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FEASIBILITY OF UNIVERSAL HEALTH CARE IN THE UNITED STATES

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ABSTRACT

As concerns grow about the inefficiency and unsustainability of the United States health care system, universal coverage health reforms have started to gain more traction. The goal of these reforms is to expand public insurance coverage eligibility, improving the access to care for individuals lacking consistent insurance coverage. However, it is not clear what the effect would be on utilization and as a result what the financial impact would likely be. This study estimates the effect of universal coverage on total expenditures of the uninsured and partially insured populations. Using a two-part model stratified by health status and age, the analysis suggests that the additional annual cost for medical care would be approximately $70.85 billion if both the uninsured and partially insured nonelderly populations became fully insured. An increase in medical spending of this magnitude would raise total health care spending by roughly two percent.

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INTRODUCTION

The United States currently has the highest per capita health spending in the world. On average, other wealthy countries spend about half as much per person on health compared to what the United States spends [21]. Despite the additional health spending per person, the level of overall health in the United States does not differ significantly from other wealthy countries [21]. This international comparison helps to showcase the shortcomings of the United States health care system, which has been criticized for being unsustainable, unaffordable, and inefficient.

Critiques on Healthcare in the United States

One of the main critiques of the United States health care system is the cost of medical services. Total health expenditures, which refer to the combined public and private expenditures spent on healthcare and health-related activities, have grown significantly within the past few decades. In 1970, the health expenditures were approximately $74.6 billion whereas the 2017 health expenditures summed to nearly $3.5 trillion [15]. Spending has more than doubled since 2000. To put this trend into perspective, in 2017, the health spending per person was $10,739. This is almost six times as much as the 1970 per capita health spending, after accounting for inflation [15].

The unaffordable nature of health care expenses in the United States is best shown through the relationship between health spending and overall economy growth. While health

spending has slowed since the turn of the century, it still grows at a faster rate than general inflation. Between 2010 and 2017 the average annual growth rate of gross domestic product (GDP) per capita was 3.1%, whereas the total national health spending per capita was 3.6% [15]. Adequate health coverage is already unaffordable for many individuals, but this trend suggests it is becoming even more unaffordable. The percentage of household income spent on health-related expenses is growing while average household income is remaining relatively constant. This mimics the total national health expenditures as a percentage of GDP which has been on a steady incline for the past few decades, totaling 17.9% in 2017 [15].

These trends are not predicted to change unless sizeable changes to the health care system are made. The Centers for Medicaid and Medicare Services (CMS) project that health spending will grow 0.8% faster than GDP per year over the 2018-2027 period. They also expect the health share of GDP to rise from 17.9% in 2017 to 19.4% by 2027 [4]. This type of growth in spending is unsustainable as more and more people will be unable to afford the necessary care, which could have detrimental effects on population health.

One key reason the United States healthcare system is described as inefficient is because it is not accessible by all citizens. There is a gap in access in the United States as many individuals have insufficient or no health coverage at all. As of 2017, 8.8% of the total United States population did not have health insurance at any point during the year [3]. While this has been significantly improved with the implementation of the individual mandate and Medicaid expansion under the Affordable Care Act, there are still approximately 28.5 million people that are uninsured in the United States as of 2017 [3].

The uninsured can be broken down into 3 age groups: children (0-17), non-elderly adults (18-64) and elderly (65+). Most of the uninsured are non-elderly adults, as there were 27.4

million nonelderly that did not have any coverage in 2017 [14]. Minority races and ethnic groups made up a majority of the uninsured population despite making up less than 40% of the total population. Socio-economic studies on the uninsured found that most uninsured had a high school education or less and were in low-income households near the poverty line [2]. These are individuals that do not qualify for Medicare or Medicaid, but also cannot afford to purchase private health insurance. The uninsured were disproportionately concentrated in the South, which corresponds with states that have not expanded Medicaid coverage [2].

The uninsured population is constantly changing, mirroring the changing nature of employment and the presence of adequate take-home income. A 2001 study performed by the Department of Health and Human Services found that 64 million individuals lacked insurance coverage for at least one month in the studied year. Of those that lacked insurance at any point during the year, 51% were uninsured for at least one full year, 20% lacked coverage for 3 months or less, and 34% were uninsured for 6 months or less [24]. The dynamics of the uninsured population identify two key groups with distinct behaviors. The first group are those that are uninsured for short periods of time due to employment transitions or other lapses in coverage. The second group incurs long-term lapses of coverage which can be caused by lengthy unemployment, jobs that do not provide affordable coverage, and prior medical or general debt.

