



Socioeconomic Factors Affecting Health Insurance In The USA

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Abstract:

Inquiry Question: Is health insurance unequally distributed among individuals living in the United States?

Primary Purpose: To explore what variables have the biggest impact in determining the health insurance status of individuals living in the US? What are the possible disadvantages of not having health insurance? How can we provide health insurance to everyone living the US by focusing on the key variables of the research? Would this solution actually increase the number of individuals who have health insurance?

Thesis: Many would argue that health insurance disparities do not exist: But in reality, health insurance is not distributed equally among people of color and underserved communities because of income inequality, the rising cost of health care, and immigration status.

Prior belief/ Knowledge: Individuals who are financially better off, with US-born citizenship status and higher education, are more likely to have health insurance in comparison to the underserved minorities with low income, non-US citizenship status, & lack of access to higher education.

Introduction

This research aims to find out the socioeconomic factors affecting the health insurance status of individuals and provides a solution to the problem of unequal distribution of health insurance. Having no health insurance is a big problem because individuals with less access to recommended care receive poorer quality of care and experience worse health outcomes than insured individuals (McWilliams, 2009). Moreover, according to research by Kimberly Amadeo, the Former President of World Money Watch, “Every year, around 530,000 people declare medical bankruptcy” (Amadeo, 2021). Many would still argue that health insurance disparities do not exist: But in reality, health insurance is not distributed equally among people of color and underserved communities because of income inequality, the rising cost of health care, and immigration status.

This research study analyzes the National Health Interview Survey (NHIS) 2020 data set, which includes information about the health insurance status of everyone living in the United States. Using this data, we focused on finding the most critical variables that determine whether one would have health insurance or not. The key variables used in the data set are age, gender, marital status, race, education, household income. We started our research by exploring and analyzing the data to understand how the data is distributed based on the different variables. This part of the research includes using descriptive statistics in R using SJ-Plots.

After analysis, we did find out some unexpected results. For example, we speculated that unemployed individuals would be less likely to have health insurance than employed individuals. But the results were the opposite. But to get more accurate outcomes, we performed the feature selection method using Boruta to exclude non-significant variables from the dataset. This process helped us run a logistic regression using only the significant variables selected in the feature

engineering process. After running the regression, we found that out of the 29 variables chosen in the feature engineering process, only seven of them were significant in predicting whether one would have health insurance.

Literature Review

In recent years, health insurance has become a necessity of life. Its importance is gaining momentum with the government taking initiatives to promote health insurance and improve health conditions (Sudha & Murugesan, 2021). Health insurance is an individual's agreement with an insurer on their behalf or on behalf of others to cover medical expenses. This cover may include some or the entire medical bill incurred. It helps keep individuals from paying for medical bills they cannot afford out of pocket. It, therefore, acts as a safety net in case of medical emergencies.

Insurance is beneficial because some illnesses and accidents are unexpected, and not being able to afford health care costs can deter one from seeking medical health. Ultimately this may lead to a decrease in their health status and eventually cause death. It has been incredibly beneficial to deal with medical inflation and ensure quality healthcare. Mitrovic & Pesic (2019) argue that insurance is an economic activity significant to the individual and the economy in general. Health insurance may also provide tax benefits and ultimately deliver financial stability. In some countries, health insurance is compulsory for everyone with equitable benefits.

However, there are times when people face discrimination based on race and ethnicity. Society identifies and treats people differently based on social markers such as race. Treadwell (2019) argues that a significant difference in healthcare provision based on race and gender exists. Historically, minority races such as blacks and Hispanics faced unfair treatment compared to whites, a dominant race, especially in the United States. This differentiation based on race has also

affected health care provision. Liu et al. (2018) argued that promoting equity in the economic accessibility of health care services to all citizens ensures healthcare justice.

There are various socioeconomic factors associated with health insurance. Some of the benefits of health insurance are that it increases the financial stability of a family or business, allows competitiveness and trade development, and improves the health status of individuals in a country. Improving individuals' health status ensures that the country's economy is stable since people need to be strong enough to work. Health insurance also promotes the country's health sector since medical bills are covered and minimal debts.

However, there are negative socioeconomic factors affecting health insurance. For example, the United States has the highest disparities in health care access based on factors such as employment status, homeownership status, and education level (Griffith et al., 2017). In addition, these factors are often against the minority groups based on social class, gender, race, and economic status. Therefore, this research analyzes the socioeconomic factors affecting health insurance and aims to provide a solution that will help governments and non-for-profit organizations find ways to help our community.

The history of health insurance is significant in understanding the progress made so far. According to Fox and Kongstvedt (2013), health insurance is an invention of the 20th century. In the late 19th century, only a few insurers offered health insurance, but they would only cover accidents that occurred in the workplace. These insurance policies would, later on, evolve to cover non-work-related accidents. The great depression of the 1930s led hospitals to implement other payment forms for medical bills. In the United States, Medicare was introduced in 1965 to cover senior citizens. In the 1980s, there was the development of managed care due to increasing

healthcare costs. Private companies would slowly emerge, offering better policies for people than the government. This participation of private companies led to an increase in the number of applications for health insurance coverage. In 2010, the health care act required most Americans to get basic health insurance coverage.

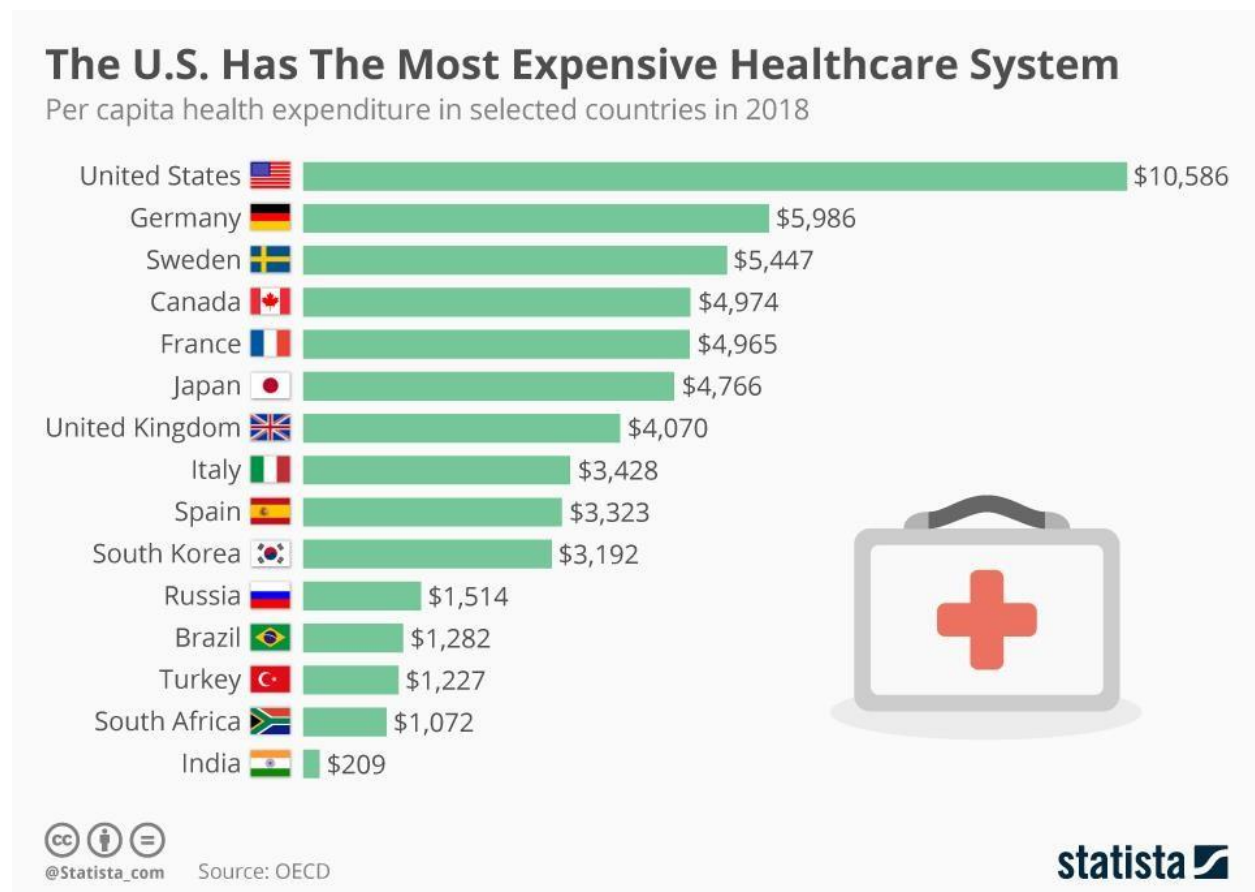
Health insurance gained momentum and consequently became politicized. Many argue that universal health insurance failed in the first half of the twentieth century because of political influence by insurers, unions, employers, and physicians (Murray, 2007). Stone (1993) argued that the politics of American health insurance is a struggle over the solidarity principle or the logic of actuarial fairness. With actuarial fairness, a sense of responsibility fosters. But it creates differences rather than interdependence and commonalities.

Furthermore, the concept of actuarial fairness creates social divisions based on socioeconomic status. Despite significant changes in the political context in recent years, the logic of actuarial fairness is still deeply embedded in the community and healthcare market today. As a result, the indifference would affect other social aspects such as race, gender, and economic status. Therefore, health insurance politicization favors those of higher socioeconomic status.

The people with higher social status are the ones who can afford health care, yet we try to serve those who need it the least and fail to serve those who need it the most. In 2019, Senator Bernie Sanders criticized the American healthcare system. He mentioned: "the incredible corruption and greed" of the pharmaceutical industry. The graph below shows how much more the United States spends on healthcare than other countries. Still, according to [US News](#), the United States is not even included in the top 10 healthcare systems globally and is way behind the countries that spend less on healthcare. The problem here is that why cannot have the best

healthcare system in the world when we spend the most money compared to other countries. For example, Sweden was ranked #1 by US News, and they spend almost half as much money as we do.

Cost & Quality of Healthcare Graph



Statista. (2019b, August 8). *The U.S. Has the Most Expensive Healthcare System in the World* [Graph]. Statista Infographics. <https://www.statista.com/chart/8658/health-spending-per-capita/>

Now we will dig deeper into the topic and analyze the reasoning behind this problem in the healthcare system. Margot Sanger-Katz briefly explains the condition of the healthcare system in her article: "Why Is U.S. Health Care So Expensive?". This article reveals: why our healthcare is expensive, the areas we spend the most money on, and breaks some myths. Margot

currently writes articles for the New York Times and holds a master's degree in Journalism from Columbia University. This article compares the cost and quality of healthcare in the United States. According to Margot, the U.S. healthcare system is not the best and the worst if we compare it with other countries.

Nonetheless, it is average considering the amount of money we spend. We think our healthcare is lagging because of the relatively low life expectancy. However, we do not realize that it might not be just the fault of the healthcare system itself that has to lead to a shorter life span. Other than the healthcare system, another major cause of the shorter life span is our diet. According to CDC, "The U.S. [obesity prevalence](#) was 42.4% in 2017 – 2018, and it increased by 11.9% since 1999-2000" (*Obesity Is a Common, Serious, and Costly Disease*, 2021).

Therefore, we cannot just blame the healthcare system for not providing optimal results and thus a decreased life expectancy. But still, some flaws also exist in the healthcare system, and there are areas where we spend more than our peers. This article also provides research-based evidence using Dr. Ashish Jha, an Indian-American physician and the Dean of the Brown University School of Public Health. Research reveals that we spend comparatively more money on medical services, which includes the cost of hospitalization, doctors' visits, and prescription drugs.

Along with low-quality healthcare, if Americans do not have health insurance for minorities, it creates an even bigger problem. Firstly, the minorities would not be able to get healthcare, and even if they do, the quality of it will not be high enough. But still, in the end, getting some form of health security is more important than nothing. So instead of focusing on quality, we thought focusing on inclusivity is more important considering the current healthcare

situation of the United States. Therefore, we further analyzed the minorities in the US to find out better ways to serve them and provide them with equal health insurance facilities.

