Dean&Francis
ISSN 2959-409X

An Analysis of Health Insurance Disparities and Treatment Adherence in Chronic Diseases

Huanuo Liu[1, *]

[1] Department of Statistics and Actuarial Science, Simon Fraser University, Burnaby, V5A 1S6, Canada
*Corresponding author: hla275@sfu.ca

Abstract:

With societal and technological development, people's lifestyles and living environments have changed significantly, leading to an increasing prevalence of chronic diseases at younger ages. Poor lifestyle habits can result in the onset of chronic diseases within just a few months; however, the treatments are often long and costly. Even in societies with well-developed health insurance systems, many patients with chronic diseases are still unable to afford long-term treatment due to gaps or inefficiencies in coverage. This study focuses on the relationship between different types of health insurance and individuals with chronic diseases, aiming to explore disparities in coverage and treatment adherence. Using data from 18,919 individuals, descriptive analyses, Pearson correlations, and multivariate logistic regression were conducted, revealing that Medicare coverage is strongly associated with chronic disease presence, private insurance shows a modest positive association, and Medicaid shows no significant independent effect. These findings highlight the differential relationships between insurance coverage and chronic disease prevalence.

Keywords: Health Insurance Coverage; Chronic Disease; Socioeconomic Disparities.

1. Introduction

With the innovation of our technology and human society, there have been some critical changes to human's eating habits, daily life routine and living environments. The new environment and technology not only bring more convenient and diverse life, but also bring many health risks to our world due to abnormal climate and complex diet structure. It has also made many of the chronic diseases getting more and more common, for instance stroke, a chronic disease that we often heard about, also known as brain attack, stroke is a disease which people normally assume that will only happen among middle-aged and elderly people, however as a member of the chronic diseases family, Stroke can happen on anyone at any age [1]. Excessive obesity, smoking, drinking, high blood pressure and high cholesterol caused by unhealthy

eating habits may all be the triggers of stroke.

Among the top ten deadly diseases in 2023 released by the U.S. National Center for Health Statistics, seven out of ten belong to the chronic disease's family. The 10 leading causes of death accounted for 70.9% of all U.S. deaths in 2023 [2], heart disease, diabetes, cancer, and kidney and liver diseases accounted for more than 50% of deaths. This is a number that we can't ignore. While chronic diseases bring significant damages to our health, the adherence of long-term medication is still a huge challenge. According to the report released by WHO, only 30% and 43% of the patients adhere to their regimen for high blood pressure in China and America [3]. Many reasons can cause this phenomenon, study shows that patients will complain about diagnosis and treatment efficacy, side-effects of drugs, economic constraints, unreliable disbursements of monetary incentive, attitude of providers and co-morbidities as reasons for non-adherence to treatment [4].

Today, financial burden is one of the most significant reasons for patients with chronic disease unable to adhere to their regular medication. And many of you may ask, don't we have health insurance? Indeed, ideally speaking, the government and the society should provide financial and medical support for the patients. Yet the outcome leaves much to be desired, the health insurance is not as powerful and convenient as we thought, a country's economic situation and governing policies may all have an impact on its insurance claims settlement capabilities.

The research indicates that among 1,823 patients with diabetes and other chronic diseases, 23% of them restricted medication due to cost, and moreover, there are almost 25% of the patients endorsed intrapersonal adherence barriers [5]. Many of the insurance providers will raise premiums significantly after knowing the person has chronic disease, and in some extreme cases, their insurance coverage might be turned down. In a study analyzing whether chronic illness affects the adequacy of health insurance coverage or not, it shows that chronic illness decreased the probability of having adequate coverage by about 10 percentage points among all individuals, and by about 25 percentage points among single individuals, this will lead to an increase of 3-7 percentage points in the prevalence of underinsurance, and 2-8 percentage points in the prevalence of uninsurance, which conclude that it is hard for the patients with chronic diseases to gain adequate health insurance [6].