While for some being uninsured may be a choice, particularly for young adults with good health, many are in this situation due to financial restrictions. In 2017, 45% of uninsured nonelderly adults said they were uninsured because the cost was too high [14]. Although employer-provided health coverage is common in the United States, there are still many people that do not have access to coverage through a job. Purchasing private insurance directly can be expensive and unattainable for those that remain ineligible for public insurance.

The uninsured access gap is an issue because those without adequate insurance are put into a situation where they either incur unaffordable medical costs or gamble on their health by forgoing needed services. In 2017, one in five uninsured adults went without needed medical care due to cost [14]. The uninsured are less likely to receive preventative care and services for major health conditions and chronic diseases. Studies have shown that the utilization of emergency services by the uninsured are similar to that of the insured, but those without insurance use other types of services such as preventative care less than the insured [27].The influence of cost on medical decisions causes individuals without coverage to have worse access to care than those with insurance coverage.

Universal Healthcare

There are various universal healthcare models which differ based on how the healthcare system is financed and provided. The spectrum ranges from fully government provided and financed health care like the United Kingdom's National Health Service to private sector provided, government financed health care like Canada's National Health Insurance system. For the purposes of this paper, the model for universal coverage will be an expansion of the current United States public health insurance system to those that are uninsured, similar to the Medicaid expansion under the Affordable Care Act.

Universal health care has been viewed as a possible solution to address the critiques of the current healthcare system in the United States. The intent is to reduce the uninsured access gap entirely by expanding public insurance coverage to cover those individuals that are currently ineligible but unable to afford private coverage on their own. Once everyone has adequate

coverage, the hope is that access to medical services will improve. One area of care that the uninsured use significantly less than the insured is preventive care, so the desired effect is that by ensuring everyone has adequate coverage that overall population health is improved. This can cause further chain reaction effects on employment and the economy as a whole.

The concept of universal health coverage could be a potential solution as it addresses the issues found in the current health care system. It is important to look at the feasibility from an economic perspective assuming that the implementation of this Medicaid expansion to eradicate the uninsured access gap is politically feasible. This feasibility concern follows the theory that "there is no such thing as a free lunch", so the expansion of coverage cannot be implemented without additional financial resources. Small changes in taxes or cost sharing per person could be feasible; however the larger the financial implications, the more improbable a policy becomes.

BACKGROUND

Policy Review

The Affordable Care Act (ACA) was implemented in 2014 with the intention of reducing the uninsured gap in the United States and providing more affordable coverage options. This federal policy used the existing private insurance industry to expand Medicaid eligibility to many low-income adults. Implementation of the Medicaid expansion under the ACA was made optional for states under the 2012 Supreme Court ruling on the constitutionality of the Affordable Care Act. As of September 2019, 37 states including Washington DC, had adopted Medicaid Expansion under the ACA and more than 12 million people were covered through this expansion [10]. In addition to expanding Medicaid eligibility, the ACA established the small group and individual health insurance ACA marketplace, as a more affordable option for those that were not covered by large group insurance. Tax credits and subsidies were provided to many with incomes less than four times the poverty level so that they could afford coverage in the private marketplace [10]. The policy not only improved access to coverage from a fiscal viewpoint but included regulations to protect those that may have previously been denied coverage based on prior health conditions.

The Affordable Care Act's intentions are two-fold: to provide access to coverage and guarantee that all citizens had at least a base amount of coverage through employer and individual mandates. The employer mandate required that employers with more than 50 full-time employees offer minimum employer provided health benefits or face financial penalties. After the ACA, large group products had to include preventive care with 100% coinsurance and meet certain benefit richness criteria to be deemed legal. The individual mandate required that all

United States citizens and legal residents with access to affordable coverage obtain minimum qualifying coverage or face a tax penalty. This was particularly geared towards bringing healthier people into the marketplace which could further reduce cost of coverage through pooling. As of 2019, the individual mandate was more or less repealed. While the mandate is still in effect under the Affordable Care Act, the December 2017 tax reform zeros out both the dollar amount and percentage of income penalties imposed by the mandate [13].