Racial discrimination is rampant in American society. It permeates every aspect of our community in which it exists. It exists in economic accomplishment, including wages, income, credit extension, prices paid, among others. It also exists in health care provision with different health measures used on different races with no medical explanation (Harris et al., 2006). In addition, marginalized groups live in undesirable residential areas, which affect their access to healthcare. Those environments have health-damaging conditions and consequently limit the socio-economic status. Discrimination can also affect health through access to good healthcare services, creating exposure to stressors such as financial strain and unemployment. These differences are also seen in health insurance practices, as well as seen below:

Racial/ Ethnic Differences in Health Insurance

Health insurance helps families access health care at low costs. Therefore, insurance should be accessible and fair to all. However, people of color, often the minority, face longstanding health coverage disparities. For example, according to Artiga et al. (2021), based on Kaiser family foundation (KFF) analysis of American Community Survey data for the non-elderly population, there are distinct differences in health coverage by ethnicity from 2010 to 2019.

According to this analysis, the Affordable Care Act (ACA) made people of color gain more accessible health coverage compared to whites. However, despite increasing the number of insured people of color, there is still a notable difference compared to the white race. In 2010, the Hispanic, Alaska Native, and American Indian recorded the highest uninsured people. Based

on the statistics, 33% of them lacked insurance while only 13.1% of white people lacked insurance. The difference was notably significant, clearly indicating a bias in health coverage regarding race.

The Affordable Care Act decided to develop new procedures to narrow the differences in health coverage by race. This policy reduced the gap but did not eliminate the disparities. This policy helped drop the percentage of uninsured Hispanics from 32% to 19%. These results are a big win for the ACA procedures; however, they still had to narrow the gap further so that people of color could match up with white people. The ACA procedures did not seem effective since they reverted years later. In 2007, the United States saw an increase in uninsured rates among Hispanics, blacks, and white people.

The current government under Trump's administration attributes to this increasing policy change. Permet (2018) argues that the anti-immigrant sentiment often spills into healthcare policy debates. In the first year of Trump's administration, immigrants who needed healthcare suffered greatly. Immigrants are often less likely to have insurance because they work in sectors that are less likely to provide insurance to their workers. As a result, the immigrants, who are often people of color, are usually at risk of getting injured in their places of work and not getting the appropriate medical attention.

However, before the Trump administration, the 1996 Personal Responsibility and Work Opportunity Reconciliation Act (PROWRA) did not allow undocumented immigrants to access government-funded health insurance programs. They argued since they were not citizens, they did not have a right to get the privileges meant for the American citizens. They failed to acknowledge that health care is a human right and should not be offered based on citizen or non-

citizen. The Act also prohibited immigrants from accessing government-funded programs even five years after gaining legal status. This policy hindered the ACA provisions to healthcare coverage for all. The Trump administration policies further strengthened the PROWRA leading to an increased number of uninsured immigrants who could not access healthcare.

In 2019, people of color were more likely to be uninsured mainly because they could not access private coverage compared to white people. Insurance coverage such as Medicaid and Children's Health Insurance Program (CHIP) purpose was to fill the gap that exists in private health coverage. However, the two insurance schemes were not efficient in fulfilling the difference. In the end, Medicaid did not ultimately expand to all states, which created a barrier in meeting insurance needs for the minority in areas that had not adopted Medicaid.

COVID-19 Effect on Ethnic Communities

The minority mainly felt health insurance disparities during the COVID-19 pandemic. The pandemic led to job loss, especially in the informal sector, primarily based on the ethnicity of employees. Therefore, the few who could initially afford health coverage no longer afforded to pay for insurance. They used the little money they had to buy food and seek shelter during the pandemic. Structural racism further affected ethnic communities through differentiation employment loss during the COVID-19 pandemic (Gemelas et al., 2021). There were more dramatic declines in the number of unemployed Black, Asian, Hispanic, and Latinx groups.

The pandemic further showed the racial disparities that exist in the health sector. According to the disease patterns, Black and Hispanic American residents showed several-fold greater incidence of infection and increased hospitalization rates (Boulwre, 2020). In addition, black patients had more significant comorbidity at presentation even at a young age, indicating

a burden of poor health care offered to Blacks compared to Whites in the United States. Evidence also shows that black patients have a greater prevalence of communicable and non-communicable diseases. Records also show that infant mortality is often high in ethnic communities compared to white communities. The cause of this infant mortality is mainly due to a lack of proper maternal health care during pregnancy which ultimately is because they do not have health insurance.

COVID-19 pandemic would rapidly spread through close contact with an infected person. Health professionals, therefore, advised people to maintain a social distance from one another and proper ventilation. Sun & Zhai (2020) argue that increasing social distance reduced infection rates by 20-40%. However, this was hard to achieve, especially for the people of color, since their living conditions and financially weak lifestyle did not allow them to quarantine. Most of them had crowded living spaces. Compared to white communities, ethnic communities have a higher population density due to high poverty levels. Due to a lack of social distance, COVID-19 spread significantly fast among the ethnic communities.

Despite high COVID-19 cases, they could not access health care since they lacked insurance. Therefore, they had no choice but to stay at home and hope they would recover. During this time, their family members catered to them and thus increasing exposure to the pandemic. The pandemic proved that diseases such as the coronavirus are non-discriminatory while the health system is discriminatory. Therefore, the minority groups were most affected when the COVID struck since they were not well-shielded against it. The pandemic should be a wake-up call to the minority group and the policymakers, in general, to advocate for equal health insurance coverage.

America Rescue Plan Act (ARPA)

To counter the effects of the pandemic, especially on people of color, the Biden administration and Congress have implemented actions to expand health coverage. Their efforts are to eliminate racial health disparities. The administration also seeks to address the inequalities across various social and economic factors that drive health. These factors include political differences based on race, differences that exist in housing, and differences in the employment sector. All these are factors that affect the health status of the minority groups.

These disparities can be removed by enrolling more people in Medicaid or marketplace coverage. The Biden administration came with ways to use the American Rescue Plan (ARPA), a federal stimulus bill to help improve public health post-pandemic. ARPA, enacted in 2021, would increase access to health coverage through the temporary increase in eligibility for subsidies to buy a health cover. The Act also allows states that have not yet adopted Medicaid expansion. It also allows the extension of Medicaid coverage for women postpartum. The ARPA Act has allowed 63% of uninsured nonelderly people to get insurance coverage. The remaining 37% lack medical covers due to their immigration status or lack of Medicaid expansion in their status due to economic reasons.

The Biden administration also reversed the changes made by the Trump Administration that made immigrant families reluctant to take medical coverage even if they were eligible. These actions by the Biden administration will increase in immigrants taking medical cover. It also reversed state waivers that had initiated work requirements to get Medicaid coverage, decreasing the number of people eligible for medical coverage. The Act also launched initiatives that would boost health insurance enrolment among Blacks and Latinos.

ARPA reforms the Affordable Care Act (ACA) to broaden the ACA's regulated individual health insurance coverage. The new Act increases the premium subsidies to cover households earning between 100% and 400% of the FPL (Federal Poverty Line) (O'Mahen & Petersen, 2021). However, ARPA reforms neglect the health insurance needs for nonelderly adults below the federal poverty line who are ineligible because of their residing states.

Therefore, ethnic communities who live in relatively more prosperous states are not eligible for the ARPA subsidy. Thus, some individuals move to relatively poorer states to get insurance coverage. This demographic factor leads to further segregation of communities based on economic status and race. In addition, the Act does not fully address the structural policy changes required to provide equitable health services (Johnson-Staub & Weerasinghe, 2021). However, Congress and the administration are looking into other methods to fill the remaining gaps in health coverage.

Effects of Racial Differences in Health Insurance

The socioeconomic differences in health insurance based on race have significant effects on the individuals affected and the nation at large. Some of the impacts associated include the following:

I. Economic decline

Health insurance protects individuals against incurring considerable losses in a medical emergency. As a result, it ensures the financial stability of an individual, family, and consequently the nation. However, in case of illnesses and accidents, individuals will be forced to use their savings or get a loan to cater to medical expenses. This inability of the government to provide

health insurance leads to financial downfall. With this financial downfall, the entire nation suffers from an economic decline and not only just the minority.

Health insurance coverage is an employee benefit covered by companies in most cases. But when individuals are not insured, they are likely to fall sick and thus not join the workforce. Therefore, with a decline in the workforce due to illness, the economy will suffer at large. On the other hand, an actively healthy and robust workforce increases production and efficiency, improving economic status. It is therefore essential to ensure the health insurance coverage of our workforce.

II. Poor health status countrywide and increased mortality rate

Racial discrepancies in health insurance not only affect the uninsured but the insured as well. This problem is evident with the COVID-19 pandemic, which made us realize the importance of our health and the policy designed to safeguard our life (Ganesan et al., 2020). The coronavirus is contagious, and therefore some insured people contracted the disease through the uninsured who could not get access to proper healthcare. This issue leads to poor health status countrywide. Due to a lack of adequate health care, there has been a consequent increase in mortality rates.

III. Increase in racial discrimination and segregation

The United States is currently fighting the battle against racial discrimination. The differences in health insurance coverage are a result of systemic discrimination. It further fuels racial bias. There needs to be sensitization of healthcare professionals to reduce the discrimination present in health care settings (Shrivastava & Shrivastava, 2021). Individuals from ethnic communities are less likely to get the best medical care due to health insurance. Therefore, they are discriminated against by their counterparts and, in most cases, segregated. In most cases, the

hospital staff quickly judges that an ethnic individual is uninsured compared to their white counterparts. This prejudice results from the bias that already exists in health insurance coverage.

IV. Decline in the health sector

The government also uses health insurance to improve the health sector. The more insured individuals, the more money the government has to expand the health sector. Thanks to health insurance, health care has been immune from economic recessions (Cutler, 2020). Therefore, the government should encourage more people to get insured to improve the health sector by buying medicine and other medical tools and equipment. With fewer insured people, hospitals in poor demographic locations do not provide all the possible facilities to their communities because the people in that neighbourhood cannot pay those hefty bills.

Therefore, with the hospital facilities not being utilized to their fullest potential, the nation suffers from health problems and ends up having financial problems. With fewer hospital facilities, there would be fewer jobs as well. Therefore, the healthcare industry does not utilize its full potential, and the community suffers economically, reducing the country's GDP. On a micro level, it could result in doctors and other medical professionals being at a massive risk of losing their jobs. Therefore, providing health insurance to all individuals living in the United States is necessary.

Results and Findings

From the study, we found out the health insurance status of individuals based on their race: Asian race had 94.5% likelihood of having health insurance, followed by the white race 93.8%, then the black race with a 90.6%, then American Indian with 85.5%, and finally Aleut Alaskan at 85.5%. Looking at the influence of race on health insurance by observing the chi-square statistic and its p-value, the chi-square test was significant at 5% level; the test shows that an individual's race was highly associated with health insurance. This data set was interesting to explore as we were speculating that the white race would possibly have the highest percentage of individuals with health insurance. Still, it turns out that the Asian race is more likely to have health insurance than the white race.

The next factor influencing health insurance was marital status. Widows had the highest number of individuals with health insurance (97.7%) and then followed by the married people who had 94.8% health insurance, and thirdly 91.7% of people who were divorced had health insurance. Separated and unmarried individuals were the least likely to have health insurance. Therefore, marital status was a significant factor influencing healthcare status. Another factor that influenced health insurance was citizenship; citizens had higher chances of having health insurance (94%) than non-citizens (69.9%).

Next, we looked at the effects of sexual orientation in determining the health insurance status of an individual. Our research found out that lesbians and gays had a higher probability of having health insurance (93.4%) than straight people (92.5%), followed by bisexuals having a rate of 88.7%, which is the lowest percentage among the three sexual orientations. Sexual orientation also proved to be a significant factor influencing health insurance.

