Assessing the Correlation Between Genetic Predisposition and Health Insurance Rates

Jared Rosen
Advisors: Kevin Crowthers Ph.D.

Background
- In the year 2020, Americans spent over $4.3 trillion on health care expenses alone, over 85% of which was through private insurance providers.
- Sec. 1101. of the Patient Protection and Affordable Care Act States that "No [Health Insurance Plan]...shall be construed as allowing discrimination on the basis of pre-existing conditions or other health status-related factors."
- However, there exists several loopholes in with this policy for Health Insurance Providers to use due to the lack of disclosure of processes used to determine premiums.

Using Condition Incidence Rates to Model Genetic Predisposition Rates
- Access to data on rates of Genetic Predisposition is very restricted.
- However, incidence and mortality rates of conditions have a significant correlation with rates of genetic mutations associated with predispositions, which were used in this study instead.

Dataset Access
- The HIX Compare Website has publicly accessible datasets displaying all insurance plans from 2014-2018, including their respective premium values. They also have crosswalk datasets converting counties to area code.
- The Centers for Medicare & Medicaid Services' Interactive Atlas of Chronic Conditions displays incidence rates of various conditions, by county.
- The US Census Bureau provides annual population estimates by county, which was used to convert incidence rates by county to by area code.
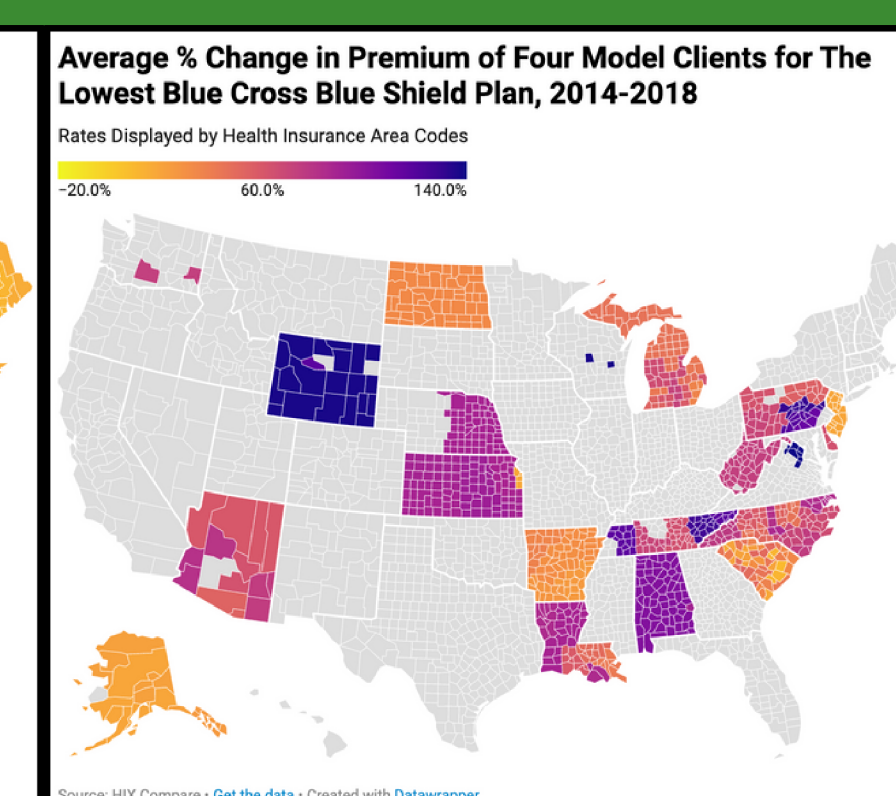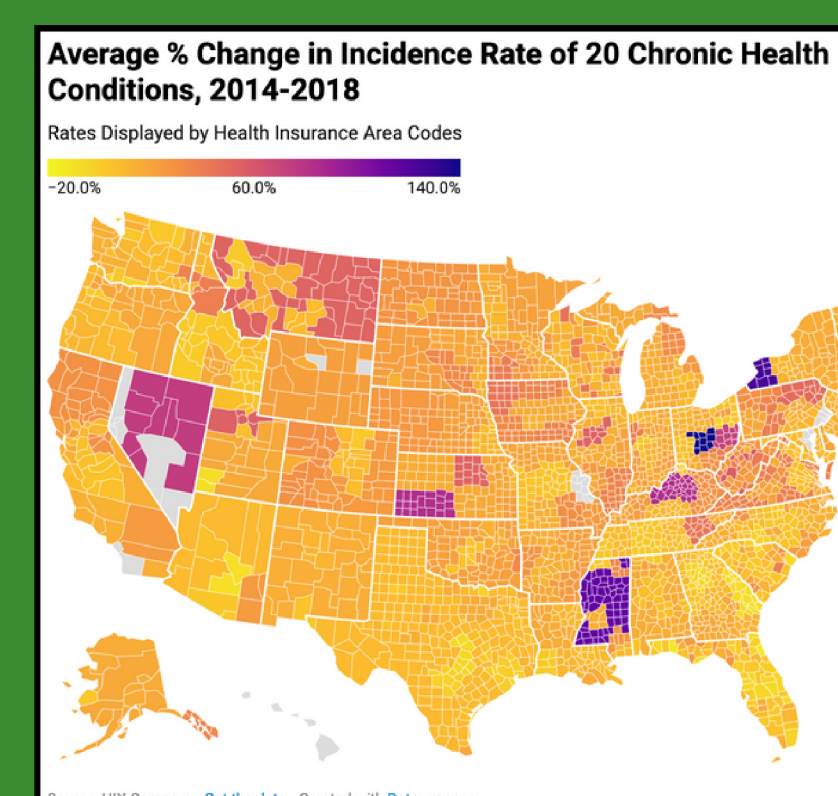
Research Question
What information do health insurance providers look at when determining their rates?