The Affordable Care Act's expansion of Medicaid has been viewed as a stepping stone to universal coverage in the United States. Despite no federal policy yet, there have been a few state attempts toward universal health care. In 2011, Vermont passed a health care reform to establish a government-financed system, called Green Mountain Care, to provide universal health coverage to state residents. This system was coupled with additional taxes of 11.5% on businesses and 9.5% on income to afford the additional care [25]. This plan was abandoned in 2014 due to cost ineffectiveness as well as political barriers to implementation. In 2017, California passed a preliminary bill to establish universal single-payer healthcare for all residents. Although extending coverage to those that are currently uninsured increases costs, the plan expects those expenses would be recouped by the projected $37.5 billion reduction in annual state health spending [9]. Legitimate hurdles still remain before this policy could actually be implemented including, but not limited to, tax reforms, gaining authorization from the federal government to divert Medicaid funding, and political stagnation. In general, state-provided universal health care coverage poses more questions than answers. However, if one state can successfully implement a universal health care program, others may follow even if no federal policy is enacted.

Characteristics of Insured and Uninsured Behavior

The type of health care and service utilization varies between the insured and the uninsured in the United States. Those without health coverage are less likely than those with insurance to have regular outpatient care, rather they are more likely to be hospitalized through emergency room services for otherwise avoidable health problems [14]. The uninsured are also more likely to decline recommended medical care. In 2017, uninsured non-elderly were more than three times as likely as adults with private insurance to say that they postponed or did not get a needed prescription drug due to cost [14]. The barriers to adequate health care are much greater for those that are uninsured, stemming from the high costs associated with medical care and the lack of consistent access to primary care facilities. Further, the financial burden is a significant factor in the disparity of health outcomes between the uninsured and insured populations.

Overall medical spending behavior differs between these two groups as well. Uninsured individuals are both less likely than those with coverage to use any health services in a given year and have lower expenditures for any services that are used on average [12]. This is consistent with the reduced utilization from cost-centric health decisions. Despite the insured population having greater health service utilization, the majority of their total expenditures are not paid out of pocket. Those that are uninsured face the entire expenditure out of pocket. While out of pocket expenditures for the uninsured are comparable to those with coverage, this type of spending consumes a more substantial portion of take-home income for those lacking coverage [12]. The uninsured continue to face the financial strain of unaffordable health care despite reducing utilization.

Effects of Prior Medicaid Expansions

Since its inception in 1965, Medicaid has gone through a few expansions to include a variety of eligibility groups. During the 1980s, Medicaid expanded eligibility to pregnant women regardless of income and to children, leading to the eventual development of the Children's Health Insurance Program (CHIP) in 1997. To analyze the effects of this Medicaid expansion, studies looked at changes in utilization, health outcomes, and access to care. These studies found that pregnant women that transitioned from no insurance to Medicaid coverage had increased utilization whereas those that transitioned from private insurance to Medicaid actually had reductions in utilization. This demonstrates a crowding out effect as individuals switched from private to public insurance after the Medicaid expansion and drove down private sector spending. Overall there was little association between Medicaid eligibility and obstetric procedure utilization because reductions and increases in utilization between the two groups offset each other [7]. Health outcomes were improved as the incidence of infant mortality and low birth weight decreased significantly. The estimated 30% increase in Medicaid eligibility for 15- 44 year old women was associated with an 8.5% decrease in infant mortality [6]. However, expansion to specific-low income groups had much larger effects on birth outcomes than the broader expansions of eligibility to women with higher income levels. Access to care amongst children was improved by the Medicaid expansion as the percentage of children having at least one visit to a doctor's office in a year increased among expansion eligible children from 56.8% in 1987 to 64.4% in 1996 [1]. There also was a shift towards more preventative care through primary care physicians and away from emergency room visits amongst all children.

The Affordable Care Act also expanded Medicaid eligibility to a larger range of low-income individuals and actually reduced the number of uninsured nonelderly drastically from

over 44 million in 2013 to just below 27 million in 2016 [14]. States that participated in the Medicaid expansion between 2014 and 2016 saw a 9.5% increase in insurance coverage, a 3.4% increase in reporting having a primary care doctor, and a 5.6% decrease in reporting that cost is a barrier to receiving care [5]. The studies saw less drastic results in states that did not participate in Medicaid expansion and were only impacted by the national components of the ACA. In addition to improved access to care, individuals in Medicaid expansion states saw a statistically significant 1.3% increase in the probability of reporting excellent health before the ACA was fully implemented. The results suggest that improvements in overall health [5]. Positive impacts from Affordable Care Act in health insurance coverage, access to care, and self-assessed health have continued to improve as more time passes since full implementation.