Whether someone served in the army was also an essential factor influencing individuals' health insurance coverage. Those who have served had a higher rate (97.8%) of health insurance than those who have never joined the military (91.9%). Another factor that significantly influenced the health insurance status was the number of years someone has stayed in America. The findings were that people who remained in America for 15 or more years had the highest rate of health insurance (87.2%), those who stayed between 5-10 years in the US had (84.2%), the group of people with the least number of people with health insurance was the one who lived in the US for less than one year (64.7%). The more years someone spends in America, the higher their chance to get health insurance.

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year (64.7%). The more years one has lived in the United States, the higher are their chances of having health insurance.

Education status was also a significant factor impacting the health insurance status of individuals. The people with higher education had a higher chance of having health insurance. According to education level, people with some college education had a 91.4% rate of having health insurance, which is the highest rate compared to people with no education or high school diploma.

However, when we compared the employment status factor and its relationship with health insurance, we found out that unemployed people had a higher rate of health insurance (94.3%) than employed individuals who had a rate of (91.1%). This output was unexpected. We expected opposite results because it would make more sense for individuals with a stable income to have health insurance and not the other way around. According to researchers from the past Healthcare, inequality is the new income inequality. According to Dan Mangan, a CNBC reporter, "the rich in the United States — despite being healthier on average than the poor — have become the biggest buyers of health care, a dramatic shift in spending patterns across income groups, according to a new Harvard study" (Mangan, 2016).

Moreover, in 2001 research, the U.S. government agency named "Agency for Healthcare Research and Quality" published a research article Health Insurance Coverage and Income Levels for the U.S. noninstitutionalized population under the age of 65. According to this research, "Approximately one-fourth of persons in poor near-poor, low-income families were not covered by health insurance at any time during the year" (Crimmel, 2004). Therefore, this research

illustrates that in 2021 minorities will be more likely to have health insurance than in 2001. This increase in insured individuals has been an enormous achievement in the past 20 years.

But before we conclude our results, we also need to consider other possible variables that could have led employed individuals to be less likely to have insurance than the unemployed. For example, maybe unemployed people have high insecurity of not being able to pay expensive medical bills and thus have started to take advantage of health insurance services. In contrast, the employed individuals are less insecure as they are more likely able to pay medical bills.

Since other factors could have also influenced the health insurance coverage, we decided to explore more variables. The next factor we explored was the health insurance status of a person based on whether a person was born in the U.S. or not. The people born in the U.S. had a higher health insurance rate (94%) than those born outside America (84.9%).

Moving on to the following variable, we concentrated on understanding the health insurance rate based on whether the employer offered health insurance or not. From this analysis, we learned that those whose employers provided health insurance had a higher rate of health insurance coverage (96.4%) than those whose employers did not offer health insurance had a rate of 77.6%.

After analyzing the data and comparing the different variables found in the data set, we moved on to creating a logistic regression model to understand further the relationship between the various factors mentioned and the health insurance status of people living in the United States of America. This model aims to analyze the odds of someone having health insurance, given that person's data, including various variable factors.

The variables that stood out to be significant in the model were:

- Sample person weight.
- Citizenship status.
- Private health insurance.
- Health insurance coverage by children's program.
- Health insurance coverage by other state-sponsored plans.

These variables were the only ones with p-values less than 0.05 (level of statistical significance). The odds ratios of sample weight were 1; hence that's not impactful as it means people with more weight are as likely to be insured as to any other people. But looking at the citizenship status, the odds of one having health insurance was 0.13 times more than one who is not a citizen. People covered by the children's program were 1.42 times more likely to have health insurance. Those covered by state-sponsored programs were 1.21 times more likely to have insurance.

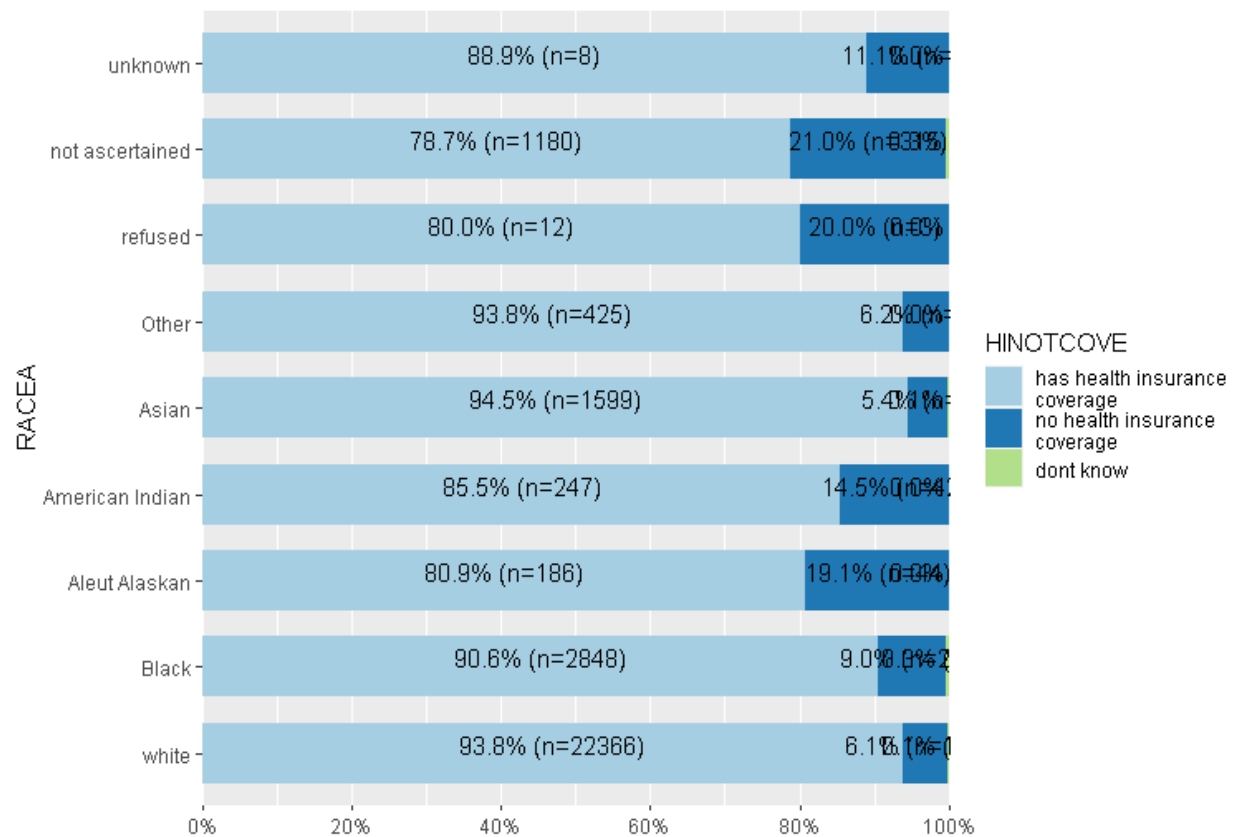
Descriptive statistics

The following figures show the summary statistics of the data. The tables and the plots show the frequency analysis of the variables grouped by the dependent variable. In addition, the tables test the association between each variable and the dependent variable (HINOTCOVE) Health insurance coverage.

Table 1: Health insurance by race

Table Health insurance by RACE				
	<i>HINOTCOVE</i>			
<i>RACEA</i>	has health insurance coverage	no health insurance coverage	dont know	<i>Total</i>
white	22366 93.8 %	1445 6.1 %	36 0.2 %	23847 100 %
Black	2848 90.6 %	284 9 %	10 0.3 %	3142 100 %
Aleut Alaskan	186 80.9 %	44 19.1 %	0 0 %	230 100 %
American Indian	247 85.5 %	42 14.5 %	0 0 %	289 100 %
Asian	1599 94.5 %	92 5.4 %	1 0.1 %	1692 100 %
Other	425 93.8 %	28 6.2 %	0 0 %	453 100 %
refused	12 80 %	3 20 %	0 0 %	15 100 %
not ascertained	1180 78.7 %	315 21 %	4 0.3 %	1499 100 %
unknown	8 88.9 %	1 11.1 %	0 0 %	9 100 %
Total	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$\chi^2=582.200 \cdot df=16 \cdot \text{Cramer's } V=0.097 \cdot \text{Fisher's } p=0.000$

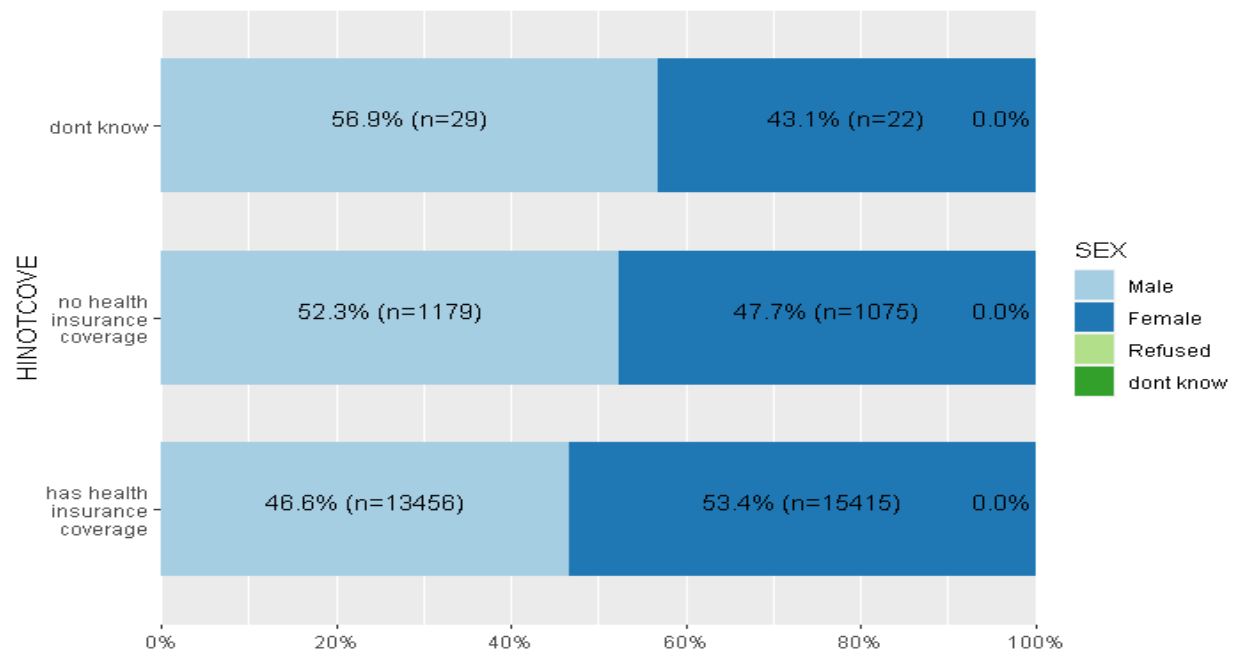
Figure 1:Plot of the health insurance by race

The Asian race had the highest percentage of people with health insurance at 94.5%; the American Indian had the lowest percentage at 85.5%.