In the United States of America, although the elders who are 65 years old are all eligible for Medicare, which also includes the chronic diseases treatments and medications, there are still 25% of the elders facing the inadequate situation of health insurance [7]. Apart from Medicare, Medicaid, which is another insurance program in the United States that is aimed at low-income citizens, was influenced by policy changes. In 2017, the weakening of the Affordable Care Act in the United States caused the insurance coverage growth for patients with chronic diseases to decrease by 0.9 percentage points [8]. Similarly, in July 2025, Trump's government has issued the One Big Beautiful Bill Act (OBBB) which will cut almost $1 trillion government support fund for Medicaid for the next ten years [9]. The problem of insufficient insurance will further affect the treatment of chronic patients, thereby prolonging the time required for recovery. And long-term illness will also affect people's quality of life, study shows that young people between the ages of 15 and 30 living with a chronic illness are three times more likely to attempt suicide than their healthy peers, chronic conditions like asthma, diabetes and Crohn's disease increase a young person's odds of suicidal thoughts by 28 per cent and plans to die by suicide by 134 per cent [10].

Based on the existing studies, this study will focus on the critical role of health insurance in medication adherence among patients with chronic diseases. It will examine different insurance policies, including Medicaid, Medicare, private insurance and uninsured through a comprehensive analysis of some common chronic diseases such as diabetes, hypertension, asthma and cancers. Therefore, the main objective of this study is to analyze how differences in health insurance can affect the medication adherence and health outcomes among patients with chronic diseases. Through the examination of these relationships, the study is aimed to provide a reference for insurance system design, improve the equity of medical accessibility, and support strategies to enhance the long-term management of chronic diseases.

2. Methods

This study will be based on the 2023 Annual Comprehensive Data File (HC-251) from the US Medical Expenditure Panel Survey (MEPS) [11]. This database, provided by the Agency for Healthcare Research and Quality (AHRQ), is nationally representative, encompassing 18,919 samples and 1,374 variables. It provides a comprehensive reflection of US residents' healthcare expenditure, insurance coverage, health status, and healthcare service utilisation.

Study Population and Sample Selection: The study population comprises adults (≥18 years) from the MEPS 2023 annual survey. All samples derive from publicly accessible anonymised data, with no personal privacy implications. Inclusion criteria require individuals possessing complete health insurance information and chronic disease diagnosis records. Chronic diseases defined include common conditions such as diabetes, hypertension, asthma, and

ISSN 2959-409X

cancer. Samples lacking key variables (e.g., insurance type, chronic disease diagnosis status, or adherence indicators) were excluded.

Variable Specification: Independent Variables: Different types of health insurance, including Medicaid, Medicare, and private insurance. Dependent Variables: Indicators related to medication and treatment adherence, including: 1. Timely payment of healthcare costs; 2. Prescription medication purchase and payment status; 3. Medical bill payment adherence; 4. Appointment attendance adherence (timely attendance); 5. Frequency of prescription refills, etc.

Control Variables (Covariates): Demographic and socioeconomic characteristics, including individual ID, survey year, age, gender, ethnicity, personal income, and type of chronic disease diagnosis.

2.1 Data Cleaning and Variable Construction

After data cleaning and variable construction, a total of N participants was included in the final analytic sample. At the beginning, the study will be focusing on unifying variable types and re-arrange some of the dependent and independent variables. We first read the dataset into R and start filtering and organizing the data needed for this analysis, and in the process delete unnecessary variables and observations, keeping the data in a relatively small range for subsequent analysis.

Then we sorted and merged all the Chronic Diseases that appeared in the Data Set. The dataset has 13 different chronic diseases and each of them has 5 different outcomes with 1 indicating the individual has certain chronic disease and 2 indicating the individual does not have certain chronic disease. In R, we created a new column named HasChronicDisease, select and mark all the individuals who have one of the chronic diseases with indicator “Yes” in this new column, and “No” vice versa.