Effects of Universal Coverage

While there has yet to be a successful universal coverage health reform in the United States, the effects of universal coverage have been analyzed in other countries that have implemented similar programs. A study on the 1961 Japanese expansion of health insurance coverage to its entire population found that health care utilization increased significantly; however the effects on the number of medical institutions, physicians, and nurses were negligible [16]. A large expansion in health insurance coverage requires sufficient financial resources to cover increased utilization in both the short and long run. Without the proper funding, the health care system is less capable of keeping up with growing demand. A common complaint of the universal health insurance in the United Kingdom is lengthy wait times for health services, especially elective procedures. This could be a significant issue in the United States as the

population ages and demand outpaces supply. Hospital density is decreasing in the United States at a faster rate than in comparable countries and there are fewer doctors per capita than there are in most comparably wealthy countries [22]. The United States could face a potential doctor shortage before universal coverage is even introduced.

Universal health coverage has also been linked to improved health through better access to health care. A study on the impacts on overall health in Taiwan following its 1995 universal health insurance policy found that life expectancy increased, and health disparities narrowed between those previously with and without insurance coverage. Major contributors to the reduction in disparity were reductions in deaths from cardiovascular diseases, ill-defined conditions, and infectious diseases. Although the Taiwanese universal coverage program is improbable in the United States due to population size and general demographics, the universal health coverage did see an increase in primary care. The ease of access to care, increased the average number of physician visits per year to 14 per person in Taiwan, which was approximately four times the United States average at that time [26]. Past Medicaid expansions in the United States have prioritized preventative care which can help to catch and treat chronic illness symptoms earlier. Studies conducted in industrialized countries indicate that stronger primary care systems are generally associated with better population health outcomes [23]. If proposed universal health insurance continues to prioritize preventative care through primary care physicians, it could also be linked with better overall health.

Background for Model Development

Since previous research has been done on the adoption of universal insurance coverage in relation to the uninsured population, the models and findings of that research were used in the development of this new analysis. There were two key studies in particular, one written in 1994 and the other in 2003, which were used as a primary foundation for the new model. Despite the lack of recency in this research, the concepts and assumptions used to build the models still hold.

The 1994 research study found that universal coverage is likely to increase the use of health care services by the previously uninsured, although it requires significant additional costs and resources [17]. For this research, multiple two-part models were used to estimate the utilization of ambulatory care and inpatient hospitalization. Using data from 1987 National Medical Expenditure Survey, the model used a variety of demographic explanatory variables including health insurance status, age, gender, and the interaction between health and insurance status.

The 2003 research study found that the addition of coverage for those currently uninsured would increase total health care spending by 3-6% [14]. The additional cost of coverage was estimated using a series of two-part models that combined a sample of uninsured individuals with individuals in the same economic class that had private and public insurance coverage respectively. Using data from 1996 –1998 Medical Expenditure Panel Surveys (MEPS), the model used a variety of socio-economic demographics, health characteristics, and insurance statue variables to estimate the effects of insurance on annual health care spending.

The model used in this analysis builds upon the two foundational models explained above but incorporates more updated data to provide a better picture of the uninsured demand today. The healthcare landscape has changed significantly since these papers were published. The

interest of this model has been broadened to include total expenditures rather than look at the demand for one or two services. The current uninsured demographics differ slightly from the previous research due to Medicaid expansion under the Affordable Care. Another area of significant change from when these papers were published is the emergence of prescription drugs as a major driver of the growing annual health spending [18].

One aspect lacking from both of these previous models is the stratification of data by health status. Health status is a complicated variable to define, however one would expect individuals with similar overall health to spend similarly. Rather than creating one overarching model that estimates total expenditures based on typical or average health, the differentiation into distinct health statuses helps to provide better estimation of actual expenditures.

METHODOLOGY

Data Retrieval

The data used in the following analysis was obtained from the Medical Expenditure Panel Survey (MEPS) conducted by the Agency of Healthcare Research and Quality. This survey is nationally representative of the civilian, non-institutionalized population. It is conducted under an overlapping panel design that follows respondents for two years, such that in any given year half of the respondents are in the first year and the others are in the second year. While MEPS data are reported on a yearly basis, the selected data were consolidated so that they span the most recent five years of data from 2012 to 2016. It is important to note that the data include both pre and post-Affordable Care Act observations as this policy was put into place in 2014. The variables that were chosen for this analysis include demographic information, insurance status, health status, and expenditure information.