Table 2: Health insurance by sex**Table Health insuracne by sex**

<i>SEX</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
Male	13456 91.8 %	1179 8 %	29 0.2 %	14664 100 %
Female	15415 93.4 %	1075 6.5 %	22 0.1 %	16512 100 %
Refused	0 0 %	0 0 %	0 0 %	0 100 %
dont know	0 0 %	0 0 %	0 0 %	0 100 %
Total	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2 = \text{NaN} \cdot df = 6 \cdot \text{Cramer's } V = \text{NaN} \cdot \text{Fisher's } p = 0.000$$

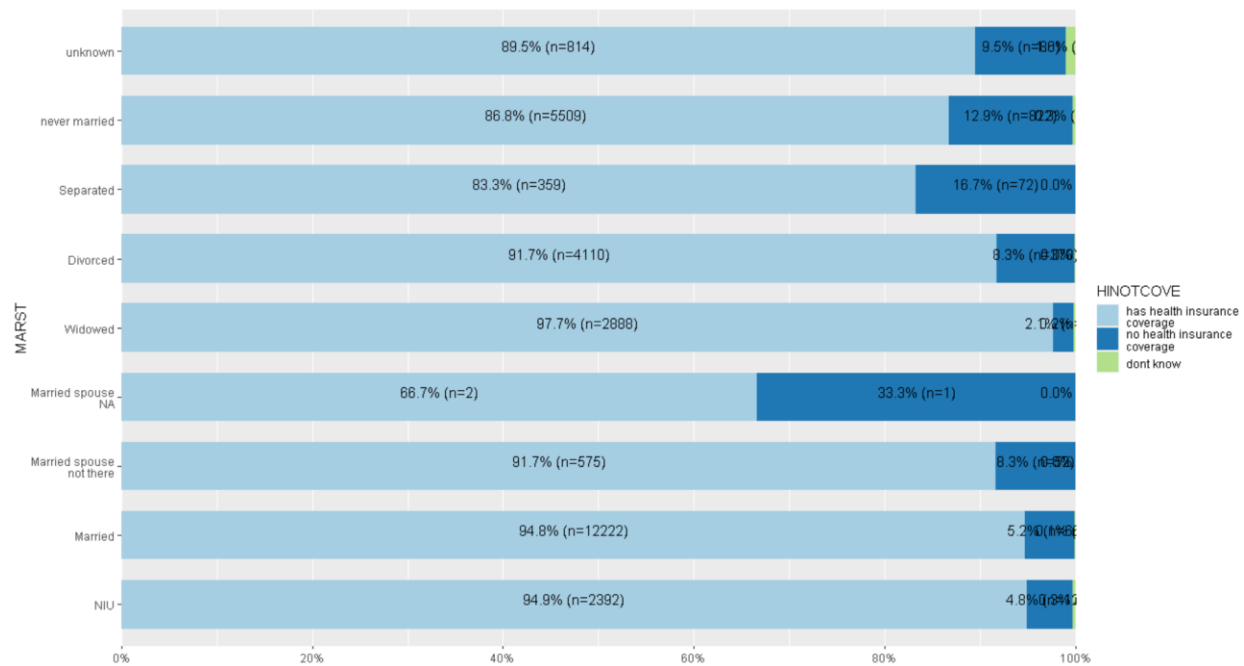
Figure 2: plot of health insurance by sex

Females had a higher likelihood of having health insurance with a 53.4% in comparison to males with a 46.6%.

Table 3: Health insurance by marital status

<i>MARST</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
Married	12222 94.8 %	667 5.2 %	10 0.1 %	12899 100 %
Married spouse not there	575 91.7 %	52 8.3 %	0 0 %	627 100 %
Married spouse NA	2 66.7 %	1 33.3 %	0 0 %	3 100 %
Widowed	2888 97.7 %	62 2.1 %	5 0.2 %	2955 100 %
Divorced	4110 91.7 %	370 8.3 %	1 0 %	4481 100 %
Separated	359 83.3 %	72 16.7 %	0 0 %	431 100 %
never married	5509 86.8 %	822 12.9 %	19 0.3 %	6350 100 %
unknown	814 89.5 %	86 9.5 %	9 1 %	909 100 %
Total	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$\chi^2=665.620 \cdot df=16 \cdot \text{Cramer's } V=0.103 \cdot \text{Fisher's } p=0.000$

Figure 3: plot of health insurance by marital status

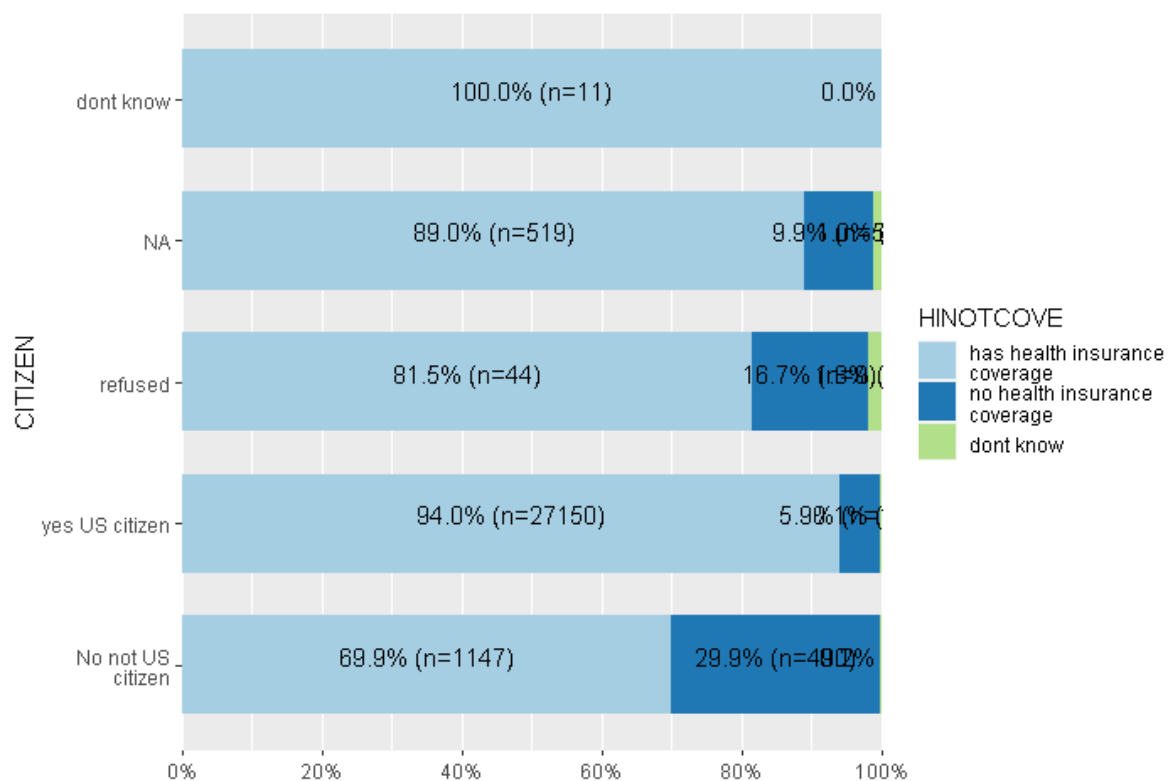
Widows had the highest percentage of health insurance (97.7%), then followed by married people at 94.8%, the lowest percentage was by married spouse NA(66.7%) and the separated (83.3%).

Table 4: Health insurance by citizenship

Table Health insurance by citizenship status

<i>CITIZEN</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
No not US citizen	1147 69.9 %	490 29.9 %	4 0.2 %	1641 100 %
yes US citizen	27150 94 %	1697 5.9 %	40 0.1 %	28887 100 %
refused	44 81.5 %	9 16.7 %	1 1.9 %	54 100 %
NA	519 89 %	58 9.9 %	6 1 %	583 100 %
dont know	11 100 %	0 0 %	0 0 %	11 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=1385.976 \cdot df=8 \cdot \text{Cramer's } V=0.149 \cdot \text{Fisher's } p=0.000$$

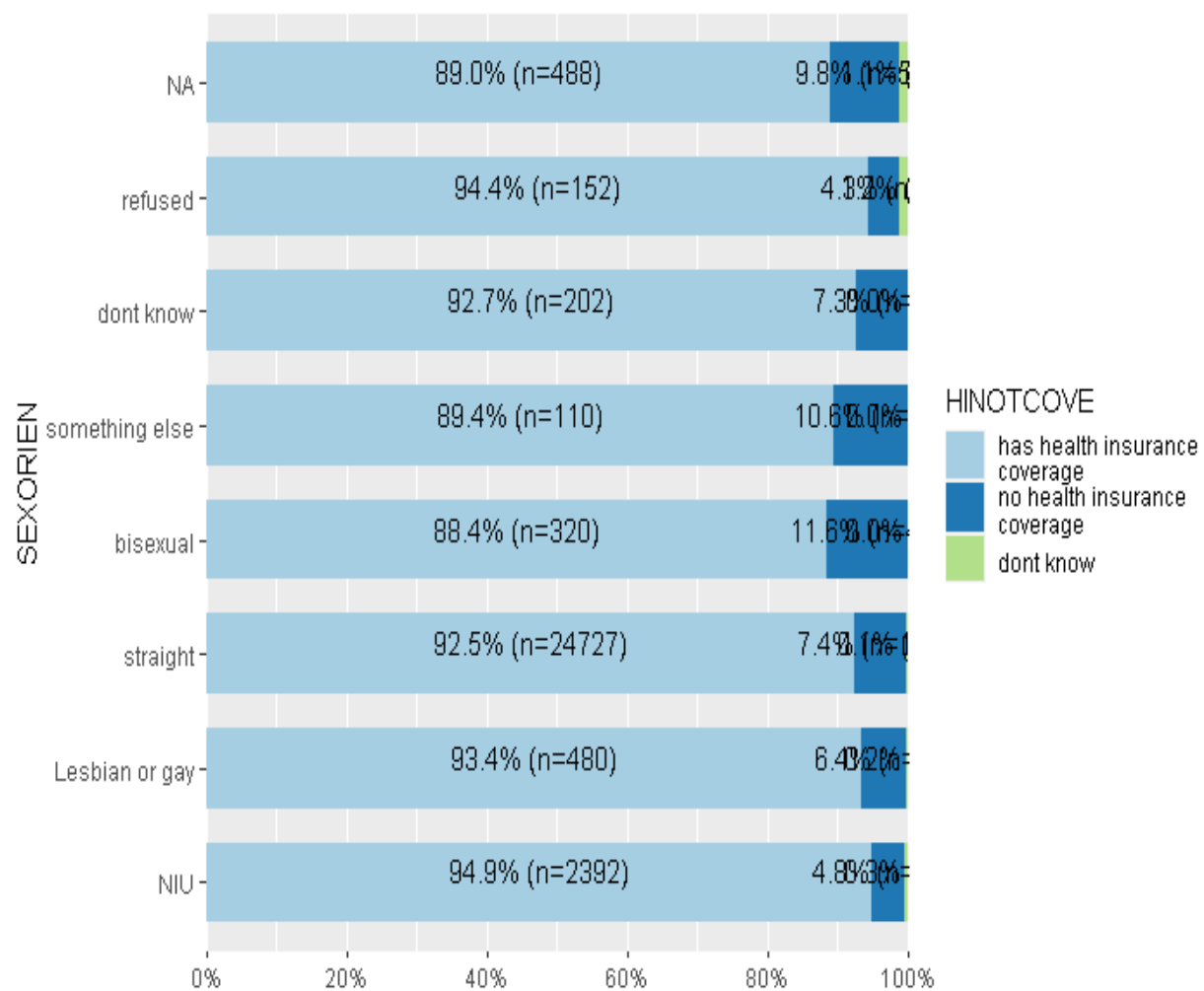
Figure 4: Health insurance by citizenship

US citizens had the highest percentage of people with health insurance (94%), non-US citizens had the lowest rate of health insurance (69.9%).

