# Effect of Social Factors and Insurance Plans on Healthcare Utilization

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## Overview

One of the most timely policy debates of our generation is around the issue of healthcare administration, use, and cost. In this paper, the connection between health insurance and the demand for healthcare across various subgroups is explored, including healthcare policy type, age, gender, and health status. This work highlights important implications for understanding how the nature of health insurance affects access for different samples and segments of America's population.

Health expenditures in the United States have soared over the last decade. Indeed, healthcare costs in this country continue to make up a significant portion of the federal budget every year. In an effort to control rising costs, President Obama introduced the Affordable Care Act in 2010. This Act seeks to contain rising healthcare costs by expanding government oversight to regulate premiums and practices set by private health insurance companies, reform healthcare payment structures that lead to waste and confusion, and increase competition in the healthcare insurer and provider market. However, there is an ongoing debate as to what exactly are the most costly factors in the American healthcare system. An appropriate and fitting healthcare policy agenda would enable America to control spiraling costs and further economic damage and collapse. Government fine-tuning of payment structure could provide for an effective means for tackling the issue of rising healthcare costs.

A major work by Manning et al. (1987) shed insight into how cost sharing, or the structure of deductibles as part of a health insurance policy, affects a person's utilization of healthcare. They used data obtained though the RAND Health Insurance Experiment to analyze demand for various healthcare services. This work was monumental in analyzing the effect of

payment structures on healthcare utilization, and it also explored the effect of belonging to various subgroups based on age, gender, and health status.

In the following report, the results of the RAND Health Insurance Experiment are examined in an effort to seek a greater understanding of how different health insurance plans affect healthcare expenditures. The RAND Health Insurance Experiment was a national scale social experiment conducted by the RAND Corporation during the 1970's and 1980's. Since then, it has spawned an enormous amount of literature on a variety of topics in medicine, economics, and other social sciences. The results of the analysis work by Manning et al. are compared to results obtained through further regression modeling. This paper seeks to answer a primary driving question, which asks, "does an individual utilize healthcare less if his or her healthcare plan requires them to pay more costs out of their own pocket?"

In this work, both ordinary least squares (OLS) and probit estimations are used to examine the interaction between the type of health insurance an individual has and how much they utilize healthcare. Individuals in the sample of the population paid 25 percent, 50 percent, and 95 percent of their healthcare costs, or they had an individual deductible plan.

Individuals that are subject to five different healthcare plans are compared in how much they utilize healthcare in terms of quantity. Specific traits of the individuals in the sample are held constant to get a sense of how the healthcare plan specifically affects the level of healthcare utilization. Using probit estimations, the effects of healthcare plans on the likelihood of a person to utilize healthcare, keeping constant factors such as healthcare status or if the individual worries about his or her health, are more precisely estimated.

Overall, it was observed that if an individual must pay more costs out of pocket, he or she would utilize health insurance less. When similar traits are controlled for however, the

differences in healthcare utilization become less significant. This shows that there is indeed an effect of belonging to a particular subgroup when comparing people's utilization of healthcare insurance for medical services.

## Theory, Regression Model, and Identification Strategy

The underlying model of this project was represented by the following regression equation (Equation 1), where *y* is the demand for healthcare, *deduct* is the healthcare policy type, *age* is the age of individual receiving healthcare, *gender* is the sex of person receiving healthcare, and *hlthstat* is the health status of the individual receiving healthcare. The error term is denoted by *u*.

**Equation 1:** $y = \beta_0 + \beta_1 * \text{deduct} + \beta_2 * \text{age} + \beta_3 * \text{gender} + \beta_4 * \text{hlthstat} + u$

As a proxy for demand for healthcare, dollar amounts spent on healthcare and numbers of hospital visits were used. The main contention was that the rise or fall in demand for healthcare was caused by various factors and drivers that were associated with the nature of a person's healthcare plan in the way of deductible payment structure, and not the other way around. Another contention was that a person's age, gender, and health status also have an effect on healthcare utilization and cause a change in demand, and not the other way around.

Any omitted variable bias would skew the weight of the effect of any of the variables on the right side of the above equation. It was argued that each of the independent variables has an effect, to some extent or another, on healthcare utilization and demand.

This work also attempted to observe new trends in the RAND Health Insurance Experiment by examining different subgroups in the sample, such as different age breakdowns that may not have been appreciated or thought of as significant or noteworthy before.