Stratification of Data by Health Status

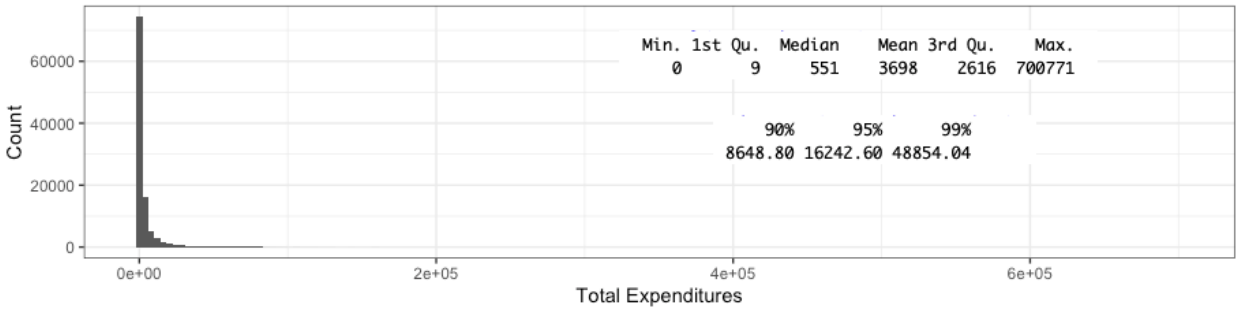
The data sample was defined as individuals between ages 18-64 and that have full eligibility throughout the entire panel survey. These restrictions were placed on the data because the majority of the uninsured population fall within the 18-64 working age and full eligibility improves data completeness. Since spending is expected to vary considerably by age and self-reported health status, the sample was split into stratified samples based on age and average health status over the year for which the data was collected.

There were 12 age - health samples defined, split into four mutually exclusive age categories and three average health categories. The age groupings are as follows: 18-25, 26-34, 35-54, and 55-64. The health status variables used for this analysis were self-reported perceived health statuses collected three times throughout the year. These values range from 1 to 5 where 1 is excellent, 2 is very good, 3 is good, 4 is fair, and 5 is poor. Rather than going into detail for every possible combination of these statuses over the year, three groups were created based on average health status: very good, good, and poor. The average health groupings are as follows: very good [1,2], good (2,4], and poor (4,5]. By splitting the data into more homogenous groupings, better models for utilization and expenditure can be developed as there is less variation in the data. A group of healthy young people might be expected to behave similarly from a medical perspective compared to a group of mixed ages and health statuses. One would not expect an 18-year-old and a 64-year-old to exhibit similar health needs.

Model Selection

Preliminary analysis of total expenditures showed a heavily right skewed distribution with a large number of zero values and very few large values. This is a common finding in healthcare expenditure data as a large percent of patients do not have any health spending in a given year while a few individuals have extensive medical spending [8]. Figure 1 is a visual representation of the total expenditures' distribution for the entire data set used. Included in the figure are summary statistics for total expenditures. The maximum total expenditure is over $700,000 while 90% of the observations are below $9,000. The large first spike in the graph represents the abundance of zeros.

Figure 1: Distribution of Unadjusted Total Expenditures



The nature of the data suggests a two-part model rather than a linear regression model. The two-part model is a combination of a Bernoulli distribution indicating whether or not the expenditures were greater than zero and a continuous distribution to model the positive values. For this analysis, a lognormal distribution is applied where the log of expenditures greater than zero follows a Normal Gaussian distribution. Gamma distributions would also be appropriate for this modeling.

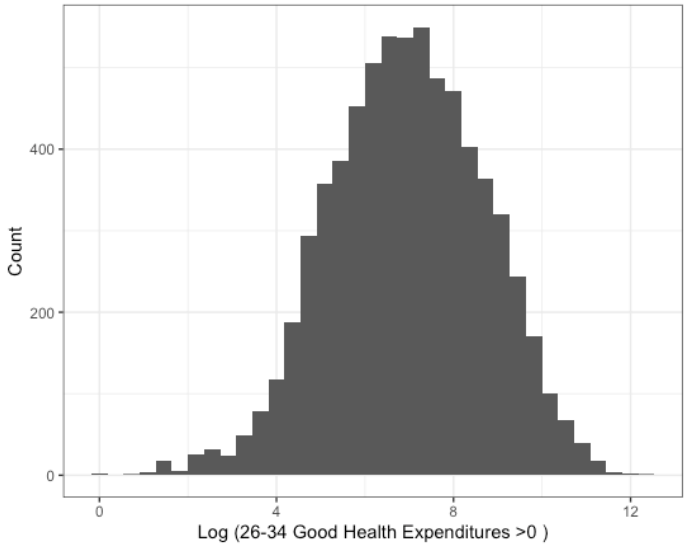
Two-Part Model

An indicator binary variable was added to the data set taking the value of 0 when total expenditures are $0.00 and the value of 1 when total expenditures are greater than $0.00. This variable follows a Bernoulli distribution with $P(y_i = 1) = p_i$ and $P(y_i = 0) = 1 - p_i$. An ordinary least squares regression is an inappropriate model because the response variable does not follow a Normal distribution and the predictions need to be restricted to [0,1]. A better model is a logistic regression which models the log odds of the indicator variable. Log odds are defined as $log\left(\frac{p_i}{1-p_i}\right)$ which transforms the probability values from $[0,1]$ to $(-\infty, +\infty)$. For this analysis,

the logistic regression is built using a linear combination of demographic explanatory variables to model the log odds.

