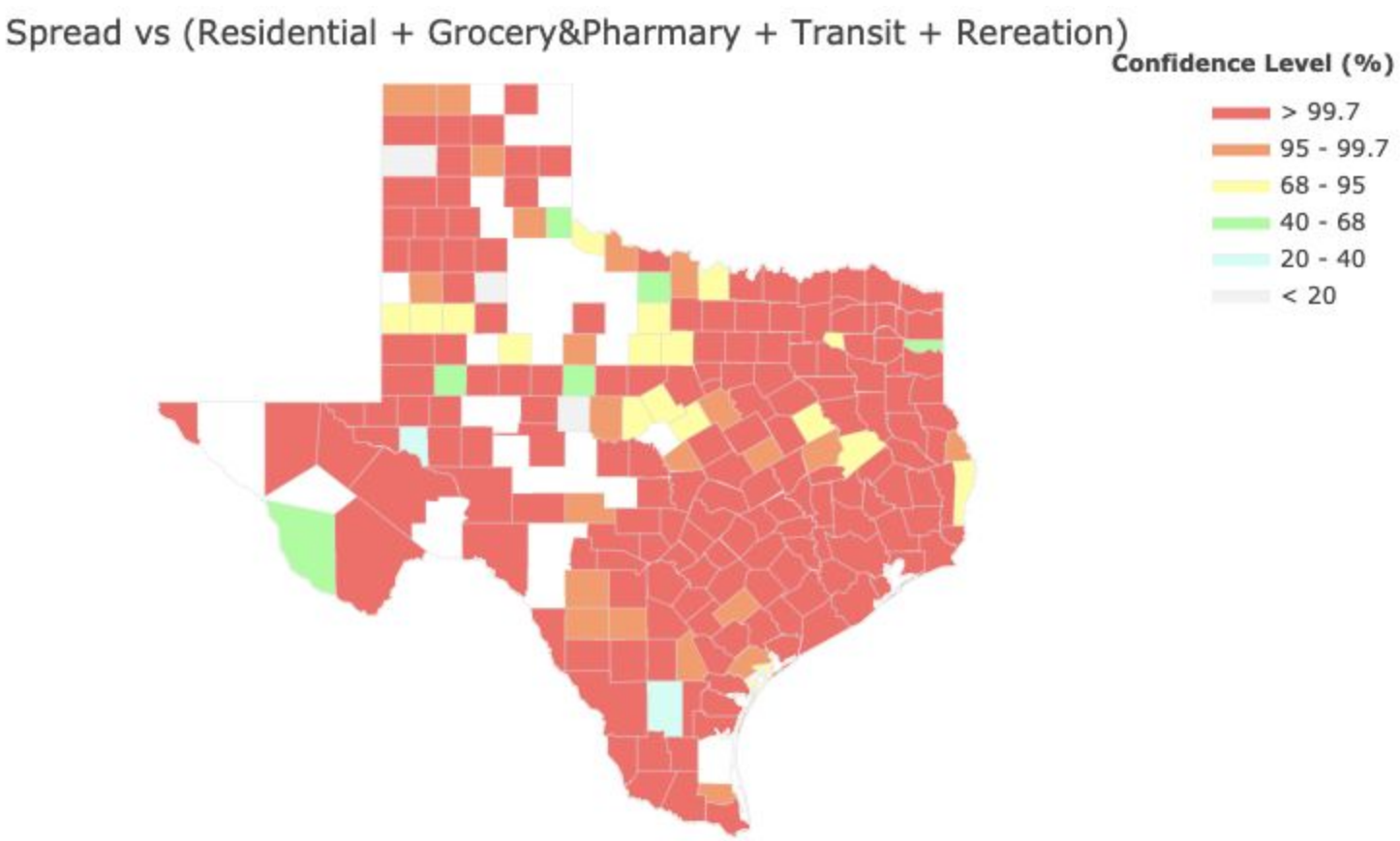


Hypothesis 7

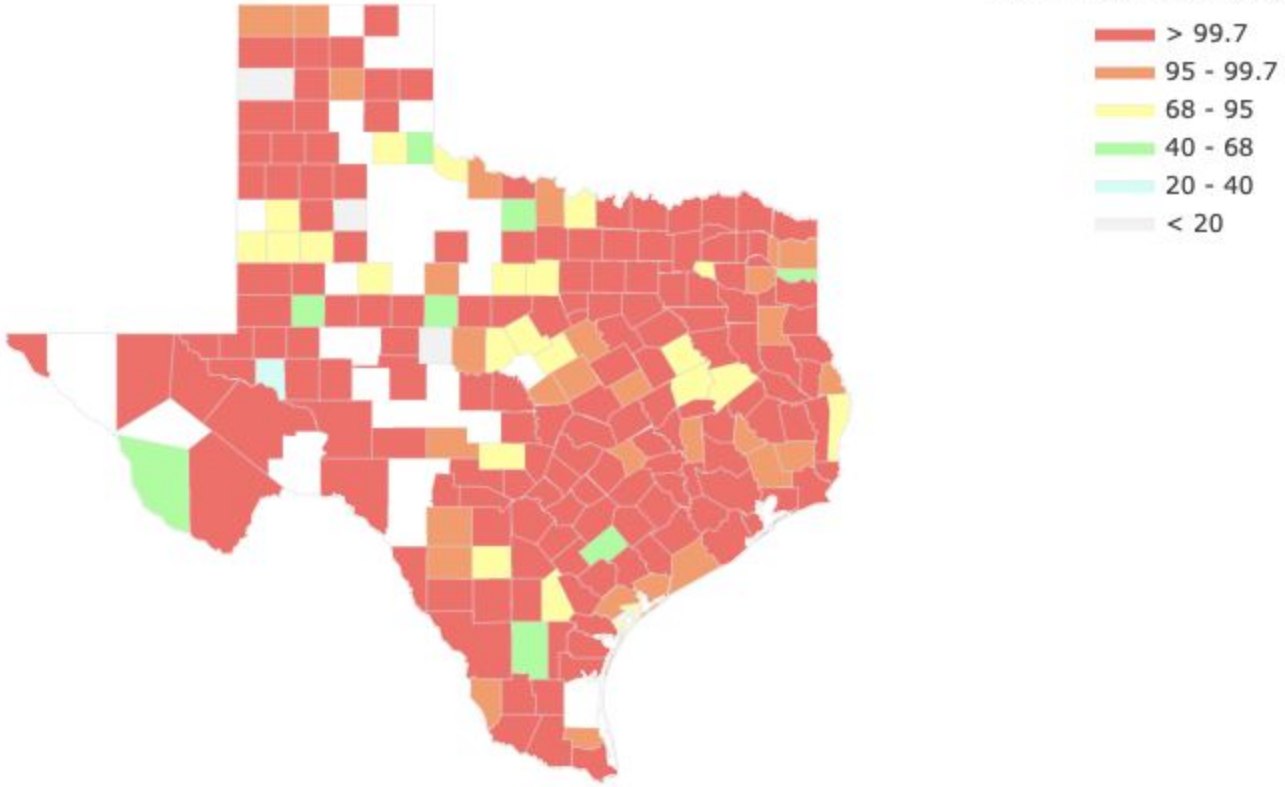
Question	Travel between regions affected spread?
H0	μ: infection rate in a period of time $\mu_{Residential} = \mu_{Grocery\&Pharmary} = \mu_{Transit}$ $= \mu_{Rereatioin} = \mu_{Work} = \mu_{Park}$
Ha	At least one of the travel data is different from others
Test	**ANOVA** when dealing with several groups of data

Spread vs (Residential + Grocery&Pharmary + Transit + Rereationi + Work + Park)




Spread vs (Residential + Grocery&Pharmary + Transit + Rereation)
Confidence Level (%)
> 99.7
95 - 99.7
68 - 95
40 - 68
20 - 40
< 20

Spread vs Travel (Residential + Grocery&Pharmary + Transit)