Ordinary least squares regression was used to analyze continuous outcomes, while probit was used to analyze binary outcomes.

## Data and Results

For this empirical project, ordinary least squares regression and other statistical techniques were used to examine data from the RAND Health Insurance Experiment. The RAND Health Insurance Experiment was conducted from the 1970's to the 1980's over a course of 15 years. In this experiment, individuals were assigned to one of 14 different fee-for-service insurance coverage groups, or deductible payment structures. Coverage varied by the amount of the deductible that the individual had to pay, and by the maximum dollar expenditure, after which the deductible was waived. Since the original study was completed, most of the analyses of the RAND Health Insurance Experiment data have grouped the plans into five broader categories: free care (no deductible), 25% co-pay, 50% co-pay, 95% co-pay, and the "individual deductible" plan, in which inpatient services were fully covered, and outpatient services were subject to a 95% co-pay. The data set also gave information on other personal and biographical attributes, such as age, gender, socioeconomic status, and general health status. Data was taken from families that lived in one of six geographic areas: Dayton, OH, Seattle, WA, Fitchburg, MA, Franklin County, MA, Charlestown, SC, and Georgetown County, SC. These sites were chosen to proxy for differences in city dynamics that define a broad healthcare delivery landscape, such as delivery wait times and physician per capita ratios.

In order to better analyze the relationship between health insurance plan and healthcare utilization, data from the RAND Health Insurance Experiment that were used were calculated in terms of 2011 prices (re-calculation done by Professor Michael Moore, University of Virginia). It was important to note that Manning et al. reported the RAND experiment data in terms of 1984 prices. The RAND experiment collected information on individuals that they randomly assigned to five possible health insurance plans: free insurance, 25 percent co-pay, 50 percent co-pay, 95 percent co-pay and an individual deductible plan which had 95 percent co-pay for outpatient services and no co-pay for inpatient services. The data set provided information on traits such as individual employment status, welfare status, health status, and an indication of how much the subject worries about his or her own health. Additionally, the RAND Health Insurance Experiment quantified the subject's utilization of healthcare through such variables as total hospital or office visits and expenditures.

Table 1 below was recreated from Manning et al. using regression analysis. There was indeed a pattern observed that showed the relationship between healthcare plan and healthcare utilization. The replicated table below shows that those who pay fewer costs out of pocket utilize health insurance more.

| **Plan** | **Total Visits** | **Outpatient Expenditures (2011 $)** | **Total Admissions to Hospital** | **Inpatient Expenditures (2011 $)** | **Probability Medical Expenditures (%)** | **Probability Inpatient Expenditures (%)** | **Total Dollars Spent (2011 $)** |
|---|---|---|---|---|---|---|---|
| Free | 7.4070 | 452.4957 | 0.1282 | 778.0141 | 0.8620 | 0.1028 | 2081.83 |
| 25 Percent | 4.8471 | 355.1723 | 0.1048 | 706.1574 | 0.7786 | 0.0839 | 1608.98 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 50 Percent | 1.9446 | 301.4199 | 0.0896 | 838.3319 | 0.7612 | 0.0732 | 1568.51 |
| 95 Percent | 2.9061 | 269.5151 | 0.0979 | 587.3661 | 0.6594 | 0.0782 | 1274.72 |
| Individual Deductible | 4.3692 | 315.5266 | 0.1155 | 717.4023 | 0.7030 | 0.0953 | 1603.07 |

**Table 1:** Mean healthcare utilization by health insurance plan (replicated from Manning et al.)

Furthermore, the way that different types of individuals utilized healthcare within their assigned health insurance plans was also explored. By holding constant different segments of the sample, changes were observed that deviated from those seen in Table 1. Since the data was taken from a randomized experiment and not from natural observations, the direct impact of an individual's health insurance plan and individual traits on how often an individual utilizes healthcare could be better understood.

For this problem, the RAND Health Insurance Experiment data was examined in order to determine the effects that different degrees of health insurance coverage may have on healthcare utilization and expenditures. Table 1 above indicated that as the percent of co-pay increased, individuals were less likely to use healthcare services, and therefore had lower medical expenditures.

