

THE VAX FACTORS

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AGENDA ZOEY

1. Background & Motivation
2. Project Overview
3. Data Sources and Preparation
4. Exploratory Data Analysis
5. Methodology
6. Conclusions & Recommendations
7. Limitations/Future Research



MOTIVATION

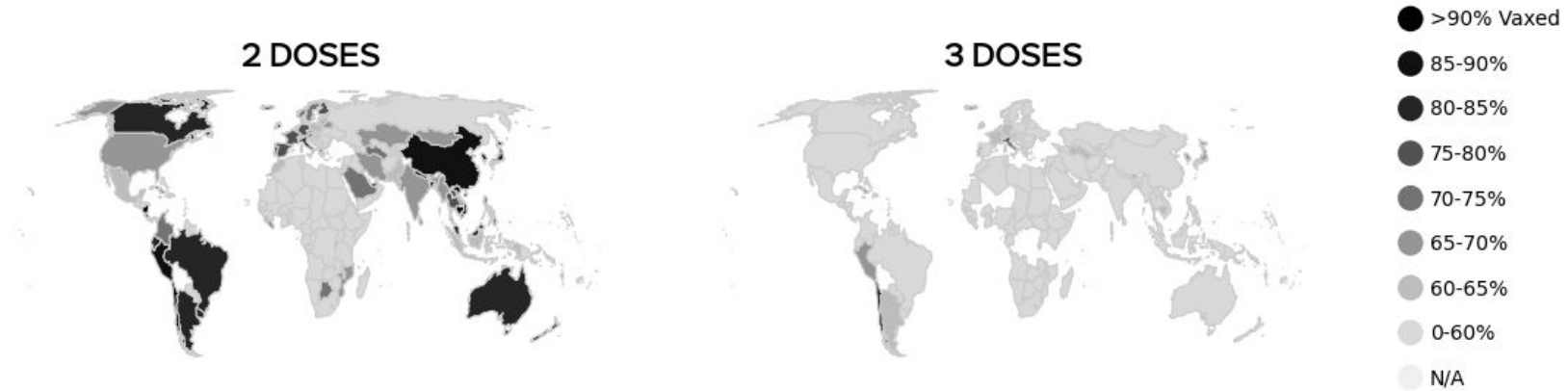


VACCINE DISPARITIES



COUNTRY LEVEL VACCINE DISPARITY

CLAIRE



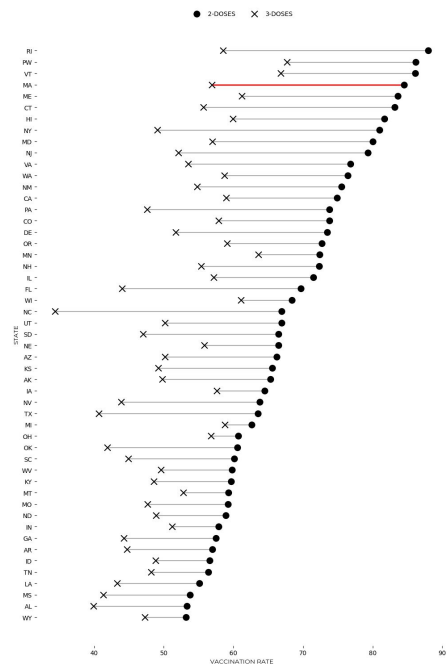
PROBLEM: HETEROGENEOUS IMMUNIZATION LEVELS



[Source: UN (Map), WHO(Vaccination)]