The second part of the model analyzes total expenditures given that they are greater than zero. Non-zero total expenditures still have a skewed distribution, though not as severe as the full total expenditure data. For improved inference and model accuracy, the total expenditure data greater than zero were modeled under a log transformation. The log of total expenditures greater than zero follows an approximate Normal distribution with a slight left tail, this can be seen in the Figure 2.

Figure 2: Logarithmic Distribution of Positive Expenditures for 26-34 Good Health



The approximate Normal distribution of this response variable lends itself to a linear regression model using the same explanatory variables as used in the logistic model for the respective age-health sample. Combining the logistic and linear regressions, the two-part model provides greater insight into the actual behavior of total health expenditures and allows for better understanding of the results.

The model used in this analysis relies on a mixture of categorical and numeric explanatory variables. These include region, gender, race, ethnicity, marriage status, education level, employment status, insurance coverage, total take home income, and income as a percentage of the poverty level. Each age-health sample was modeled separately but uses the same underlying model. The introduction of separate modeling allows for the interaction between all of the explanatory variables and age and health without explicitly adding these terms to the model. While interaction between variables is important in the precision of a model, interpretability diminishes when too many explanatory variables are introduced. Both parts of the model are consistent with the use of the same explanatory variables.

Analysis Methodology

The goal of this analysis is to estimate expected additional medical expenditures associated with providing uninsured and partially insured individuals full coverage. To estimate how increasing insurance coverage might affect health care utilization, counterfactual analysis was done using the regression estimates. First, the marginal effects of moving from both uninsured to full insurance and partial insurance to full insurance for each age-health sample were estimated.

Marginal effects were only reported if the insurance status variable was significant in the model with a p-value less than or equal to 0.05. In the context of this model, if the insurance status variables are not significant then the total expenditures are essentially the same regardless of insurance status. When the insurance status variable is not significant in the model, the corresponding mean marginal effects are either close to 0 or negative. In reality, one would not

expect for an individual to have less medical spending given full insurance coverage. At the bare minimum, they would maintain the same amount of medical spending they had as uninsured or partially insured. There were three combinations of age, health, and insurance status that lacked significance in the model. These marginal effects were not reported nor incorporated into further calculations for the purposes of this analysis. The marginal effects were calculated following Equation 1.

$$Marginal\ Effects = \left(\hat{P}_1 - \hat{P}_0\right) * \left(\hat{Y}_1 - \hat{Y}_0\right) \quad (1)$$

In Equation 1, $\hat{P}_i$ represents Pr $(Y > 0|\ X)$ and $\hat{Y}_i$ represents $E(Y|Y > 0, X)$ where the total expenditures are denoted by Y and the unique combination of explanatory variables by X. $\hat{P}_1$ and $\hat{Y}_1$ represent the predicted values for each of the two parts of the model when all observations are fully insured, keeping all other explanatory variables the same. $\hat{P}_0$ and $\hat{Y}_0$ change depending on which insurance type the marginal effects are being calculated under, whether uninsured or partially insured. In either case, all of the observations are set to the insurance type of interest keeping the rest of the explanatory variables the same.

Pr $(Y > 0|\ X)$ was calculated using the predict feature of the logistic regression model to assign a probability of nonzero expenditures for each of the observations with their specific explanatory variable values. $E(Y|Y > 0, X)$ requires a transformation since the model used predicts the expected log of nonzero expenditures. In general, a linear regression model with log transformation calculates fitted values using the following equation, where the B_i are the estimated coefficients and the X_i are the explanatory variable values from the data, as seen in Equation 2.

$$E[\log(Y)] = B_o + B_1X_1 + \cdots + B_nX_n \quad (2)$$

The expected value that is needed is $E[Y] = E[\exp(\log(Y))] \neq \exp(E[\log(Y)])$ where Y > 0. Since the errors of the linear regression model are Normally distributed with constant variance σ^2, $E(Y|Y > 0, X)$ can be estimated by $\exp\left(B_o + B_1X_1 + \cdots + B_nX_n + \frac{\sigma^2}{2}\right)$ in conjunction with the properties of the lognormal distribution. These predictions are calculated for each of the observations, applying the model to their specific mixture of explanatory variables.