Each of the health insurance has 3 different indicators for their outcomes with 1 indicating Yes and 2 indicating No, they have been separated by month, so each of the insurance will have 12 columns in total. Three summary indicators were generated as what we did earlier for the different chronic diseases in this dataset. First, create 3 new columns in R, named as MedicareCoverage; MedicaidCoverage and PrivateInsuranceCoverage, indicating whether the individual has this type of health care in the past 12 month in the year 2023 or not, mark the result as “Yes” if the individual has at least one month of the corresponding health insurance covered and “No” if the individual did not get any coverage for the corresponding health insurance in the past 12 months of 2023. Then delete the monthly results for the three types of health insurance to clean up the data.

2.2 Descriptive Analysis

AGE23X is representing the individual’s age in this dataset as of 12/31/2023, with the range from 0 to 85, and -1 representing inapplicable. The code first filters and deletes the -1 and then splits the sample’s ages into 5 different ranges, 0-17, 18-34, 35-49, 50-64 and 65+. The prevalence of chronic diseases increased from X% in the 0–17 group to Y% in the 65+ group. Next, each age group was further divided by genders, male and female to observe the prevalence of chronic diseases across different ages and genders. The results were presented using both proportional and count views and displayed as bar plots.

Next, a descriptive analysis was conducted on the prevalence of chronic diseases across different types of insurance. Chronic disease prevalence was highest among individuals with Medicare coverage (X%), followed by Medicaid (Y%) and private insurance (Z%). Three bar charts were used to separately show the proportional relationship between having a chronic disease and having medical coverage, with X-axis displaying insurance coverages and Y-axis displaying the proportions.

2.3 Pearson Correlation Analysis

The Pearson correlation analysis served as an exploratory step to identify the strength and direction of linear associations between chronic disease status and different types of health insurance coverage, guiding the selection of predictors for subsequent regression modeling. The Pearson correlation coefficients were calculated to assess the pairwise linear associations between chronic disease status and individual types of health insurance coverage for Medicare, Medicaid, and Private Insurance.

For this analysis, all variables were coded as binary with indicators 0 = No and 1 = Yes. The correlation coefficient (r) indicates the strength and direction of the association, while the p-value tests whether the correlation differs significantly from zero. This exploratory analysis provides an initial understanding of the relationships and helps identify which insurance variables are relevant for further multivariate modeling.

2.4 Logistic Regression

The Multivariate logistic regression was conducted to examine the independent associations between chronic disease status with a binary outcome: 0 = No, 1 = Yes, and multiple insurance types simultaneously. Each insurance variable was included as a categorical predictor with 2 outcomes: Yes and No.

Logistic regression estimates the log-odds of having a

chronic disease for each level of the predictors, allowing for adjustment of potential confounding among insurance types. Results are presented as odds ratios (OR) with 95% confidence intervals, indicating the relative likelihood of chronic disease associated with each insurance type while controlling for the others. This approach provides both statistical significance and effect size for each predictor, enabling clear interpretation of independent relationships.

3. Results

3.1 Descriptive Analysis

Fig.1 of the descriptive analysis shows that in the sample, nearly 50% of individuals aged 35 to 49 have chronic diseases. As age increases, the number of individuals suffering from chronic diseases increases, showing a steady growth trend. More than 80% of individuals aged 65 and above have chronic diseases.