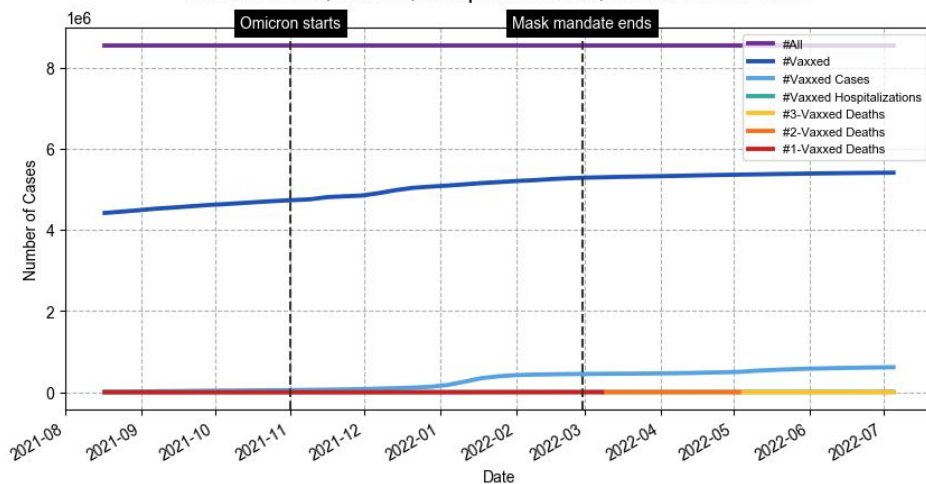
STATE LEVEL VACCINE DISPARITY

CLAIRE



MA

Vaccinations, Cases, Hospitalizations, Deaths Over Time



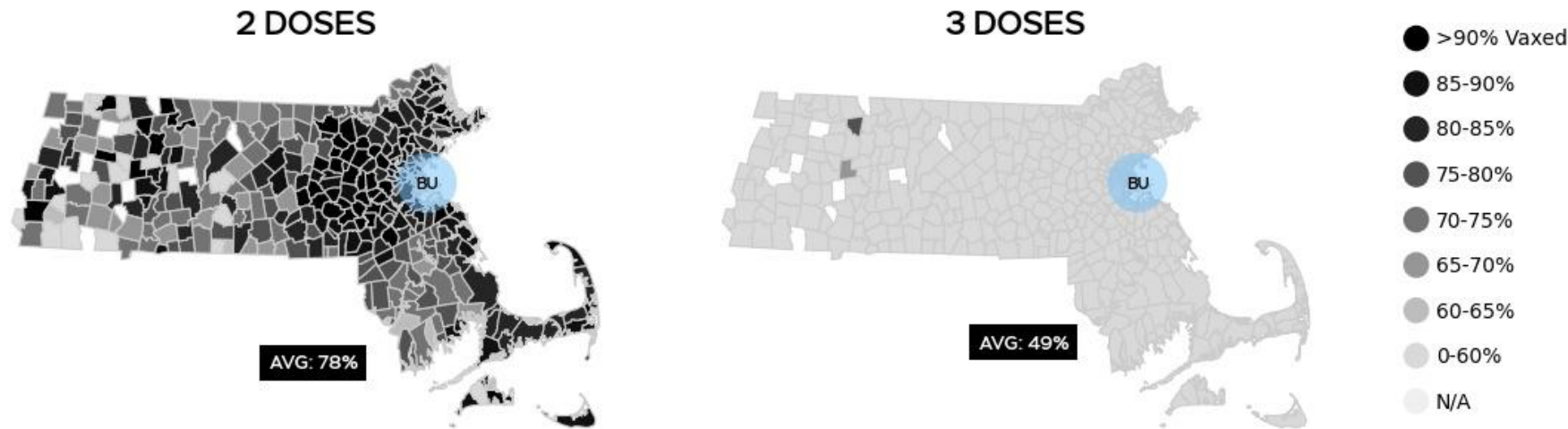
PROBLEM: HETEROGENEOUS IMMUNIZATION LEVELS



[Source: [COVID-data_Massachusetts-vaccines](#)]

CITY/TOWN LEVEL VACCINE DISPARITY

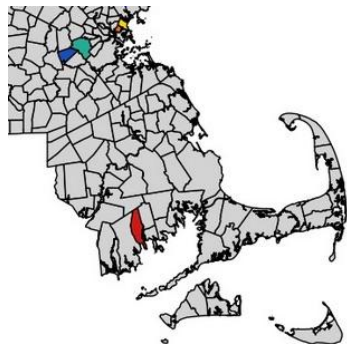
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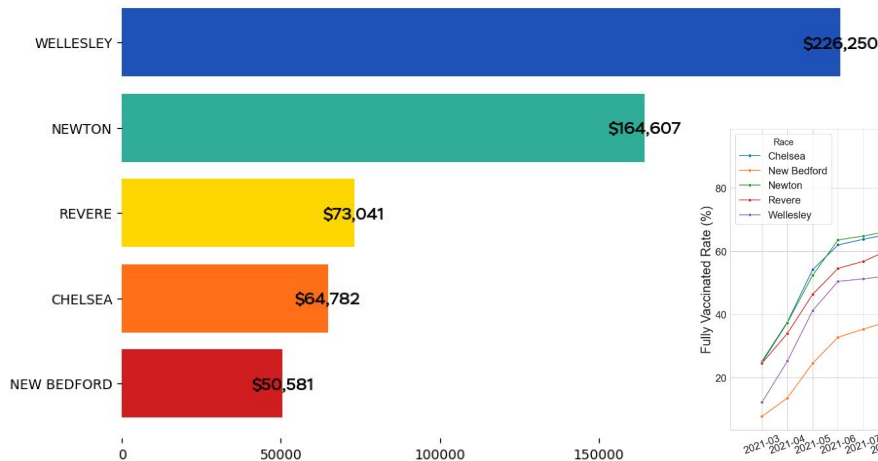
PROBLEM: HETEROGENEOUS IMMUNIZATION LEVELS

[Source: [COVID-data_Massachusetts-vaccines](#)]

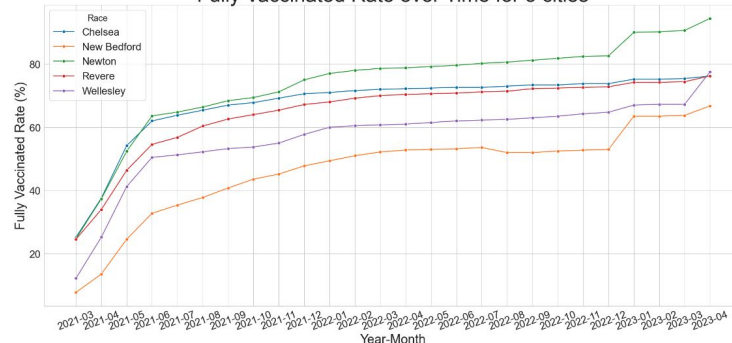
5 CITIES OF INTEREST CLAIRE



INCOME



Fully Vaccinated Rate over Time for 5 cities



NEW BEDFORD • CHELSEA • REVERE • NEWTON • WELLESLEY

IN SEARCH OF “VAX FACTORS” TO REDUCE VACCINE DISPARITY



VACCINE FACTORS



VAX FACTOR CANDIDATES & DATA SOURCES ZOEY

<u>CATEGORY</u>	<u>VARIABLES</u>	<u>SOURCES</u>
Monthly Data	Fully Vaccinated Population Number of Population Get Boosted Age Gender Race Mortality Employment Data	COVID-data_Massachusetts-vaccines
Yearly Data	Income Levels Education Background Social Vulnerability Index Population Size	US Census