After calculating the mean marginal effects for each insurance type, the person weight variable is applied to calculate the additional expected cost for the increased coverage. MEPS assigns a person weight to each of the individuals it interviews for the survey. The person weight value represents the estimated United States population that have similar explanatory variables to a particular surveyed individual. The summation of the additional costs per insurance group and age-health sample is the aggregate estimate for additional overall spending after providing universal coverage.

RESULTS

Population Characteristics by Insurance Status

Table 1 reports the mean values of the numerical explanatory variables used in the model for each of the three insurance statuses: fully insured, partially insured, and uninsured. In general, partially insured and uninsured individuals are younger than individuals that are fully insured for 12 months. The average incomes of fully insured individuals are greater than that of partially insured individuals followed by the average incomes of the uninsured, which is reported as both total income and income as a percentage of the poverty level.

Table 1: Numerical Variable Means Per Insurance Type

Numerical Variables	Fully Insured	Partially Insured	Uninsured
Age	41.41	36.34	38.17
Total Income	$37,691.21	$21,600.00	$17,591.36
Income as % of Poverty Level	392%	234%	196%
Total Medical Expenditures	$4765.14	$2,279.44	$1,029.81

Table 2 reports the population characteristics of the different insurance groups. Within the fully insured population, the greatest proportion of individuals self-report having very good health while the greatest proportion of the partially insured and uninsured populations identify having good health. The uninsured population also has a smaller proportion of individuals with poor health status than the fully insured and partially insured populations. This is consistent with the concept that individuals with poorer health conditions obtain insurance coverage to reduce the out of pocket medical costs.

The uninsured population is predominantly from the South making up 48.45% followed by 27.3% from the West, 13% from the Midwest, and 11.25% from the Northeast. The uninsured

regional distribution is consistent with which states had implemented the optional Medicaid expansion under the Affordable Care Act. Table 2 also indicates a shift in the predominant gender between individuals with at least partial coverage and no coverage at all. The partially and fully insured are made up of slightly more females, just over 50% of the total populations, while the uninsured are made up of a greater proportion of males to females.

The marital statuses are well mixed within each of the insurance types, however the fully insured are predominately married whereas the partially insured and uninsured are mostly single. All three insurance types are predominantly white which is consistent with the overall population, and the partially insured population has the highest percentage of minority races. The uninsured population actually has the lowest proportion of racial minorities however it is more likely to have ethnic minorities with 51.96% of the population identifying as Hispanic.

The uninsured population is also characterized by lower educational attainment as 30.16% have less than a high school educational equivalent. Comparatively, only 15.8% and 21.83% of the fully insured population and partially insured population have below a high school equivalent education respectively. The partially insured individuals are most likely to be at least sometimes employed, making up 77.41% of the partially insured population, followed by 77.05% of the fully insured population, and 73.02% of the uninsured population. Consequently, the uninsured population has the highest proportion of unemployment.

Table 2: Covariate Distributions by Insurance Status

Categorical Variables		Fully Insured	Partially Insured	Uninsured
Health Status	Very Good	49.24%	45.85%	43.93%
	Good	46.92%	50.99%	53.58%
	Poor	3.83%	3.16%	2.50%
Region	Northeast	18.04%	14.51%	11.25%
	Midwest	19.97%	17.48%	13.00%
	South	33.67%	38.56%	48.45%
	West	28.32%	29.45%	27.30%
Gender	Male	45.44%	44.77%	53.80%
	Female	54.56%	55.23%	46.20%
Marital Status	Married	51.43%	37.97%	39.64%
	Single	33.29%	45.64%	43.74%
	Other	15.28%	16.40%	16.61%
Race	White	66.20%	64.93%	73.07%
	Black	20.78%	24.02%	18.97%
	Native American	0.70%	1.12%	1.20%
	Asian	9.49%	7.13%	5.33%
	Multiple Races	2.81%	2.80%	1.43%
Ethnicity	Hispanic	24.38%	34.94%	51.96%
	Non-Hispanic	75.62%	65.06%	48.03%
Education	Non-Disclosed	22.67%	21.99%	22.99%
	None	0.09%	0.13%	0.25%
	Some primary	4.99%	6.88%	12.38%
	Some high school	10.72%	14.82%	17.53%
	High School	18.24%	20.94%	22.08%
	Some college	15.80%	17.44%	13.18%
	College	19.66%	14.94%	10.08%
	College+	7.82%	3.18%	1.51%
Employment	Non-Disclosed	0.49%	1.86%	2.04%
	Employed	65.73%	49.66%	54.25%
	Partially Employed	11.32%	27.75%	18.77%
	Unemployed	22.46%	20.73%	24.94%