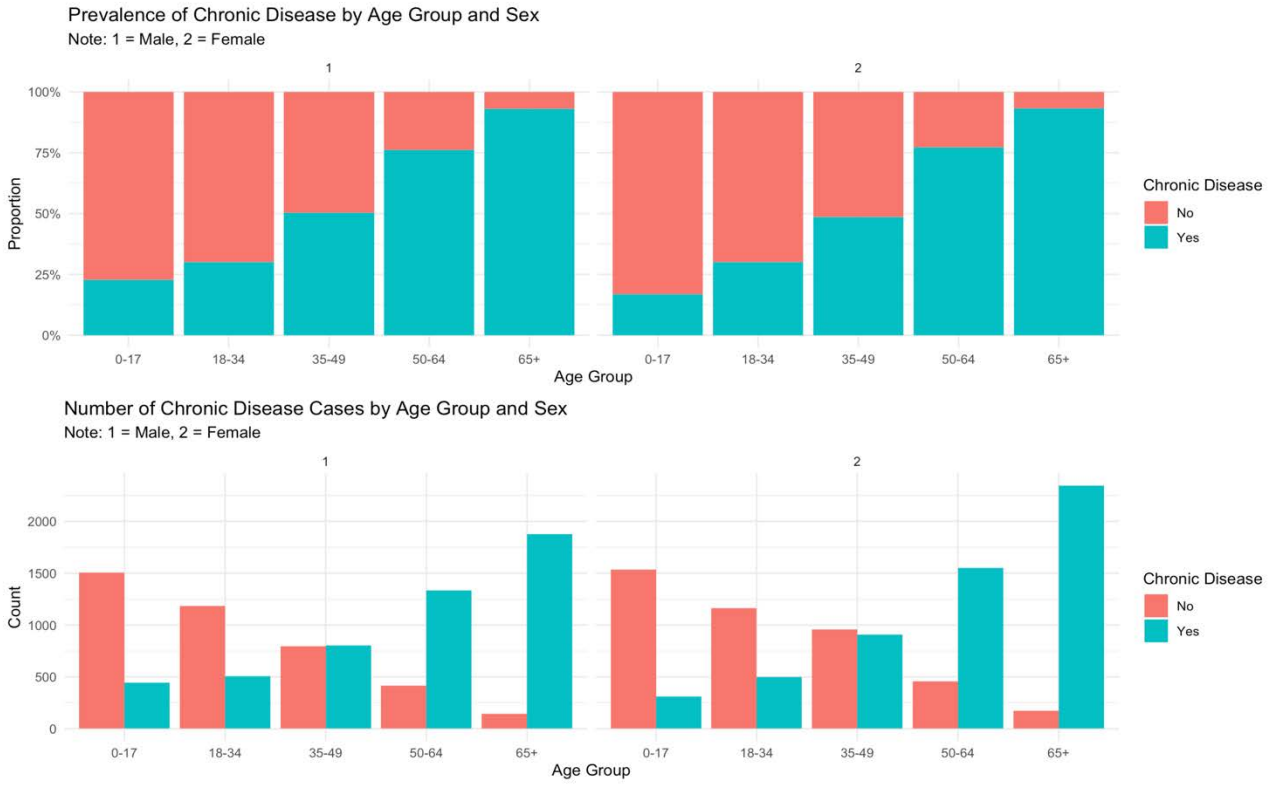

Fig. 1 Prevalence and Count of Chronic Diseases by Age Group and Sex (Picture credit: Original)

Fig. 2 of the descriptive analysis shows the proportion of coverage by different health insurance types based on whether individuals have chronic diseases. In the middle Medicare coverage bar plot, we can see that individuals with chronic diseases have a much higher insurance coverage rate compared to those without chronic diseases, which indirectly indicates that the demand for insurance is higher after developing a chronic disease.