Hypothesis
This study hypothesized that health insurance companies look at genetic information to determine their rates.

Results

Average % change in Health Condition Prevalence (Left), and average % change in Health Insurance Premiums (Right), from 2014-2018. The Correlation between these datasets was then statistically assessed, as displayed in the figures to the right.

| Condition	Pearson Correlation Value with Health Insurance Rates
Alcohol Abuse	0.2667
Alzheimer's Disease/Dementia	0.0648
Arthritis	-0.0708
Asthma	-0.1542
Atrial Fibrillation	0.0059
Autism Spectrum Disorders	-0.1043
Cancer	0.0161
Chronic Kidney Disease	0.1132
COPD	-0.1539
Depression	0.0353
Diabetes	-0.0222
Drug Abuse/Substance Abuse	0.2194
HIV/AIDS	0.0769
Heart Failure	0.0420
Hepatitis (Chronic Viral B & C)	0.0211
Hyperlipidemia	-0.0187
Hypertension	0.0219
Ischemic Heart Disease	0.1437
Osteoporosis	0.1166
Schizophrenia/Other Psychotic Disorders	0.1216
Stroke	0.0459
Average	0.1198
Average Among Genetic Conditions	0.1464

Average of All Conditions Dot Plot
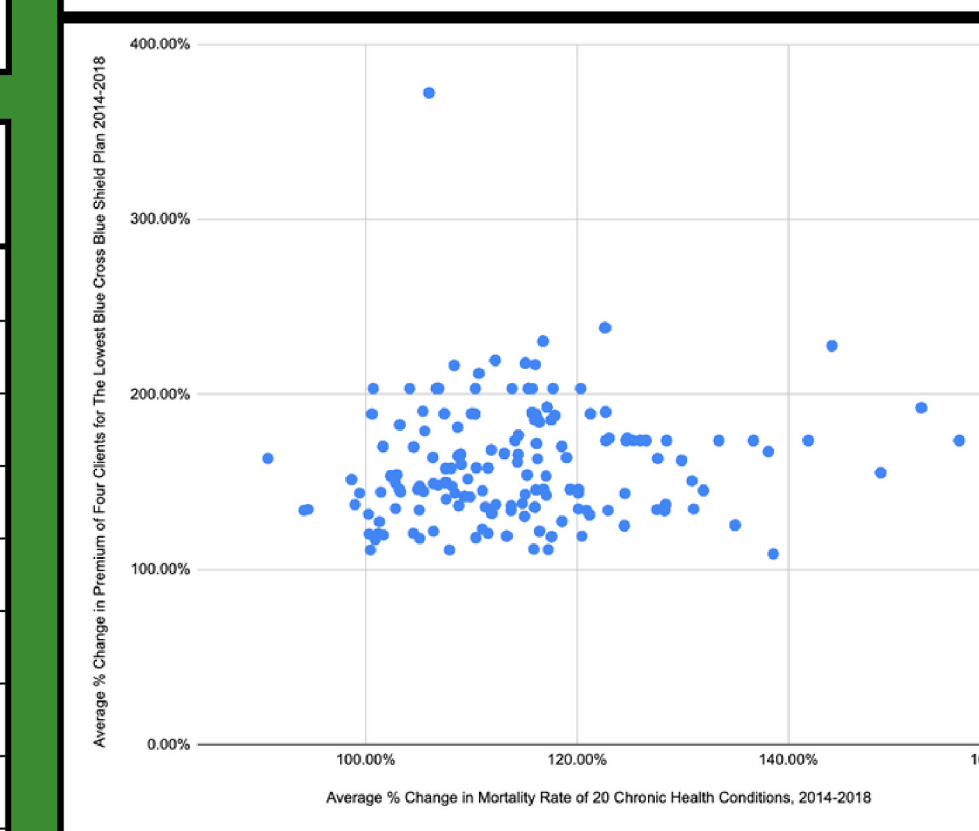
Pearson Correlation Values by Conditon based on Health Insurance Premiums (Left), and Dot Plot showing average % changes of condition prevalence vs. insurance premiums (Top). As shown by the figures, there was an average Pearson Correlation value between the two datasets of r = 0.12.