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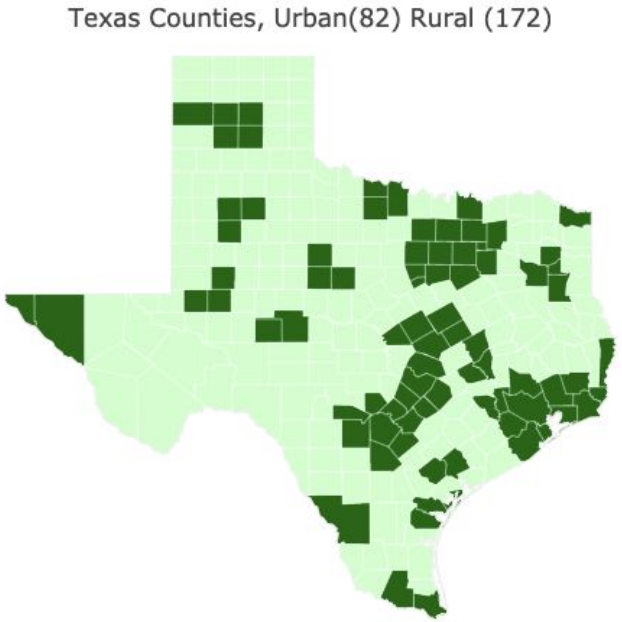
Ha	At least one of the travel data is different from others
Test	**ANOVA** when dealing with several groups of data

REJECTED

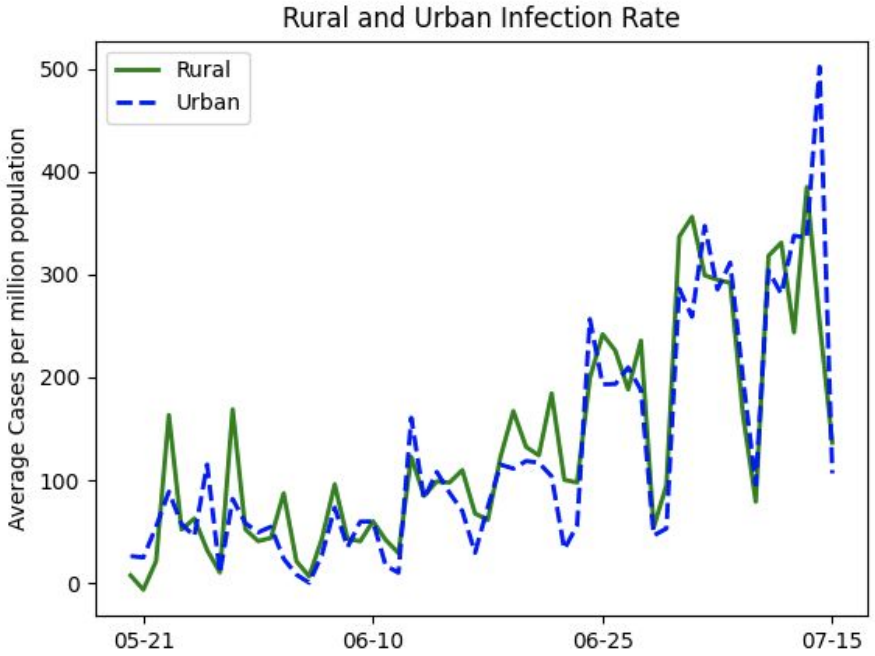
Travel between regions affected spread

Hypothesis 8

Question	Rural counties had less spread (low population, as opposed to population density)?
H0	$R1 = Rate_{\text{average rural counties}}$ $R2 = Rate_{\text{average urban counties}}$ $R1 - R2 >= 0$
Ha	$R1 - R2 < 0$
Test	**t-test**



Confidence Level = 83.38 %



Hypothesis 8

Question	Rural counties had less spread (low population, as opposed to population density)?
H0	R1 = Rate average rural counties R2 = Rate average urban counties R1 - R2 >= 0
Ha	R1 - R2 < 0
Test	**t-test**

Rural counties did not have less spread

Thank you

Question?