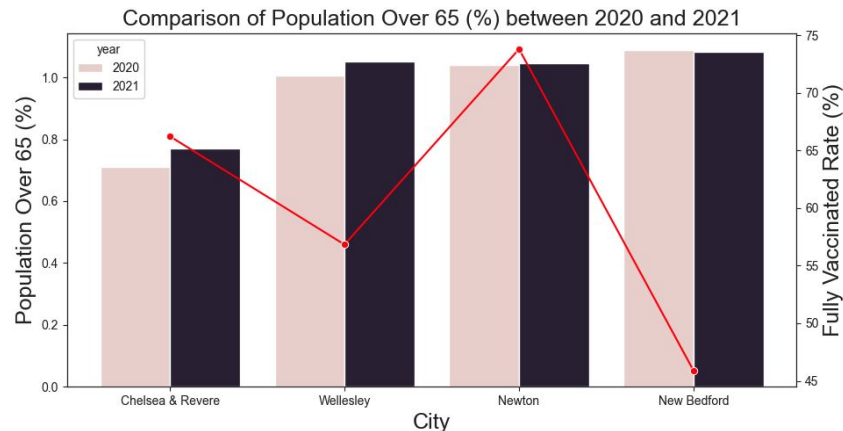
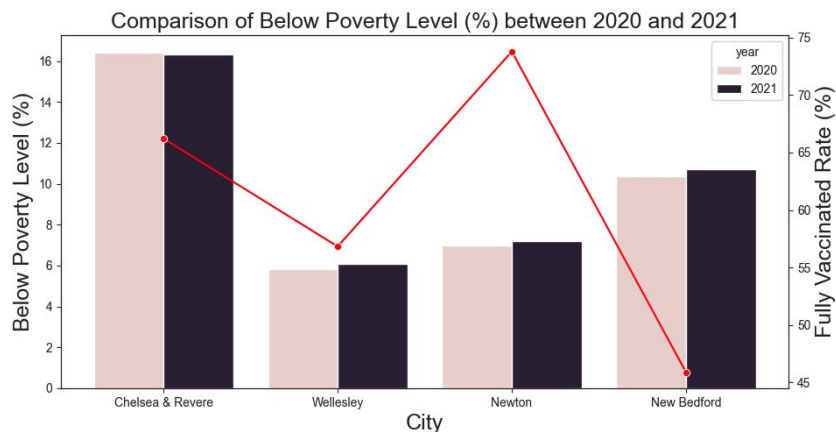


HYPOTHESES & DR KOEHLER'S QUESTIONS ZOEY

1. Are there changes in the vaccination rate over time?
2. Differences among five cities (New Bedford, Chelsea, Revere, Newton, Wellesley)
3. What factors affect vaccination rates? Race? Gender? Age? SVI?
4. Of these factors, which ones most strongly influence vaccination rates?



SVI (SOCIAL VULNERABILITY INDEX) CASSIE

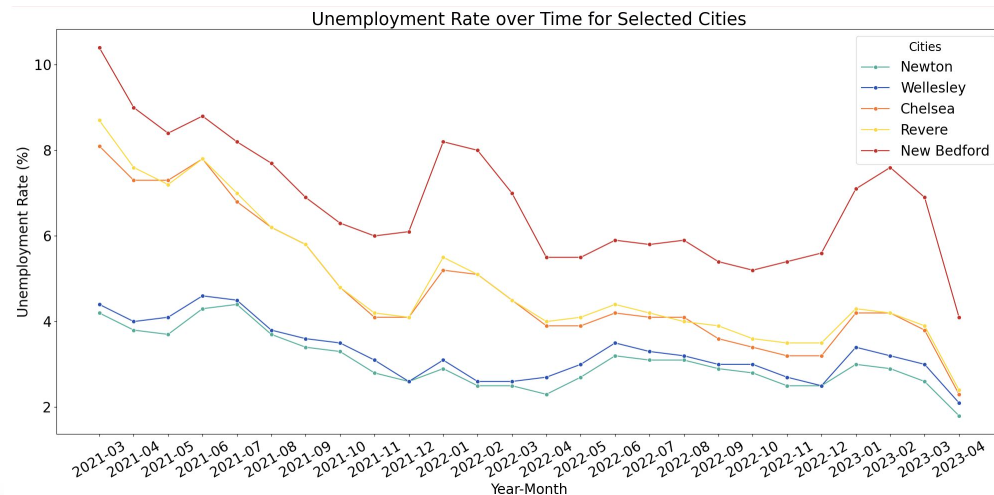
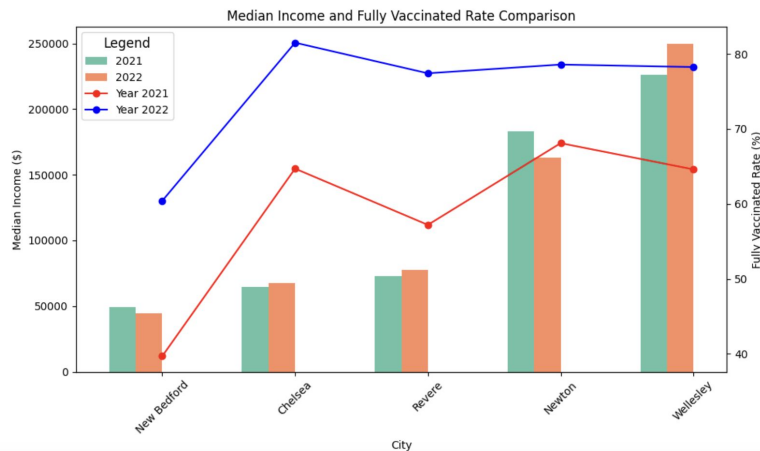


- New Bedford has higher economic vulnerability index in terms of poverty level and elderly population. In assumptions, New Bedford should have lower rate of vaccination rate because of its economics vulnerability and education level. Other three cities should have higher vaccination rate given the larger rate of elderly population.