Table 5: Health insurance by sex orientation**Table Health insurance by sex orientation**

<i>SEXORIEN</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
Lesbian or gay	480 93.4 %	33 6.4 %	1 0.2 %	514 100 %
straight	24727 92.5 %	1967 7.4 %	35 0.1 %	26729 100 %
bisexual	320 88.4 %	42 11.6 %	0 0 %	362 100 %
something else	110 89.4 %	13 10.6 %	0 0 %	123 100 %
dont know	202 92.7 %	16 7.3 %	0 0 %	218 100 %
refused	152 94.4 %	7 4.3 %	2 1.2 %	161 100 %
NA	488 89.1 %	54 9.9 %	6 1.1 %	548 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=88.085 \cdot df=14 \cdot \text{Cramer's } V=0.038 \cdot \text{Fisher's } p=0.000$$

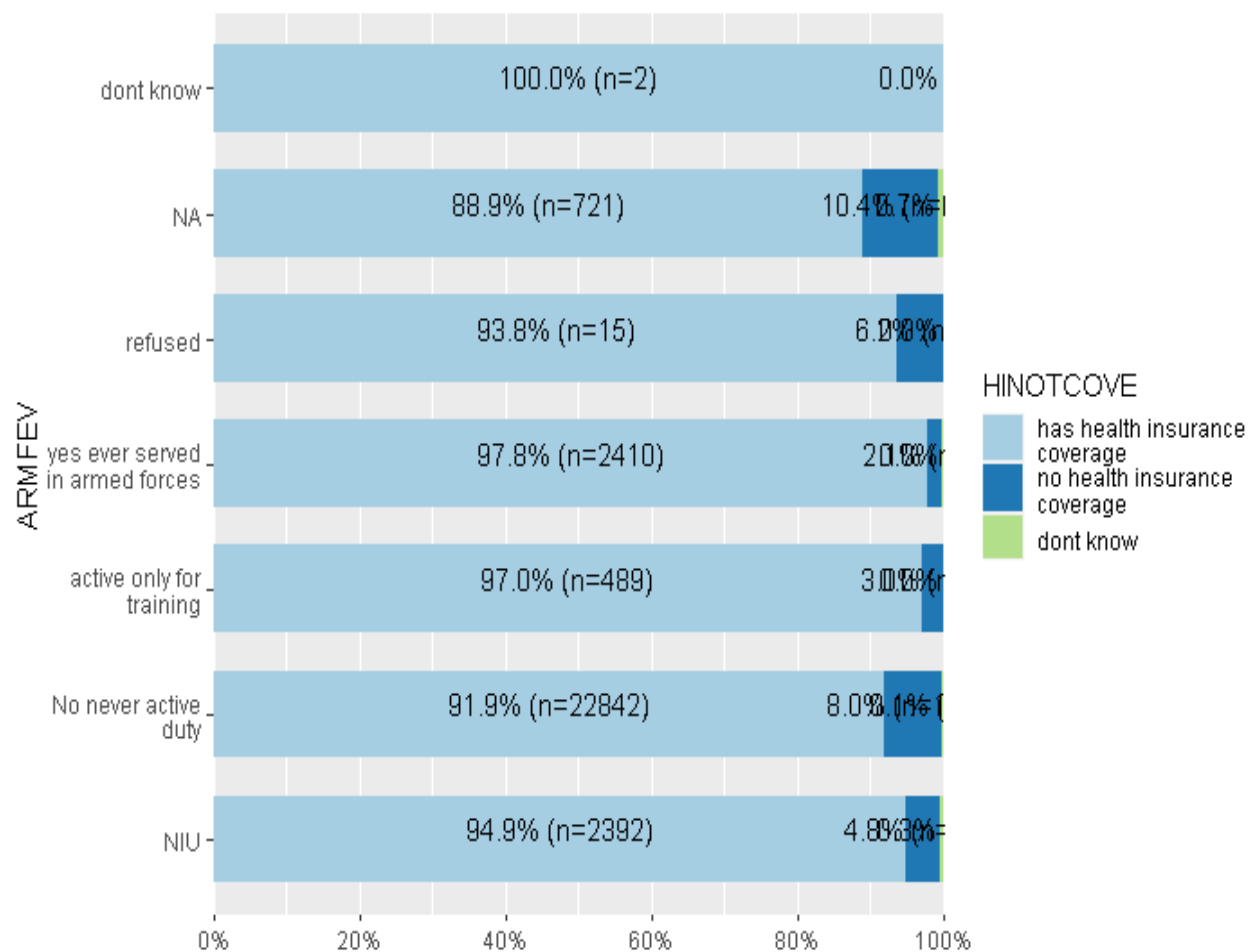
Figure 5: Health insurance by sex orientation

The above plot shows people who refused to inform about their sexual orientation had the highest percentage of insurance coverage (94.4%), and the lowest percent (88.4%) was that of bisexuals.

Table 6: Health insurance by army service record**Table Health insurance by army service**

<i>ARMFEV</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
No never active duty	22842 91.9 %	1979 8 %	37 0.1 %	24858 100 %
active only for training	489 97 %	15 3 %	0 0 %	504 100 %
yes ever served in armed forces	2410 97.8 %	53 2.2 %	1 0 %	2464 100 %
refused	15 93.8 %	1 6.2 %	0 0 %	16 100 %
NA	721 88.9 %	84 10.4 %	6 0.7 %	811 100 %
dont know	2 100 %	0 0 %	0 0 %	2 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=184.177 \cdot df=12 \cdot \text{Cramer's } V=0.054 \cdot \text{Fisher's } p=0.000$$

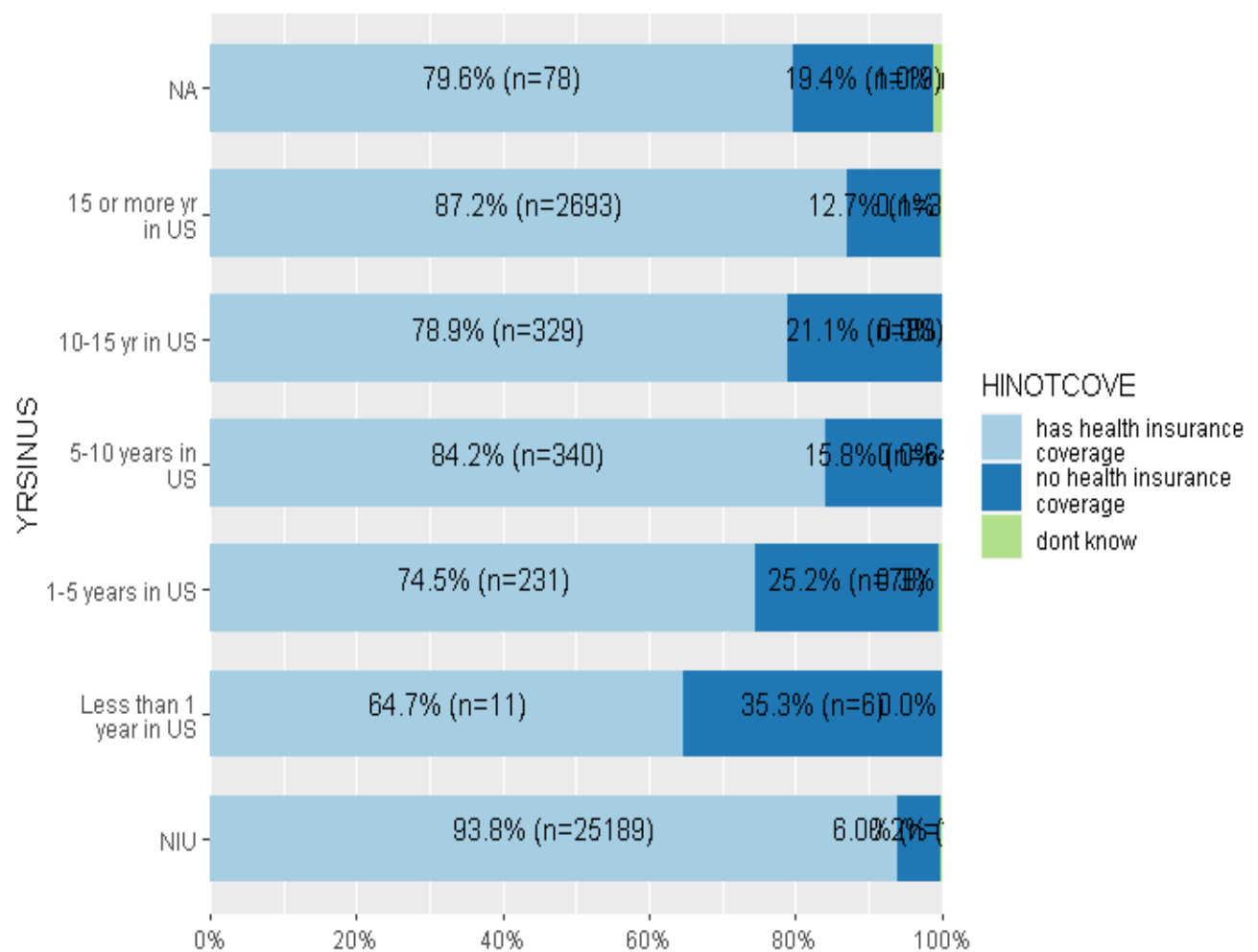
Figure 6: Plot of Health insurance by army service record

Using the above plot, we observed that individuals who did not respond to the active military service question had the highest percent(100%) of health insurance coverage, and NA had the lowest percent (88.9%) of health insurance coverage. On the other hand, the second-highest percentage (97.8%) of individuals who received health insurance participated in the armed forces. Therefore, we can conclude that participating in the armed forces is beneficial and can increase the chances of individuals having health insurance. Table 5 also illustrates the calculated chi-square value (184.177) and degree of freedom equal 16.

Table 7: Health insurance by years in the US**Table Health insurance by years in the US**

<i>YRSINUS</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	25189 93.8 %	1607 6 %	45 0.2 %	26841 100 %
Less than 1 year in US	11 64.7 %	6 35.3 %	0 0 %	17 100 %
1-5 years in US	231 74.5 %	78 25.2 %	1 0.3 %	310 100 %
5-10 years in US	340 84.2 %	64 15.8 %	0 0 %	404 100 %
10-15 yr in US	329 78.9 %	88 21.1 %	0 0 %	417 100 %
15 or more yr in US	2693 87.2 %	392 12.7 %	4 0.1 %	3089 100 %
NA	78 79.6 %	19 19.4 %	1 1 %	98 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=560.111 \cdot df=12 \cdot \text{Cramer's } V=0.095 \cdot \text{Fisher's } p=0.000$$

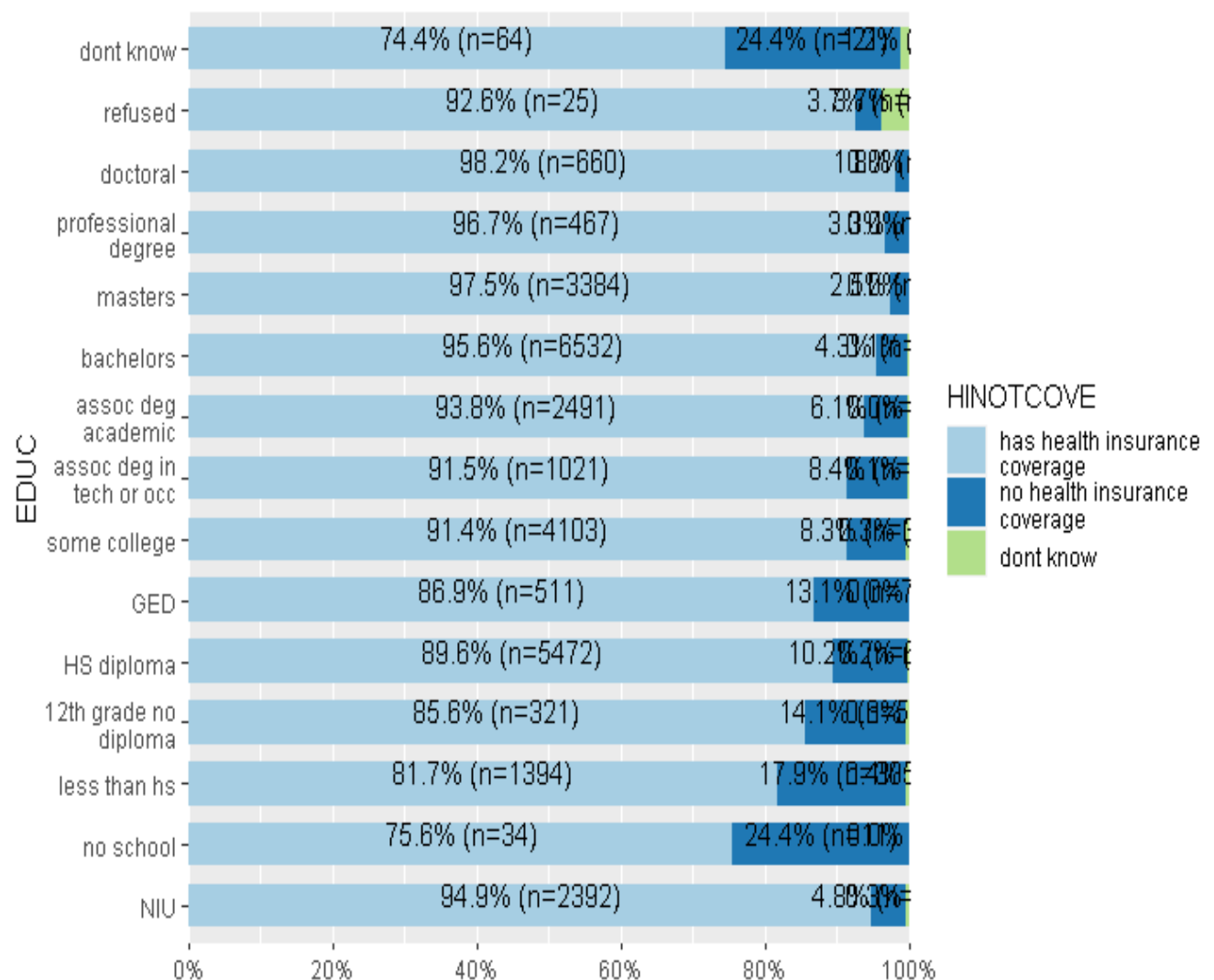
Figure 7: Plot of Health insurance by years in the US

Plot 7 shows NIU had the highest percent (93.8%) of health insurance, and those who lived in the US for less than a year had 64.7% had health insurance coverage.