However, it would have been premature to make conclusions from these statistics. It was important to control for covariates of healthcare utilization to ensure that the difference due to the insurance plans was adequately and effectively being analyzed. Table 2 below contains the difference in healthcare utilization according to insurance plans when the age, education level, gender, AFDC (Aid to Families with Dependent Children) status, income level, and the individual's health status were being controlled for. The reference demographic was young adult (20-40) male with free healthcare coverage.

| Plan | Total Visits | Outpatient Expenditures (2011 $) | Total Admissions to Hospital | Inpatient Expenditures (2011 $) | Probability Medical Expenditures (%) | Probability Inpatient Expenditures (%) | Total Dollars Spent (2011 $) |
|---|---|---|---|---|---|---|---|
| 25 Percent | 2.37 | -99.32* | -0.0165 | 265.24 | -7.82* | -2.61* | -254.88 |
| 50 Percent | -5.64 | -334.90* | -0.0757* | 115.32 | -12.90* | -6.56* | -978.71* |
| 95 Percent | -3.50 | -282.14* | -0.0370* | -29.27 | -18.18* | -3.37* | -984.39* |
| Individual Deductible | -2.47 | -208.27* | -0.0422* | -2.74 | -12.89* | -3.37* | -601.15* |
| Female | 5.73* | 233.96* | .07644* | 270.69 | 14.85* | 6.20* | 681.60* |
| High School | -2.32 | -0.13 | -0.0350* | -165.68 | 2.45 | -2.73* | 52.37 |
| Age 13-19 | -2.35 | -48.22 | -0.0214 | 12.98 | -2.25 | -2.89 | -288.23 |
| Age 41-62 | 5.53* | 256.28* | 0.0364* | 542.01* | 8.08* | 1.42 | 1030.66* |
| AFDC | 10.30 | 60.46 | 0.0547 | -229.55 | -12.72* | 5.30* | 342.87 |
| Health Status | -22.26* | -390.79* | -0.4311* | -7284.44* | -7.00 | -20.43* | -7885.95* |
| Constant (Baseline) | 26.59* | 836.98* | 0.5637* | 7968.76 | 85.08* | 32.12* | 9916.95* |

**Table 2:** Difference in healthcare utilization by various individual characteristics. The base line was young adult (20-40) male with free healthcare coverage. Note that the results with a * indicates that the coefficient was significant at the 5% level.

When additional covariates were controlled for, the difference in healthcare utilization according to the insurance plans was not as clear and evident as in Table 1. In fact, the difference in total number of visits and inpatient expenditures was not statistically significant at the 5% level. Nevertheless, the difference in outpatient expenditures, total admissions, probability of medical expenditures, probability of inpatient expenditures, and total dollars spent on healthcare confirmed that individuals use significantly less healthcare services when their co-pay increases.

Table 2 also shows some additional interesting facts and trends. The average female used more healthcare services than the average male. However, when the number of admissions due to maternity and pregnancy were removed, the difference in admissions between male and female was not significant. It was presumed that if maternity and pregnancy-related medical expenditures, or visits, were also removed, then the difference would also become less significant for these healthcare utilization proxies as well.

Some of the results obtained, specifically in terms of age categories, were not very surprising. It was observed that individuals between the ages of 40 and 62 seemed to use much more healthcare than other individuals, while the difference in healthcare utilization between teenagers and young adults was not significant.

There was no significant difference found in healthcare utilization according to education level. This was surprising as it was expected that individuals with low education levels would be more prone to diseases and unhealthy lifestyles, and thus use more healthcare.

Among the variables that were used for measuring healthcare utilization, the probability of medical expenditures and inpatient expenditures were also given. These variables were very important to the study because they measured the likelihood to use healthcare services. However, in Table 2, the effects of plans on these variables were estimated using ordinary least squares

regression, and that caused severe empirical discrepancies, such as negative probability. In order to correct for these discrepancies, new estimates were computed using a probit model. The marginal effects are shown below in Table 3:

| **Plan** | **Probability Medical Expenditures (%)** | **Probability Inpatient Expenditures (%)** |
|---|---|---|
| 25 Percent | -10.75 | -2.22* |
| 50 Percent | -17.78 | -5.64* |
| 95 Percent | -22.78 | -2.83* |
| Individual Deductible | -16.72 | -2.88* |

**Table 3:** Marginal effects of healthcare plan on probability of medical expenditures and probability of inpatient expenditures using probit estimation. Although not shown in the tables, the same explanatory variables as in Table 2 were used in the probit estimation. Note that the results with a * indicates that the coefficient was significant at the 5% level.