[Source: US Census]

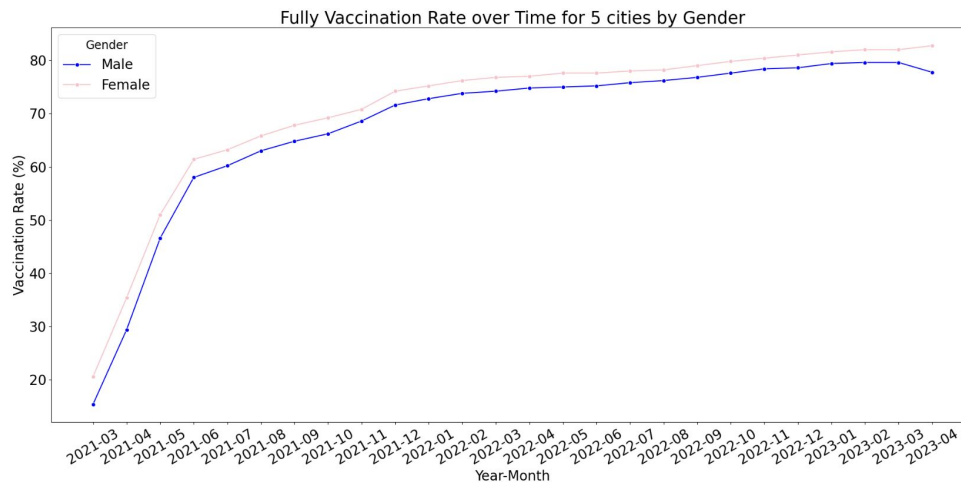
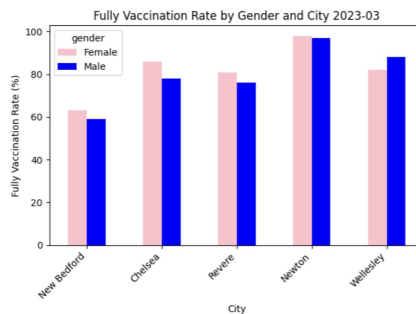
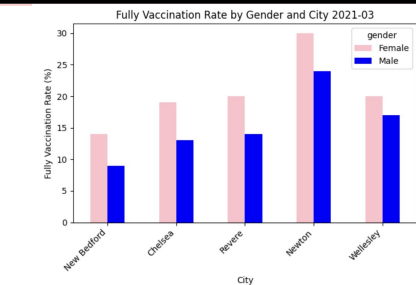
INCOME & UNEMPLOYMENT CASSIE



- Wellesley, and Newton having the highest median income, lowest unemployment rate might have the higher vaccination rates. Conversely, New Bedford, with the lowest median income, might have lower vaccination rates.



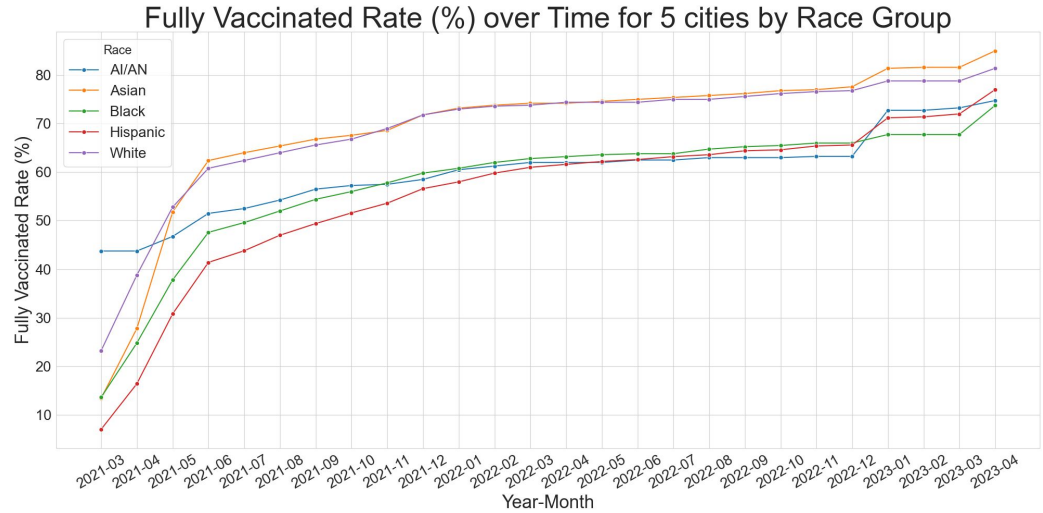
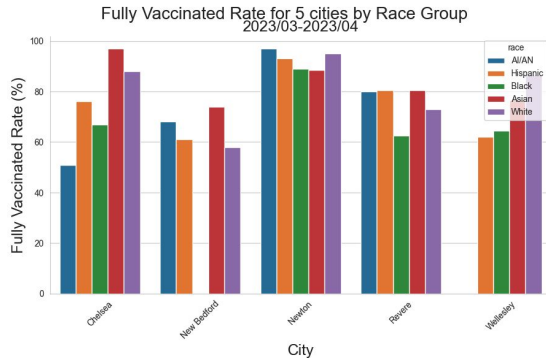
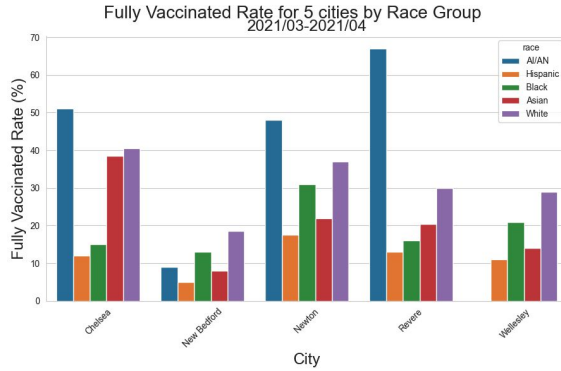
GENDER CASSIE



Gender appears to influence vaccination rates, with females more likely to be fully vaccinated than males in the cities observed.