Table 8: Health insurance by education status

<i>EDUC</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
no school	34 75.6 %	11 24.4 %	0 0 %	45 100 %
less than hs	1394 81.7 %	305 17.9 %	7 0.4 %	1706 100 %
12th grade no diploma	321 85.6 %	53 14.1 %	1 0.3 %	375 100 %
HS diploma	5472 89.6 %	625 10.2 %	12 0.2 %	6109 100 %
GED	511 86.9 %	77 13.1 %	0 0 %	588 100 %
some college	4103 91.4 %	372 8.3 %	14 0.3 %	4489 100 %
assoc deg in tech or occ	1021 91.5 %	94 8.4 %	1 0.1 %	1116 100 %
assoc deg academic	2491 93.8 %	163 6.1 %	1 0 %	2655 100 %
bachelors	6532 95.6 %	295 4.3 %	5 0.1 %	6832 100 %
masters	3384 97.5 %	87 2.5 %	1 0 %	3472 100 %
professional degree	467 96.7 %	16 3.3 %	0 0 %	483 100 %
doctoral	660 98.2 %	12 1.8 %	0 0 %	672 100 %
refused	25 92.6 %	1 3.7 %	1 3.7 %	27 100 %
dont know	64 74.4 %	21 24.4 %	1 1.2 %	86 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

 $\chi^2=820.846 \cdot df=28 \cdot \text{Cramer's } V=0.115 \cdot \text{Fisher's } p=0.000$

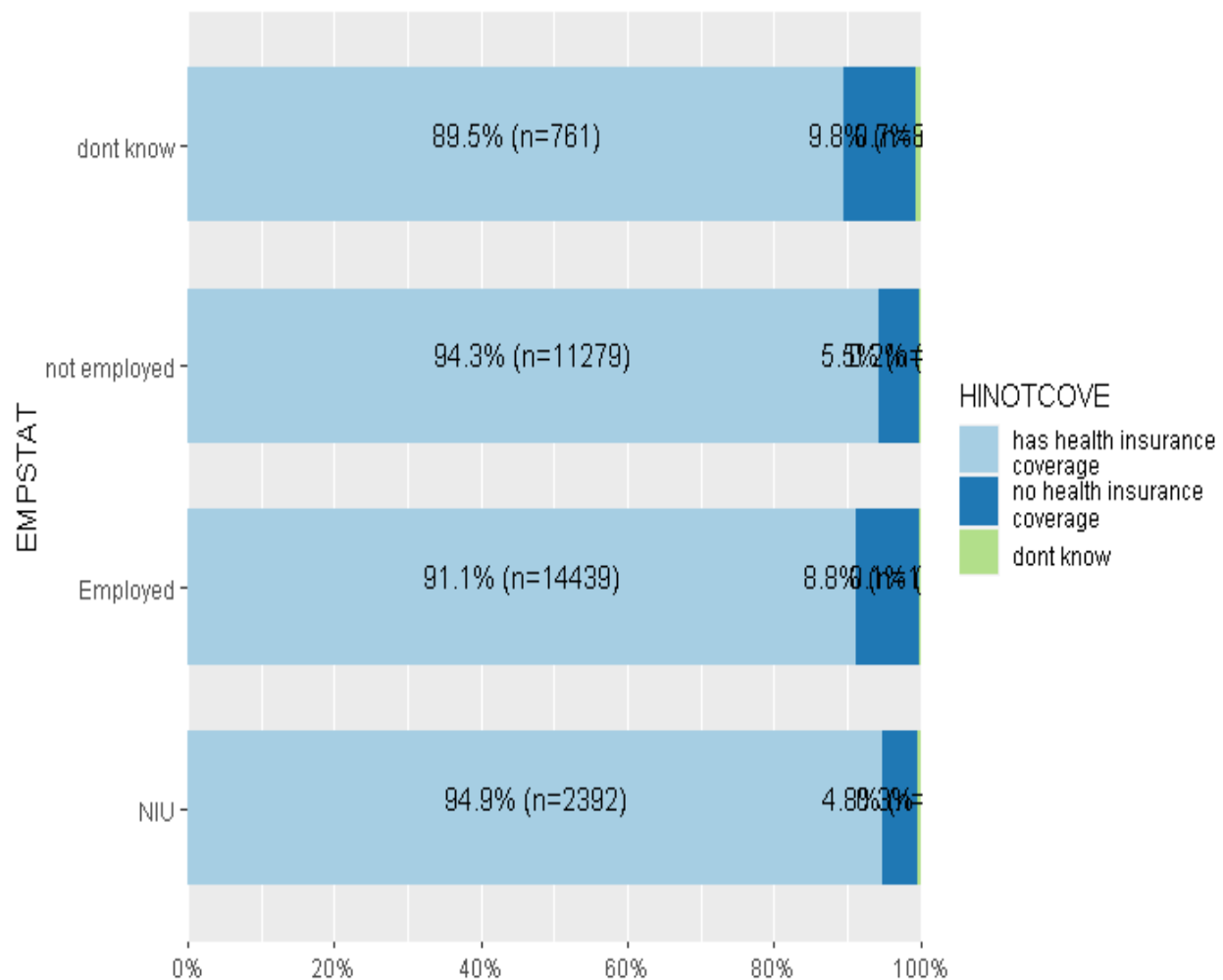
Figure 8 Plot of Health insurance by education status

Based on education status, individuals with a doctoral degree had the highest percentage of health insurance coverage (98.2%), and the population with the lowest rate (75.6%) of individuals with health insurance coverage are the ones who have less than a school degree. Therefore, we can conclude that being more educated is directly proportional to health insurance coverage. Thus, having more education increases the probability of individuals having health insurance and vice versa.

Table 9: Health insurance by employment status**Table Health insurance by employment status**

<i>HINOTCOVE</i>				
<i>EMPSTAT</i>	has health insurance coverage	no health insurance coverage	dont know	<i>Total</i>
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
Employed	14439 91.1 %	1393 8.8 %	15 0.1 %	15847 100 %
not employed	11279 94.3 %	656 5.5 %	23 0.2 %	11958 100 %
dont know	761 89.5 %	83 9.8 %	6 0.7 %	850 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=163.537 \cdot df=6 \cdot \text{Cramer's } V=0.051 \cdot \text{Fisher's } p=0.000$$

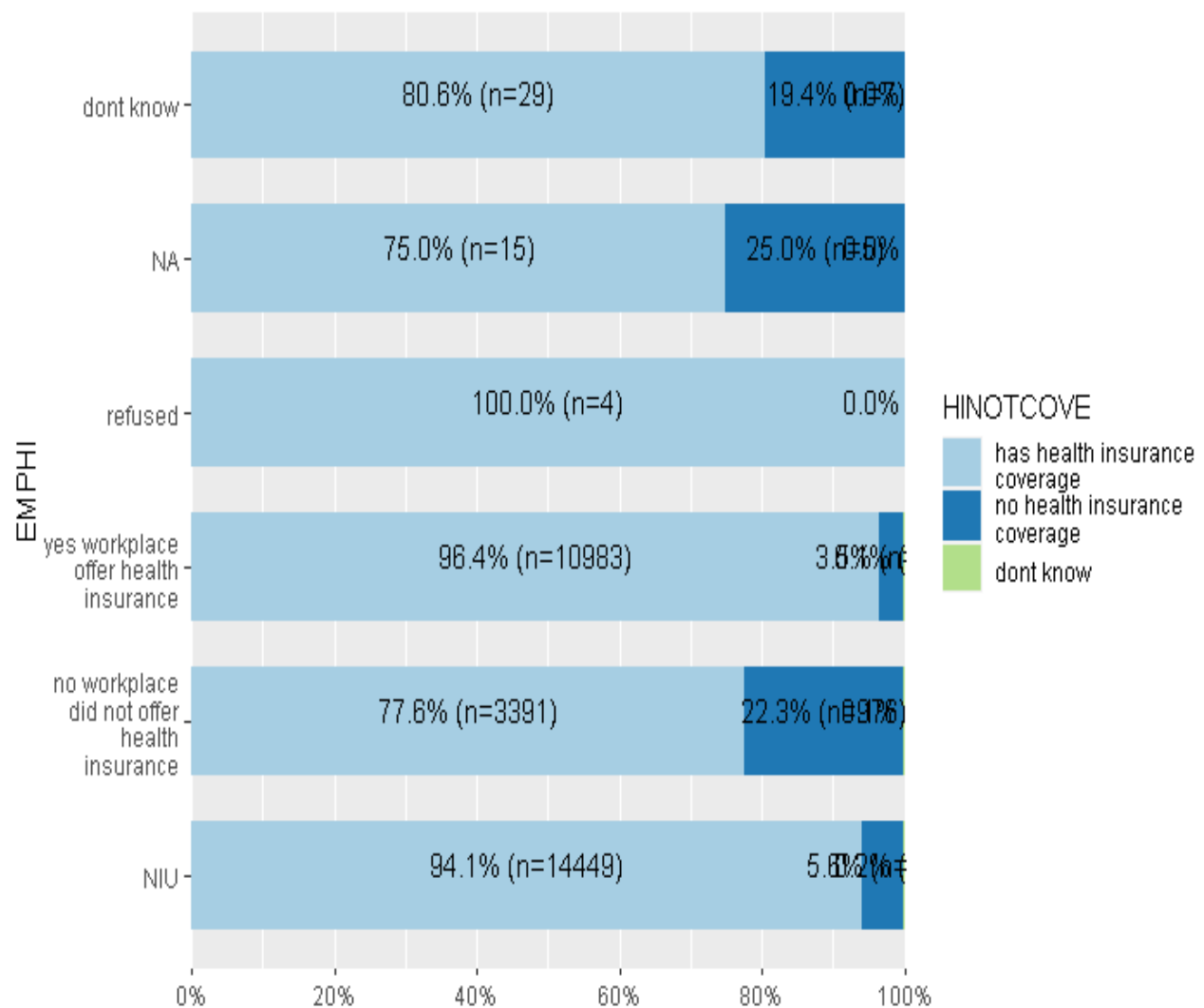
Figure 9: Plot of Health insurance by employment status

Based on the employment status NIU had the highest percentage (94.9%) of health insurance coverage, and those who did not respond employment status had the lowest percentage (89.5%) of health insurance coverage.