Graphical Abstract of Data Access and Calculation Methodology
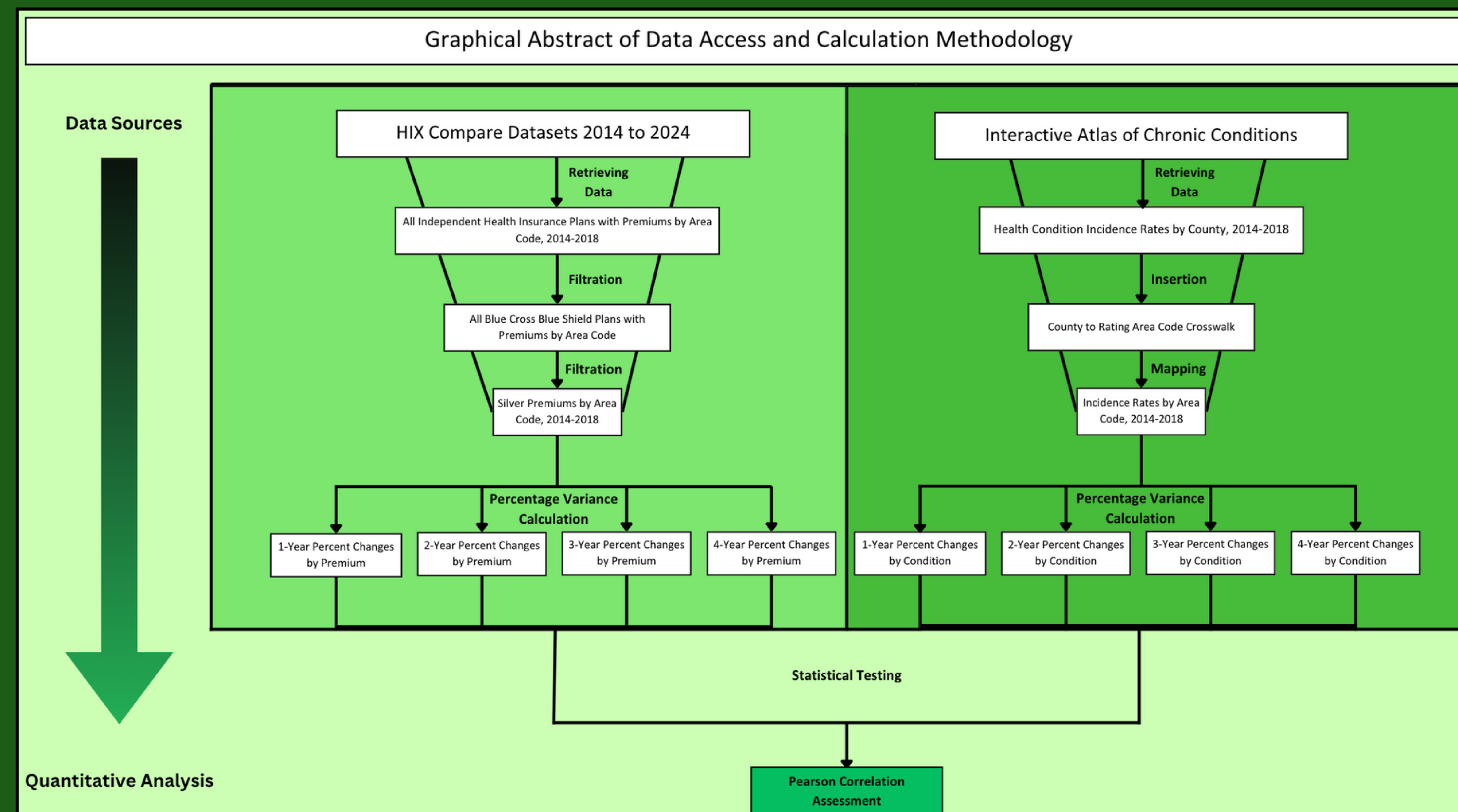
The process of data normalization (Top Left) consisted of filtering Health Insurance rates to be by one provider's silver plans, then converting health conditions incidence rates by area code to be by health insurance rating area, which was done using a the HIX Compare website's crosswalk dataset, and the US Census Bureau population estimates to find the overall condition prevalence by health insurance area.