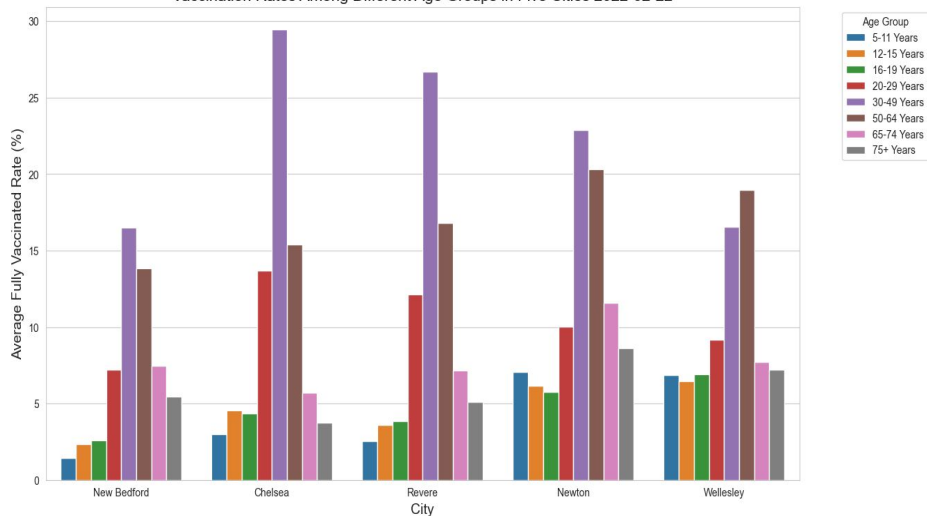
RACE ZOEY



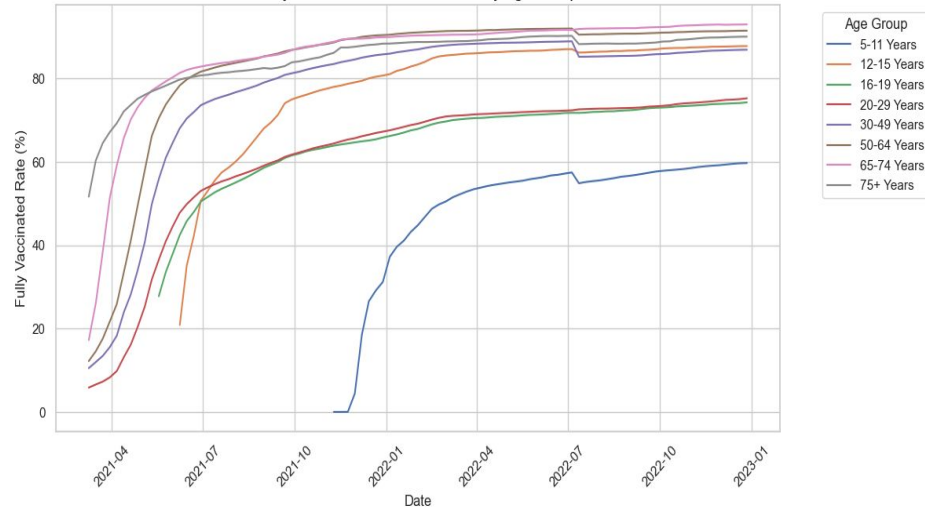
- Increased vaccination rates across all racial groups: 20% to 70-80%.
- White individuals have consistently higher vaccination rates.
- The American Indian and Alaska Native (AI/AN) group shows the lowest vaccination rates among the races considered.



Vaccination Rates Among Different Age Groups in Five Cities 2022-02-22



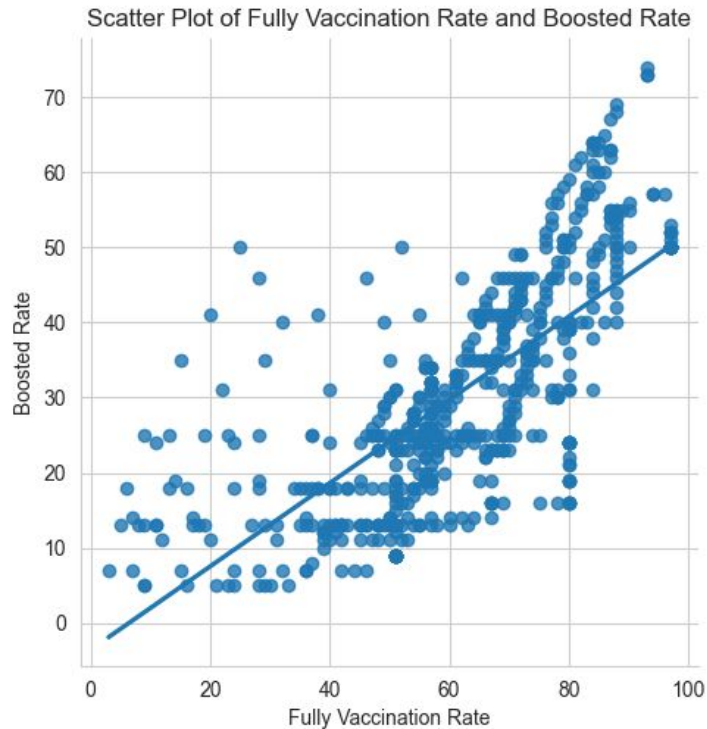
Fully Vaccinated Rate Over Time by Age Group



- Socioeconomic Factors:** Cities with higher socioeconomic status might show more consistent vaccination rates across age groups. This leads to a hypothesis that access to healthcare, education, and resources positively influences vaccination rates