Table 10: Health insurance by whether employers offer health insurance**Table Health insurance by whether employer offer health insurance**

<i>EMPHI</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	14449 94.1 %	865 5.6 %	36 0.2 %	15350 100 %
no workplace did not offer health insurance	3391 77.6 %	976 22.3 %	5 0.1 %	4372 100 %
yes workplace offer health insurance	10983 96.4 %	401 3.5 %	10 0.1 %	11394 100 %
refused	4 100 %	0 0 %	0 0 %	4 100 %
NA	15 75 %	5 25 %	0 0 %	20 100 %
dont know	29 80.6 %	7 19.4 %	0 0 %	36 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=1804.196 \cdot df=10 \cdot \text{Cramer's } V=0.170 \cdot \text{Fisher's } p=0.000$$

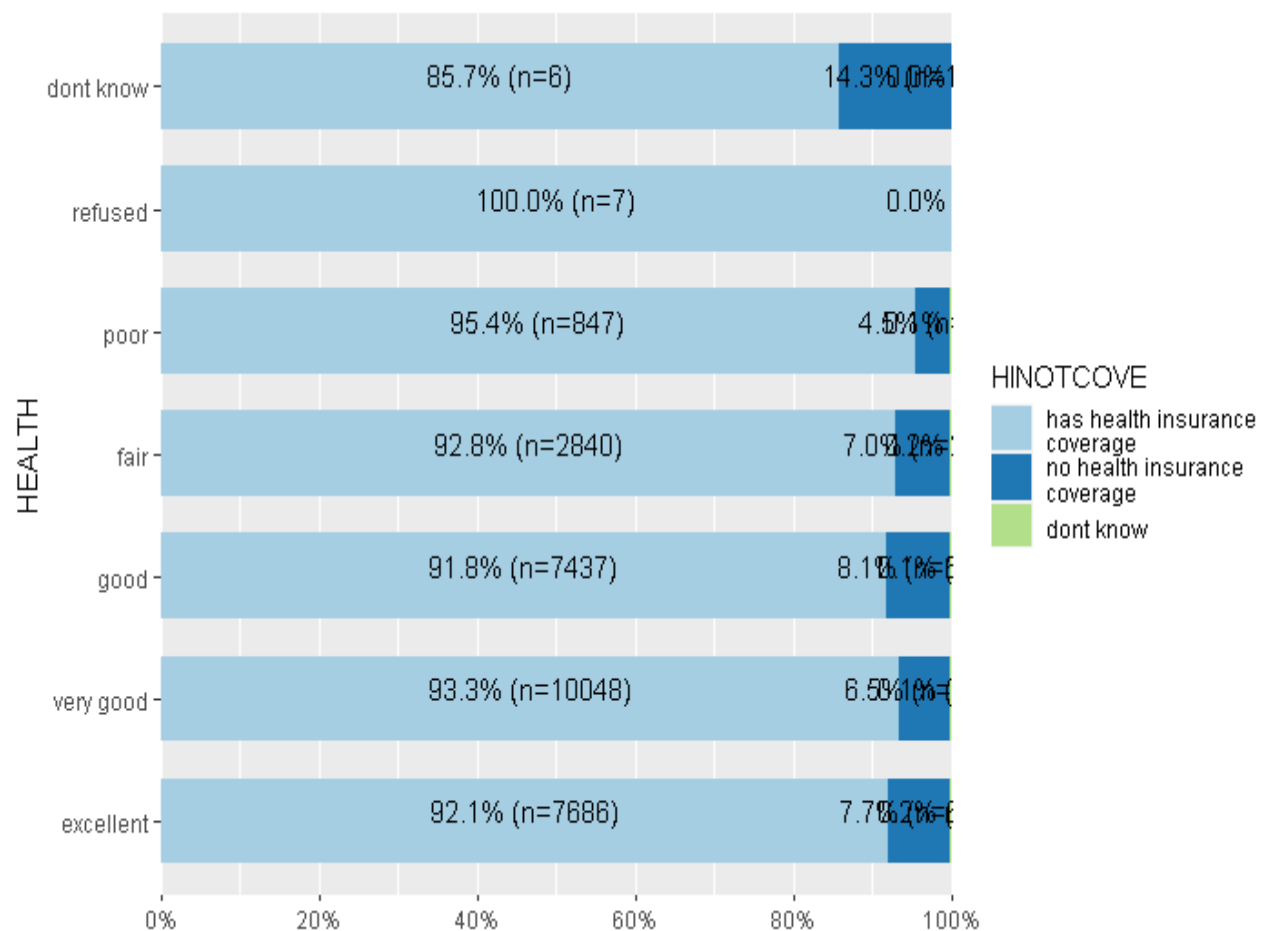
Figure 10: Plot of Health insurance by whether employers offer health insurance

From figure 10, we determine that those who refused to respond whether health insurance coverage was offered by the employers or not had 100% health insurance coverage, and NA had the lowest percent (75%) of health insurance coverage.

Table 11: Health insurance by health status**Table Health insurance by health status**

<i>HEALTH</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
excellent	7686 92.1 %	642 7.7 %	19 0.2 %	8347 100 %
very good	10048 93.3 %	702 6.5 %	14 0.1 %	10764 100 %
good	7437 91.8 %	656 8.1 %	11 0.1 %	8104 100 %
fair	2840 92.8 %	213 7 %	6 0.2 %	3059 100 %
poor	847 95.4 %	40 4.5 %	1 0.1 %	888 100 %
refused	7 100 %	0 0 %	0 0 %	7 100 %
dont know	6 85.7 %	1 14.3 %	0 0 %	7 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=34.636 \cdot df=12 \cdot \text{Cramer's } V=0.024 \cdot \text{Fisher's } p=0.000$$

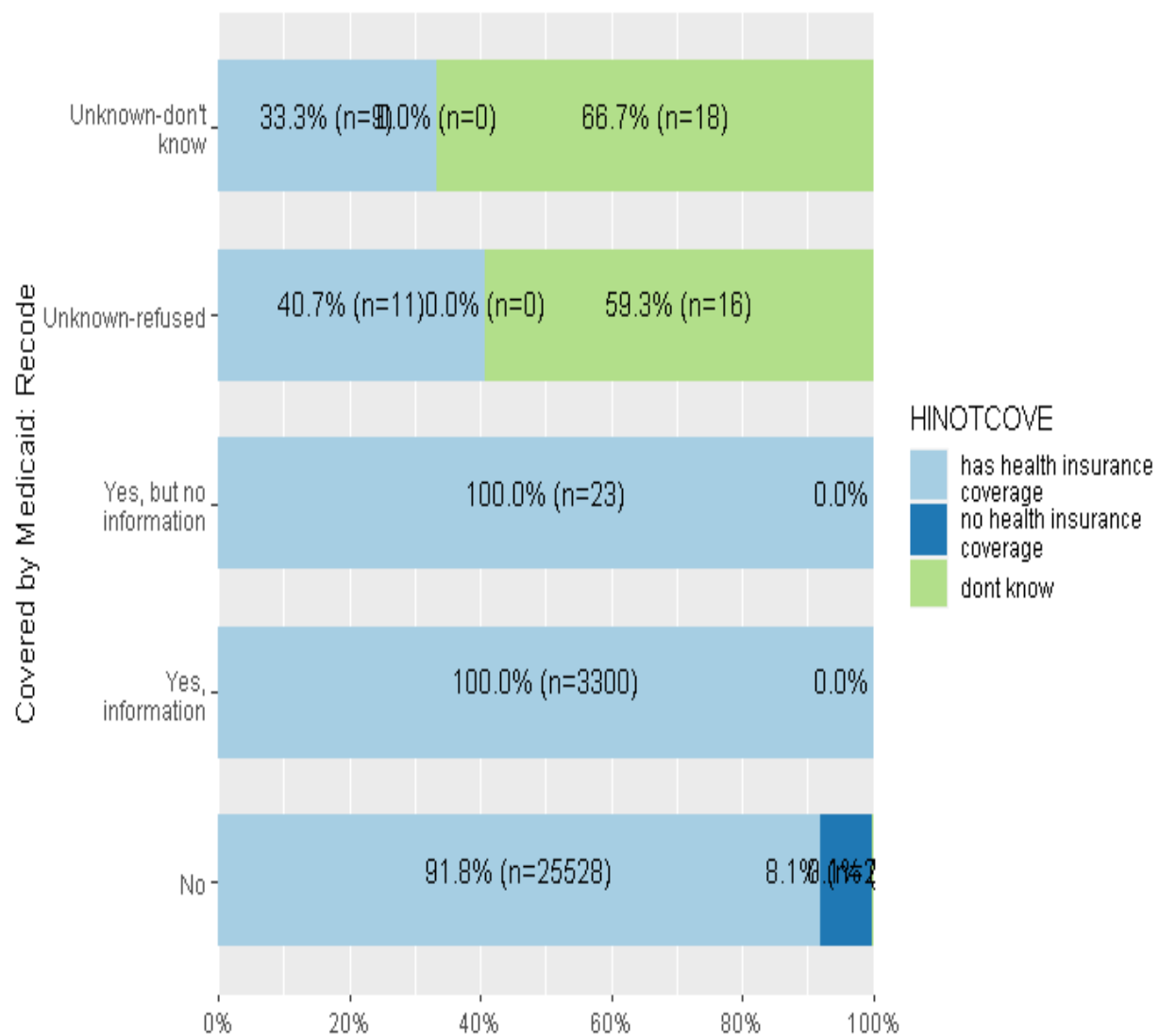
Figure 11: Health insurance by health status

Based on health insurance coverage status from figure number 11, we determine that participants who refused to respond to their insurance status had the highest percentage (100%) of health insurance coverage. In contrast, those with good health status have the lowest 91.8% health insurance coverage rates. Therefore, this analysis illustrates that the healthier individuals are less likely to care about their health insurance status than unhealthy individuals as they are less likely to visit the doctor and have a lower chance of getting sick.

Table 12: Health insurance by Medicaid status**Table Health insurance by whether one has medicaid**

<i>Covered by Medicaid: Recode</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
No	25528 91.8 %	2254 8.1 %	17 0.1 %	27799 100 %
Yes, information	3300 100 %	0 0 %	0 0 %	3300 100 %
Yes, but no information	23 100 %	0 0 %	0 0 %	23 100 %
Unknown-refused	11 40.7 %	0 0 %	16 59.3 %	27 100 %
Unknown-don't know	9 33.3 %	0 0 %	18 66.7 %	27 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=13400.181 \cdot df=8 \cdot \text{Cramer's } V=0.464 \cdot \text{Fisher's } p=0.000$$