Average of Genetic Conditions Dot Plot
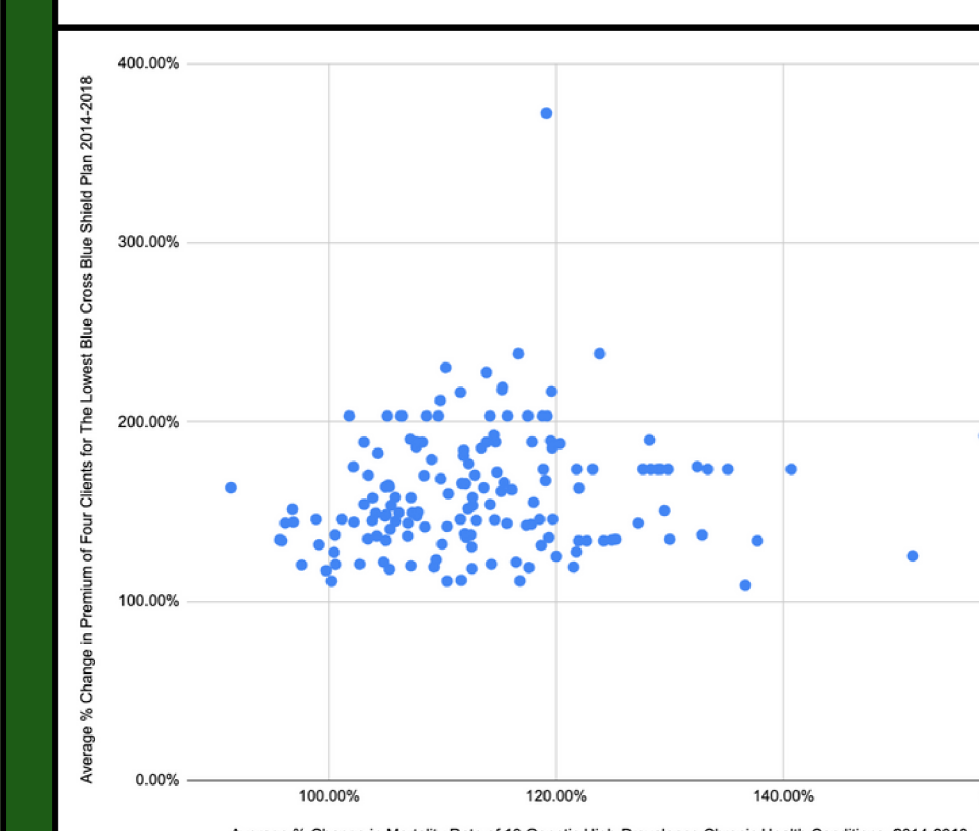
In comparison to the average of all 20 Chronic Conditions assessed, the 13 genetic high-prevalence genes (Top Right) showed a higher overall correlation value in reference to Health Insurance premiums. The thirteen selected conditions showed a Pearson Correlation Assessment Coefficient of r = 0.15

Analysis
- Of the researched conditions, Alcohol and Drug Abuse, Asthma, Cancers, Chronic Kidney Disease, Heart Diseases, HIV/AIDS, Osteoporosis, and Strokes are high-prevalence conditions with associated genetic mutations.
- In comparison to the overall average Pearson Correlation Coefficient of r = 0.12, the Pearson Correlation Coefficient of the average of the selected high-prevalence genetic conditions in relation to Health Insurance was r = 0.15.

Conclusion
- High-prevalence conditions with associated Genetic Mutations showed higher correlation values with health insurance rates.
- Following this study, there is significant evidence promoting further research of this trend using genetic predisposition data.

Future Steps Within Study
- The process of this study could be expanded to other insurance providers and plan tiers, as well as an average of all insurance rates.
- More health condition rates could be assessed, such as CDC's State Cancer Profiles and the Genetic Screening Panel.

Future Steps among Future Studies
- As stated in the Thesis, this study provides significant evidence for a higher-level study on the correlation between genetic predisposition and health insurance rates.
- This data can be presented to third-party research and governmental organizations to conduct such a study.