FULL VAX RATES vs BOOSTER RATES JOEL

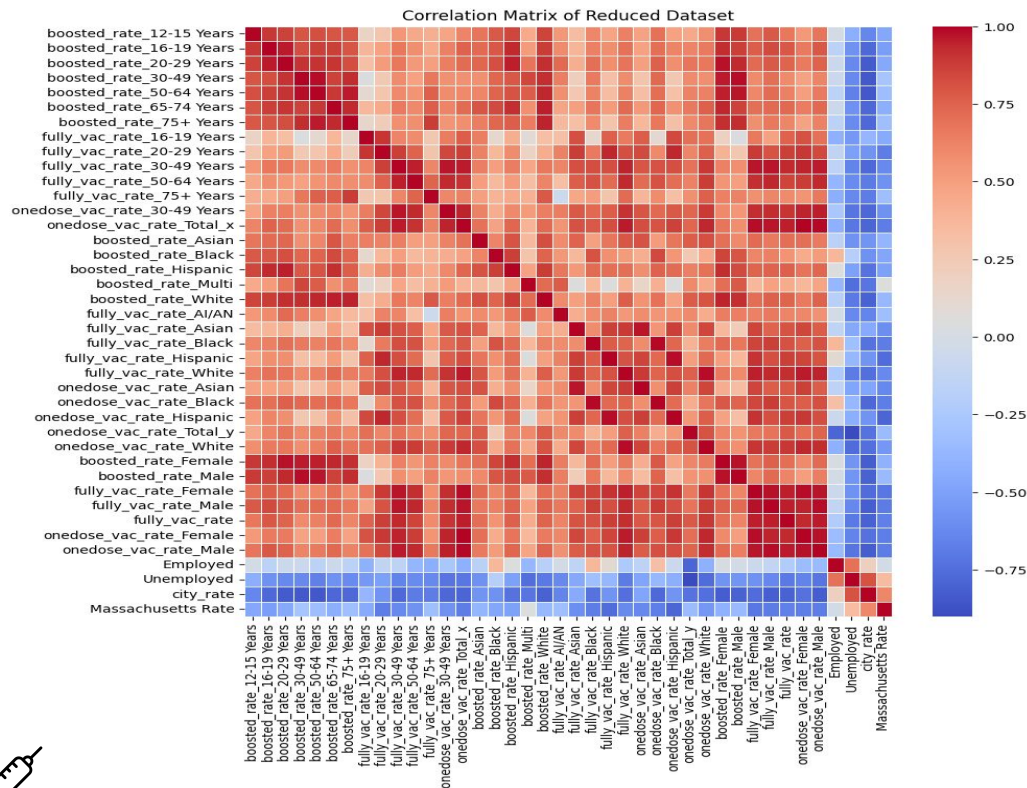


[Source: [COVID-data_Massachusetts-vaccines](#)]

**GETTING CLOSER
TO THE
VAX UPTAKE
“EQUATION”**



CORRELATION MATRIX JOEL

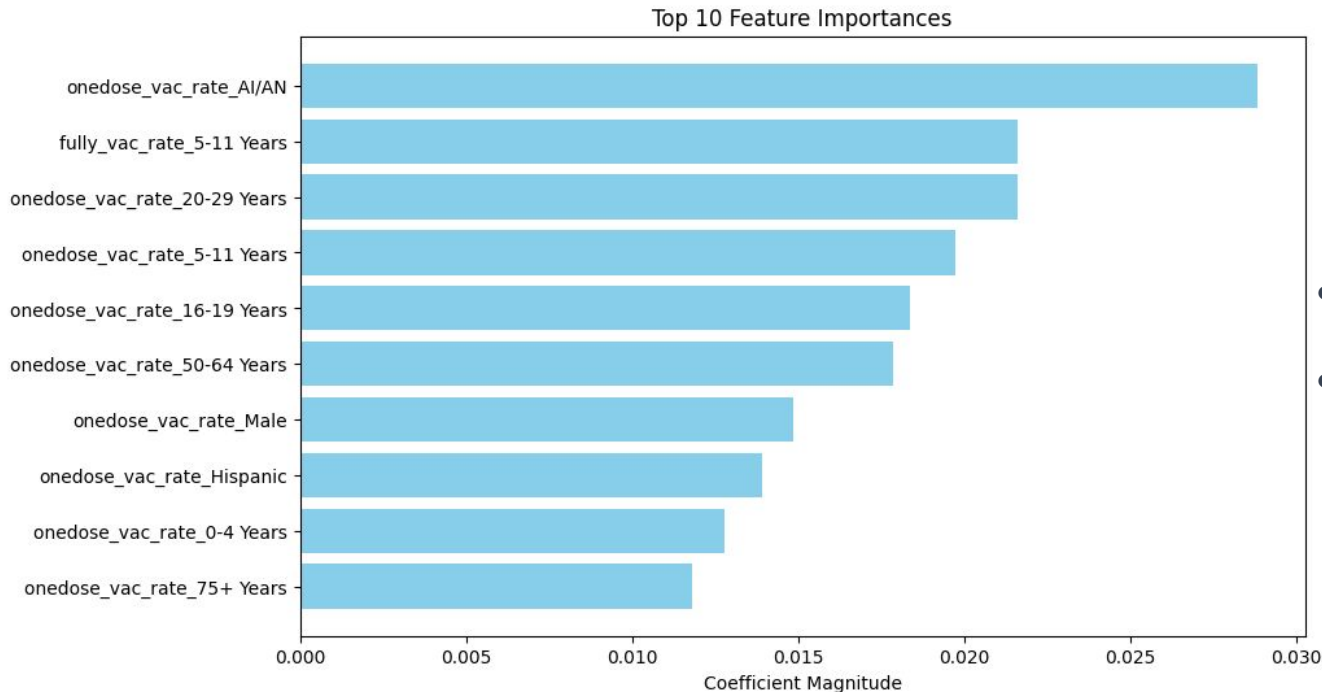


Regression Coefficients:

The negative coefficient between the vaccination rates and unemployment rate suggests that, there's a tendency for the fully vaccinated rate to increase as unemployment decreases.