ISSN 2959-409X

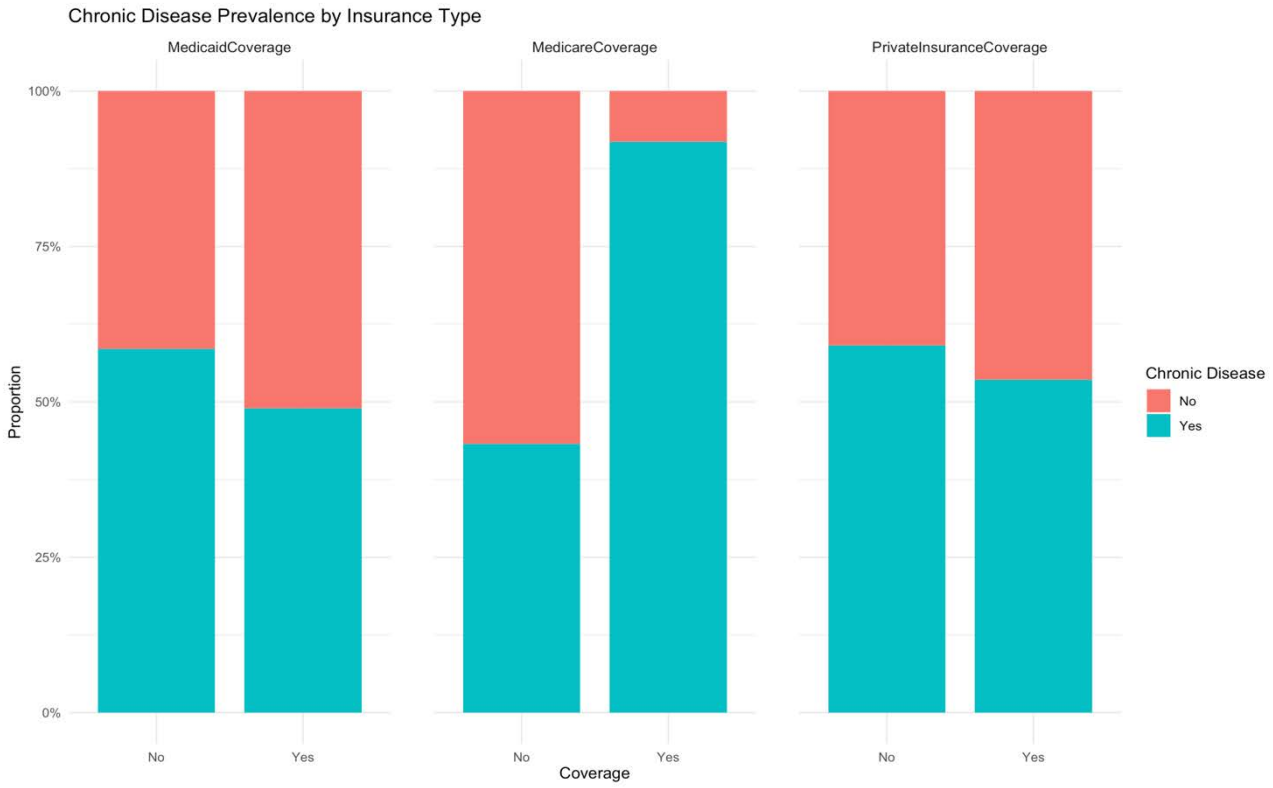

Fig. 2 Chronic Disease Prevalence by Type of Health Insurance Coverage (Picture credit: Original)

3.2 Pearson Correlation Analysis

In this study, the total sample size is 18,919. The Pearson correlations were calculated to examine the associations between chronic disease status and different types of health insurance coverage:

Medicare coverage: $r = 0.431$, 95% CI [0.419, 0.443], $t = 65.69$, $p < 0.001$. This indicates a moderate positive association, suggesting that individuals with Medicare were more likely to report having a chronic disease. Medicaid coverage: $r = -0.085$, 95% CI [-0.099, -0.071], $t = -11.72$, $p < 0.001$. This shows a weak negative association, indicating that individuals with chronic diseases were slightly less likely to have Medicaid coverage. Private insurance coverage: $r = -0.055$, 95% CI [-0.069, -0.040], $t = -7.53$, $p < 0.001$. This also shows a weak negative association, suggesting that individuals with chronic diseases were slightly less likely to have private insurance.

3.3 Logistic Regression

A multivariate logistic regression was also conducted to examine the independent associations between chronic disease status and three types of health insurance coverage: Medicare, Medicaid, and private insurance. The outcome variable was binary, with outcomes indicating 0 as no chronic disease and 1 as has chronic disease.

Medicare coverage: Individuals with Medicare had significantly higher odds of having a chronic disease compared to those without Medicare (OR = 16.19, 95% CI [14.49, 18.13], $p < 0.001$), indicating a strong positive association. Medicaid coverage: The association with Medicaid was weak and not statistically significant (OR = 0.93, 95% CI [0.85, 1.01], $p = 0.088$), suggesting no clear effect after controlling for the other insurance types. Private insurance coverage: Individuals with private insurance had modestly higher odds of having a chronic disease (OR = 1.33, 95% CI [1.22, 1.45], $p < 0.001$), indicating a positive but smaller association compared to Medicare.