The results confirm the overall trend that was noticed when using the ordinary least squares regression. Actually, it was observed that the marginal effects were even more pronounced when using the probit model.

Another interesting way to analyze the data set was to estimate a regression of healthcare utilization covariates on the log of medical expenditures. By doing so, individuals who did not have any medical expenditure were eliminated, and thus the effects in terms of percent of dollars spent were better measured. The results are shown in the table below. The results conformed to the results obtained in Table 2 in that they were not significant for inpatient expenditures, but significant for outpatient expenditures.

| Plan | Log (Outpatient Expenditures) (%) | Log (Inpatient Expenditures) (%) |
|---|---|---|
| 25 Percent | -16.94* | -32.97* |
| 50 Percent | -60.90* | 28.71 |
| 95 Percent | -43.38* | 14.08 |
| Individual Deductible | -25.54* | -3.22 |

**Table 4:** Marginal effects of healthcare plan on outpatient expenditures and inpatient expenditures. Although not shown in the tables, the same explanatory variables as in Table 2 were used in the probit estimation. Note that the results with a * indicates that the coefficient was significant at the 5% level.

The results in Table 4 were interesting, because they confirmed that the difference in expenditure was mostly for outpatient medical expenditure. This seemed to indicate that individuals in the experiment were less likely to use healthcare for minor health issues when they had to share the costs.

## Discussion

In order to analyze and explain the data, the RAND Health Insurance Experiment data set needed to be broken down into a smaller, more manageable piece. However, in the process of doing so, multiple sources of bias were created.

First, variables of groups were created. These groups consisted of data that was given in the form of Likert scale-like surveys. However, in the process of converting this type of data into binary variables, detail that was associated with the original survey was lost or compromised.

Second, there was an area of contention when examining employment status of individuals in the survey. When looking at workers versus non-workers, it was difficult to distinguish between workers who were not able to work (i.e. disabled or old-aged) and workers who were simply not able to find a job at the time of the study (i.e. effectively unemployed). This posed a potential problem when analyzing how employment status affected a person's healthcare usage.

A third bias inherent within the RAND Health Insurance Experiment data set involved the possible observer effect, in that the mere assignment of individuals into a specific category and plan for healthcare may have affected individual motive, preference, and behavior.

There was a fourth bias in regard to difference in incomes between geographic areas in which the study was conducted. It appeared that in some of the sites there were many more individuals that were at low income levels than in some other areas. That may have been an indication of oversampling, and thus some of the estimations should have been weighted. Additionally, it was noticed that a particular geographic area might have had a particular "healthcare culture" in which certain services and types of services were more preferable than others.

A fifth bias was observed in terms of doctor quality, or rather differences in doctor quality. This difference may have existed between different geographic regions, or even between different hospitals within the same geographic region. For example, a doctor that placed heavy emphasis on preventive care may have had a higher likelihood of slipping into a habit of over-prescribing services on the front end of a patient's care regimen, which may have been a source of higher healthcare costs and services rendered. Also, it was conceivable to imagine and a possibility that a less qualified or less experienced doctor ordered tests and examinations that

may not have been required or, even worse, may have been the wrong test. In either case, healthcare costs would have increased, and may have been exaggerated or skewed due to the quality of healthcare actually administered.

In conclusion, it was observed that the less an individual pays, the more likely that individual would visit the doctor. However, the difference between likelihood of visits decreased between the groups when similar variables were controlled for. If people utilized healthcare more in the experiment, they may have been taking advantage of preventative care visits, and therefore may have had less costs in the long run. When considering the implications of number of visits and total healthcare costs, it was important to keep in mind that those who go to the doctor less may actually be more costly to the overall healthcare system because they might only be going for emergency situations when a particular medical issue gets out of control. In this sense, one interesting study would be to compare medical expenditures of individuals without insurance and individuals with various degrees of healthcare insurance. The RAND Health Insurance data set that was analyzed did not include the medical expenditures of individuals without insurance. Having this type of data would be of major interest to policy makers, especially in light of the universal health insurance mandate included in the Affordable Care Act and other timely healthcare legislation within the state and federal policy arenas.

References

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