IMPORTANT FEATURES ZOEY



After running the logistic regression, the graph shows the most 10 important features.

- Age group shows great impact on fully vaccinated rate.
- Certain race group and gender group have important impact on fully vaccinated rate.



LINEAR REGRESSION FOR GENDER CASSIE

OLS Regression Results

```
=====
Dep. Variable:          fully_vac_rate    R-squared:                0.300
Model:                  OLS              Adj. R-squared:         0.286
=====
              coef    std err          t      P>|t|      [0.025    0.975]
-----
Intercept          71.0236     2.370    29.968     0.000     66.356    75.691
gender[T.Female]    2.8760     1.941     1.481     0.140    -0.947     6.699
city[T.New Bedford] -20.8077     3.058    -6.805     0.000    -26.830   -14.786
city[T.Newton]       9.8585     3.088     3.192     0.002     3.777    15.940
city[T.Revere]      -3.8654     3.058    -1.264     0.207    -9.887     2.156
city[T.Wellesley]    0.0769     3.058     0.025     0.980    -5.945     6.099
=====
...
=====
```

`gender[T.Female]` has a coefficient of **2.8760**, suggesting that female is associated with an increase of approximately **2.88** percentage points in the vaccination rate compared to male, though this result is not statistically significant (**p-value of 0.140**).



LINEAR REGRESSION FOR RACE

ZOEY

OLS Regression Results

Dep. Variable:	fully_vac_rate	R-squared:	0.662			
Model:	OLS	Adj. R-squared:	0.656			
=====						
	coef	std err	t	P> t	[0.025	0.975]

Intercept	38.0041	1.857	20.463	**0.000**	34.357	41.652
race[T.Asian]	-13.4168	1.880	-7.137	**0.000**	-17.109	-9.725
race[T.Black]	-10.1647	1.652	-6.154	**0.000**	-13.409	-6.921
race[T.Hispanic]	-9.5051	1.615	-5.886	**0.000**	-12.677	-6.334
race[T.White]	-18.6380	2.007	-9.284	**0.000**	-22.581	-14.69
city[T.New Bedford]	-4.3921	1.691	-2.597	0.010	-7.714	-1.071
city[T.Newton]	-8.3870	1.599	-5.245	0.000	-11.527	-5.246
city[T.Revere]	2.5676	1.501	1.711	0.088	-0.380	5.515
city[T.Wellesley]	-12.0109	1.595	-7.528	0.000	-15.144	-8.877

...

R-square = 0.662. This value indicates that approximately 66.2% of the variation in the fully vaccinated rate is explained by the model's independent variables.

Holding other variables constant, race groups have statistically significant impact on fully vaccination rate.



LINEAR REGRESSION FOR AGE JOEL

OLS Regression Results

Dep. Variable:	fully_vaccinated_rate	R-squared:	0.552			
Model:	OLS	Adj. R-squared:	0.550			
Method:	Least Squares	F-statistic:	370.4			
=====						
	coef	std err	t	P> t	[0.025	0.975]

Intercept	17.1431	1.694	10.119	0.000	13.821	20.465
age_group[T.12-15 Years]	69.7098	1.811	38.500	0.000	66.160	73.260
age_group[T.16-19 Years]	56.1731	1.803	31.150	0.000	52.638	59.709
age_group[T.20-29 Years]	51.8966	1.782	29.123	0.000	48.403	55.390
age_group[T.30-49 Years]	67.9056	1.782	38.106	0.000	64.412	71.399
age_group[T.50-64 Years]	73.5990	1.782	41.301	0.000	70.105	77.093
age_group[T.65-74 Years]	76.3284	1.782	42.833	0.000	72.835	79.822
age_group[T.75+ Years]	75.6063	1.782	42.428	0.000	72.113	79.100
city[T.New Bedford]	-27.0745	0.922	-29.351	0.000	-28.883	-25.266
city[T.Newton]	3.1055	0.922	3.367	0.001	1.297	4.914

R-squared = 0.552. This value indicates that approximately 55.2% of the variation in the fully vaccinated rate is explained by the model's independent variables.

Holding other variables constant, age groups have statistically significant impact on fully vaccination rate.



CONCLUSIONS AND RECOMMENDATIONS



CONCLUSION: THE VAX FACTOR “EQUATION” ZOEY

1. Vaccination rates varied among five cities.
2. Race and age are important factors associated with vaccination rates. Different races and age groups have varying impacts on vaccination rates.
3. The elderly are more likely to get vaccinated than other age groups ($p = 0.0$).
4. White and Asian groups are more likely to be fully vaccinated ($p = 0.0$).



SUGGESTIONS ZOEY

1. Vaccination equity: Increase vaccine access and public health education to vulnerable groups.
2. NGOs provide services in vulnerable areas and make public data from these services available.
3. Partnerships with Local Communities: Encourage NGOs to form partnerships with local community leaders and organizations. This can help tailor vaccination efforts to the specific needs and cultural contexts of each community.
4. Mobile vaccination services.