In conclusion, the model indicates that Medicare coverage is the strongest predictor of chronic disease presence, while private insurance shows a weaker positive effect, and Medicaid shows no significant association in this multivariate context.

4. Summary

Chronic disease prevalence increases with age, with over 80% of individuals aged 65 and above affected. Individuals with chronic diseases are more likely to have

Medicare, reflecting higher coverage among this group. Pearson correlations show a moderate positive association for Medicare, and weak negative associations for Medicaid and private insurance. Multivariate logistic regression confirms that Medicare is the strongest predictor of chronic disease (OR = 16.19), private insurance shows a modest positive effect (OR = 1.33), and Medicaid has no significant association. These results emphasize the structural differences in health insurance systems and their implications for equity in chronic disease management. Future research should examine longitudinal patterns and policy reforms to better address disparities in healthcare accessibility and long-term disease outcomes.

References

[1] Johns Hopkins Medicine. Stroke. Retrieved September 9, 2025, from Johns Hopkins Medicine, website: https://www.hopkinsmedicine.org/health/conditions-and-diseases/stroke

[2] Murphy, S. L., Kochanek, K. D., Xu, J. Q., & Arias, E. (2024, December 19). Mortality in the United States, 2023 (NCHS Data Brief No. 521). Hyattsville, MD: National Center for Health Statistics. https://doi.org/10.15620/cdc/170564

[3] World Health Organization. (2003, July 1). Failure to take prescribed medicine for chronic diseases is a massive, worldwide problem [Departmental update]. Geneva: World Health Organization. Retrieved September 9, 2025, from WHO website: https://www.who.int/news/item/01-07-2003-failure-to-take-prescribed-medicine-for-chronic-diseases-is-a-massive-world-wide-problem

[4] Abbas, S., Kermode, M., Khan, M. D., Denholm, J., Adetunji, H., & Kane, S. (2023). What makes people with chronic illnesses discontinue treatment? A practice theory informed analysis of adherence to treatment among patients with drug-resistant tuberculosis in Pakistan. International Journal of Health Policy and Management, 12, Article 6576. https://doi.org/10.34172/ijhpm.2022.6576

[5] Mackey, K., Parchman, M. L., Leykum, L. K., Lanham, H. J., Noël, P. H., & Zeber, J. E. (2012). Impact of the chronic care model on medication adherence when patients perceive cost as a barrier. Primary Care Diabetes, 6(2), 137–142. https://doi.org/10.1016/j.pcd.2011.12.004

[6] Stroupe, K. T., Kinney, E. D., & Kniesner, T. J. (2000, March). Does chronic illness affect the adequacy of health insurance coverage? (Center for Policy Research Working Paper No. 20). Syracuse University, Maxwell School, Center for Policy Research. https://doi.org/10.1215/03616878-25-2-309

[7] Huguet, N. (2023). Impact of health insurance patterns on chronic disease outcomes. Journal of the American Board of Family Medicine, 36(5), 839–850. https://doi.org/10.3122/jabfm.2023.05.220462

[8] Myerson, R., & Crawford, S. (2020). Coverage for adults with chronic disease under the first 5 years of the Affordable Care Act. Medical Care, 58(10), 861–866. https://doi.org/10.1097/MLR.0000000000001370

[9] Dow, W. (2025, July 22). What do the looming cuts to Medicaid really mean? UC Berkeley School of Public Health. https://publichealth.berkeley.edu/articles/news/commentary/what-do-cuts-to-medicaid-really-mean

[10] University of Waterloo. (2017, August 17). Young people with chronic illness more likely to attempt suicide. https://uwaterloo.ca/health/news/young-people-chronic-illness-more-likely-attempt-suicide

[11] Agency for Healthcare Research and Quality. (2025, August). MEPS HC-251: 2023 Full Year Consolidated Data File. U.S. Department of Health & Human Services. https://meps.ahrq.gov/mepsweb/data_stats/download_data_files_detail.jsp?cboPufNumber=HC-251