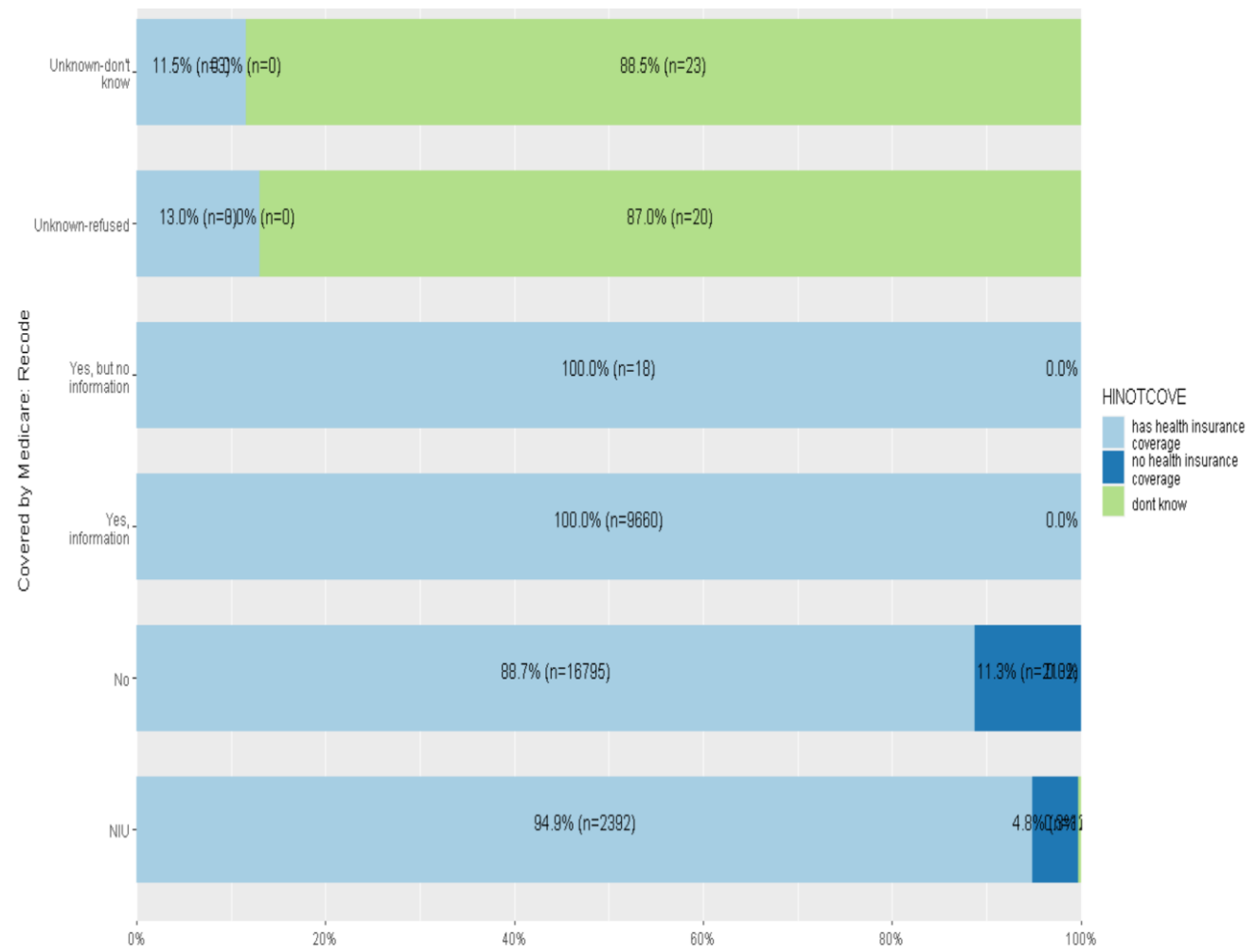
Figure 12: Health insurance by Medicaid status

Based on Medicaid status from figure 12 shows that 100 percent of health insurance coverage had Medicaid, and the lowest 33.3 percent who are unknown.

Table 13: Health insurance by Medicare status**Table Health insurance by whether one has medicare**

<i>Covered by Medicare: Recode</i>	<i>HINOTCOVE</i>			<i>Total</i>
	has health insurance coverage	no health insurance coverage	dont know	
NIU	2392 94.9 %	122 4.8 %	7 0.3 %	2521 100 %
No	16795 88.7 %	2132 11.3 %	1 0 %	18928 100 %
Yes, information	9660 100 %	0 0 %	0 0 %	9660 100 %
Yes, but no information	18 100 %	0 0 %	0 0 %	18 100 %
Unknown-refused	3 13 %	0 0 %	20 87 %	23 100 %
Unknown-don't know	3 11.5 %	0 0 %	23 88.5 %	26 100 %
<i>Total</i>	28871 92.6 %	2254 7.2 %	51 0.2 %	31176 100 %

$$\chi^2=24302.186 \cdot df=10 \cdot \text{Cramer's } V=0.624 \cdot \text{Fisher's } p=0.000$$

Figure 13: Plot of Health insurance by Medicare status

From figure 13, those who are taking Medicare have the highest percentage (100%) of health insurance coverage, and those who do not know or are unknown have the lowest, 11.5 percent had health insurance coverage.

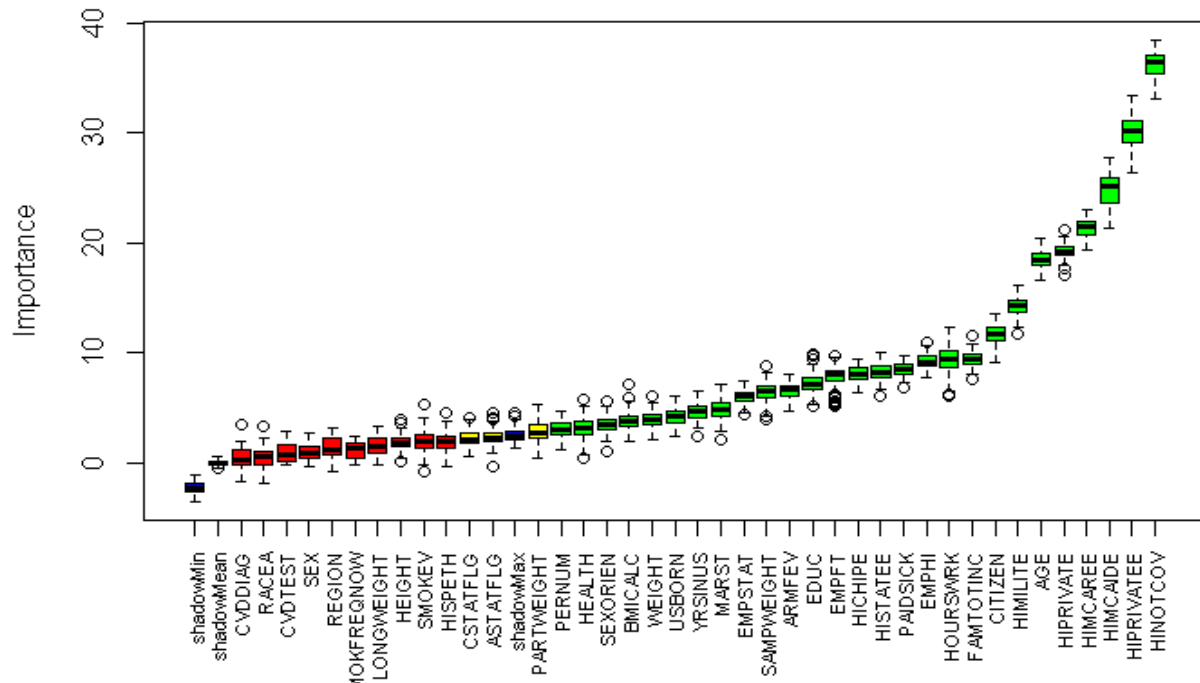
Feature Engineering

The data was taken through feature selection to exclude non-significant variables from the dataset. The feature selection process reduces the number of features to a minimum and a more manageable number to be able to fit a model that performs well in predicting whether a person has health insurance. In R the Boruta package was used to perform feature selection.

Boruta performed 99 iterations in 2.10329 mins. Twenty-seven attributes confirmed importance: AGE, ARMFEV, BMICALC, CITIZEN, EDUC, and 22 more; 10 attributes confirmed unimportant: CVDDIAG, CVDTEST, HEIGHT, HISPETH, LONGWEIGHT and five more; 3 tentative attributes left: ASTATFLG, CSTATFLG, PARTWEIGHT.

The following regression plot shows the variables plotted based on importance. The Blue boxplots represent the minimum, average, and maximum Z scores of a shadow attribute. The red, yellow, and green boxplots reflect the Z scores of rejected, tentative, and verified qualities, respectively. It is now time to make a judgment on tentative characteristics. The tentative characteristics will be identified as confirmed or rejected by comparing their median Z scores to the median Z score of the best shadow attribute.

Regression Graph: Health Insurance Based On The Key Variables



The best selected features selected were as follows:

"PERNUM", "SAMPWEIGHT", "PARTWEIGHT", "ASTATFLG", "CSTATFLG", "AGE", "SEXORIEN", "MARST", "YRSINUS", "USBORN", "CITIZEN", "ARMFEV", "EDUC", "EMPSTAT", "HOURSWRK", "PAIDSICK", "EMPHI", "EMPFT", "FAMTOTINC", "HEALTH", "WEIGHT", "BMICALC", "HIPRIVATE", "HICHIPE", "HIMILITE", "HISTATEE", "HIMCAIDE", "HIMCAREE", "HINOTCOV", "HIPRIVATE".

Model fitting

The aim of the study was to identify factors that impact the likelihood or the odds of someone having health insurance, given data about them is used as the predictors. The best model to fit on

data with a categorical dependent variable is the logistic regression model. The model was fitted on the data with features that were selected by the Boruta package in R. The model had only seven significant predictors out of the 29 selected features. The model has fitted again with the seven predictors, and their odds ratios were as follows:

H insurance			
<i>Predictors</i>	<i>Odds Ratios</i>	<i>CI</i>	<i>p</i>
(Intercept)	0.00	0.00 – 0.01	<0.001
Sample Person Weight	1.00	1.00 – 1.00	0.001
CITIZEN: yes US citizen	0.11	0.06 – 0.20	<0.001
CITIZEN: refused	0.00	NA – 29925883778150993920.00	0.980
CITIZEN: NA	0.45	0.13 – 1.31	0.169
Covered by other state-sponsored health plan:Recode	1.33	1.25 – 1.42	<0.001
Covered by Medicaid:Recode	0.23	0.11 – 0.45	<0.001
Covered by Medicare:Recode	0.52	0.35 – 0.76	0.001
Has no health insurance(excluding single service plans)	290.14	142.51 – 660.87	<0.001
Has any private health insurance	0.17	0.10 – 0.27	<0.001
Observations	3117		
R ² Tjur	0.691		

From the figure above, the odds ratios can be interpreted as follows:

- The sample weight does not change the odds of someone having health insurance.
- The odds of someone having health insurance were 0.11 more for US citizens than non-US citizens.
- People covered by the other state-sponsored health coverage were 1.33 times more likely to have health insurance than people who did not have the coverage.
- People covered by the Medicaid health coverage were 0.23 times more likely to have health insurance than people who did not have the coverage.
- People covered by the Medicare health coverage were 0.52 times more likely to have health insurance than people who did not have the coverage.
- People with any private health insurance were 0.17 times more likely to have health insurance than people who did not have the coverage.

Conclusion:

In conclusion, health insurance is an essential aspect of life. Accidents and illnesses are inevitable and consequently, so are medical expenses. Health insurance helps prepare for the often-unexpected medical expenses. Employers usually provide medical coverage to employees and sometimes also to their immediate families. In the long run, medical insurance help keep the economy afloat and promotes health.

However, some differences exist in health insurance based on social attributes. From the feature engineering process, we learned the seven essential variables that predict the health insurance status of individuals are citizenship status, Medicaid status, the employer provides insurance, family income, military status, age, and private health insurance status.

Based on the existing data, people of color are less likely to be insured than their white counterparts. This segregation is mainly due to political influence, such as enacted policies. These policies disadvantage people of color and especially immigrants. Other factors associated with these discrepancies affect the health sector, such as housing and employment for the minority. In most cases, the minority have jobs that do not offer medical coverage. This problem further expanded during the Trump administration that significantly disadvantaged people of color.

In recent times, other policies have helped narrow the gap in health insurance coverage. These policies include the Affordable Care Act, allowing the poor to afford health insurance. In addition, insurance policies such as Medicaid have been developed under the ACA to benefit the poor communities, mainly compromising Blacks and Hispanics. Finally, the ARPA strengthened the ACA, instituted under the Biden administration. ARPA allowed most people under the federal poverty line to access health insurance and healthcare. This action further narrowed the gap in health insurance coverage but did not eliminate it.

Solving the disparities in health insurance in the United States can lead to an overall improved country's economic welfare. It will also result in a healthier nation and consequently a healthier workforce. In addition, children will be able to get vaccinated on time. As a result, we can catch cancer-like illnesses early on, and pregnant mothers can get proper prenatal care to benefit their unborn children. This improvement would ultimately reduce the overall mortality rate.

In the long run, it will solve one of the country's social issues, which is racism and segregation. Diseases affect everyone equally, and therefore, everyone should have equal access to healthcare. Therefore, individuals who live in the U.S must know the importance of getting

health coverage. And the role of the government should be to enact more policies and take actions to bridge the gap and provide health insurance to everyone regardless of their background and other features.

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