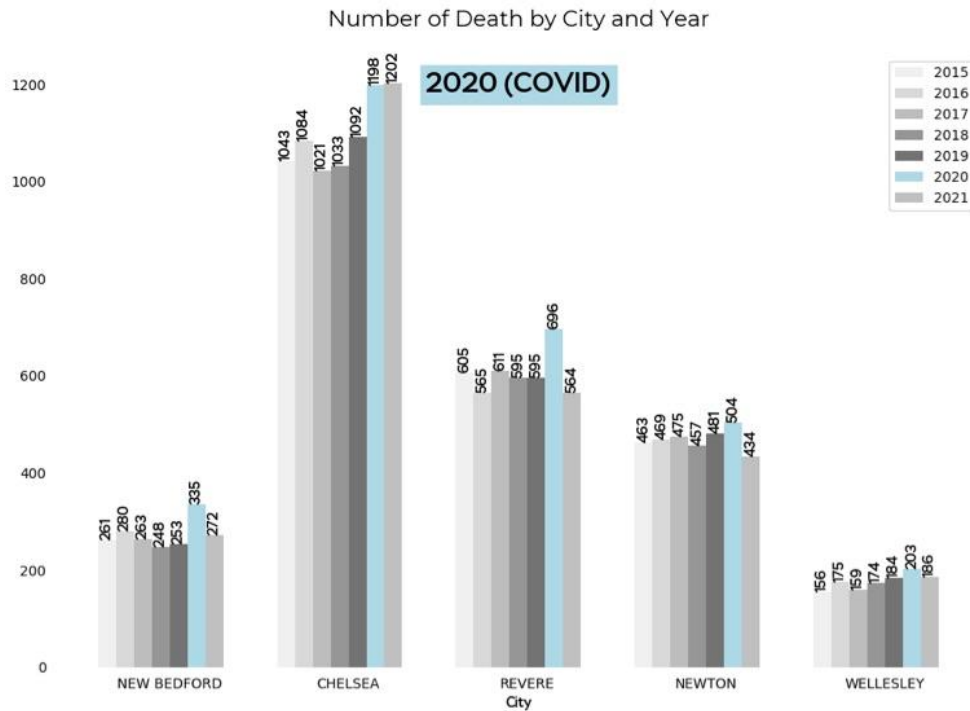


BONUS: VACCINE EFFICACY



REMINDER: COVID KILLS

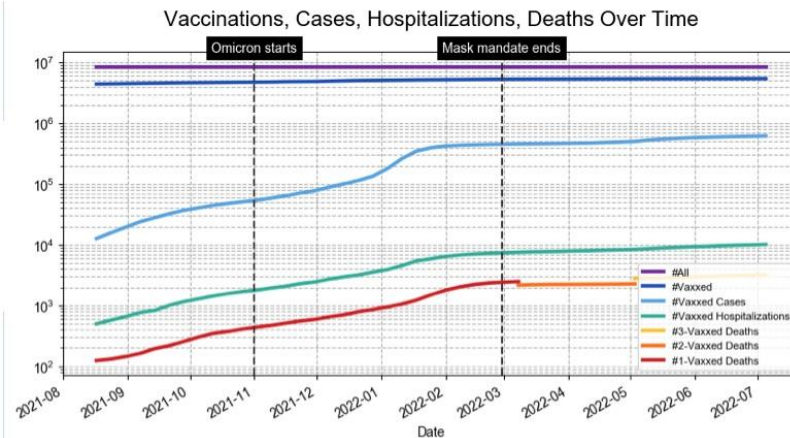
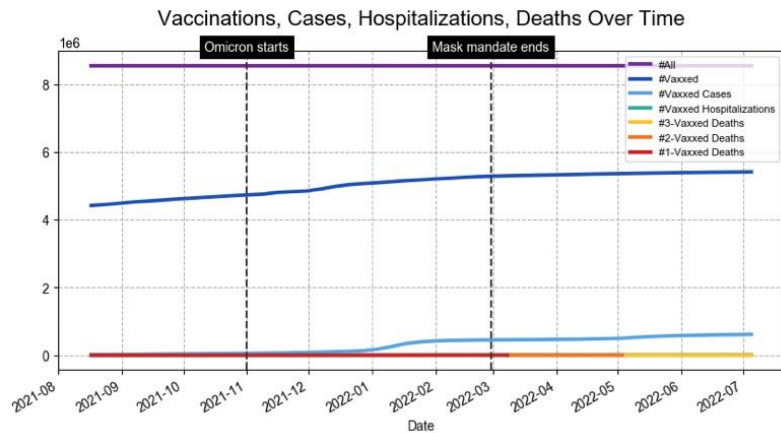
CLAIRE



[Source: <https://www.mass.gov/info-details/deaths-of-massachusetts-residents>]

VAX EFFICACY

CLAIRE

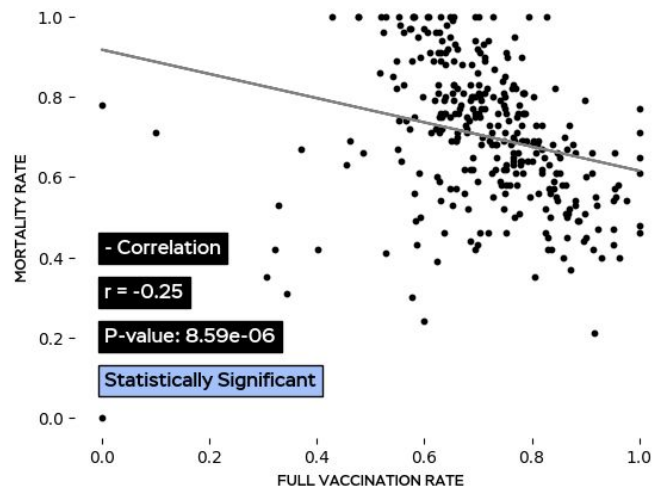


MANY CASES BUT VACCINATED PEOPLE DID NOT DIE AS MUCH



MORTALITY RATES vs VAX RATES CLAIRE

VAX RATES vs FORWARD MORTALITY RATES IN MA



HIGH VAX RATES ARE WEAKLY ASSOCIATED WITH LOWER MORTALITY RATES



THANK YOU!

**SPECIAL THANKS TO
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