Tables 3 through 6 show the unadjusted average annual medical expenditures per person within each health status and each of the insurance statuses: fully insured, partially insured, and uninsured. In general, the average expenditures are highest for the fully insured, followed by partially insured and then uninsured within each age-health sample. Additionally, spending is

substantially higher for worse self-reported health across each age group. The largest average expenditure differences between the insurance statuses are seen within the poor health group. The minimum difference between the fully insured and uninsured for poor health amongst the four age groups is $15,000. The maximum differences between the fully insured and uninsured for the very good and good health categories amongst the four age groups is $2,750 and $6,250 respectively.

These findings are consistent with expected medical spending behavior. It is expected that poorer health individuals will have higher expenditures due to increased health care needed to treat those conditions. Individuals that expect extensive utilization and subsequently higher expenditures tend to be insured to cover the majority of those costs. The top 5% of individuals ranked by their health care expenses account for roughly 50% of the total health care expenditures [20]. Taking these both into consideration, the average expenditures would be greater for fully insured individuals because of the few exceedingly large claims.

Individuals that are uninsured for a full year are much less likely to have any expenditures within a given year. The proportion of non-zero expenditures is only 47.67% of all the reported expenditures. The proportion of non-zero expenditures is significantly greater in both the partially and fully insured populations, with 73.01% and 75.45% of the expenditures being greater than zero respectively.

Table 3: Unadjusted Average Annual Medical Expenditures for Ages 18-25

Health Status	Insurance Status	Unadjusted Average Annual Medical Expenditures (Per Person)	Sample Size
Very Good	Fully Insured	$1,401.30	7692
	Partial	$1,007.86	2250
	Uninsured	$365.36	2614
Good	Fully Insured	$3,556.09	3447
	Partial	$2,353.93	1440
	Uninsured	$726.07	1565
Poor	Fully Insured	$23,881.36	74
	Partial	$8,118.92	24
	Uninsured	$7,354.63	24

Table 4: Unadjusted Average Annual Medical Expenditures for Ages 26-34

Health Status	Insurance Status	Unadjusted Average Annual Medical Expenditures (Per Person)	Sample Size
Very Good	Fully Insured	$2,136.66	7116
	Partial	$1,671.03	1840
	Uninsured	$406.26	2825
Good	Fully Insured	$4,176.62	5111
	Partial	$2,474.92	1711
	Uninsured	$714.99	2611
Poor	Fully Insured	$23,077.46	233
	Partial	$25,577.00	51
	Uninsured	$3,114.29	62

Table 5: Unadjusted Average Annual Medical Expenditures for Ages 35-54

Health Status	Insurance Status	Unadjusted Average Annual Medical Expenditures (Per Person)	Sample Size
Very Good	Fully Insured	$2,262.38	13549
	Partial	$1,474.32	1915
	Uninsured	$457.24	3503
Good	Fully Insured	$5,566.51	15278
	Partial	$3,130.65	3003
	Uninsured	$1,261.93	5843
Poor	Fully Insured	$21,181.64	1238
	Partial	$15,339.30	240
	Uninsured	$6,169.74	294

Table 6: Unadjusted Average Annual Medical Expenditures for Ages 55-64

Health Status	Insurance Status	Unadjusted Average Annual Medical Expenditures (Per Person)	Sample Size
Very Good	Fully Insured	$3,845.85	5414
	Partial	$2,495.66	521
	Uninsured	$1,098.59	803
Good	Fully Insured	$8,800.31	8345
	Partial	$5,175.64	1104
	Uninsured	$2,552.92	1866
Poor	Fully Insured	$22,057.66	1080
	Partial	$16,257.03	134
	Uninsured	$5,513.36	174

Predicted Increases in Total Medical Spending

Tables 7-10 report the estimated marginal effects associated with providing full insurance coverage to uninsured and partially insured individuals, as well as the associated estimate of the change in total spending. This estimate is calculated using the per person increase in spending estimates multiplied by the total weighted population in MEPS.

There were three cases where the estimated coefficient of insurance status was not significant in modeling total expenditures, so the marginal effects were not reported. This includes 18-25 poor partially insured and 55-64 poor both partially insured and uninsured. The lack of significance can be caused by a variety of factors including sample size. The sample sizes for these age-health samples that lack statistical significance are smaller than the other stratified samples. For example, there are only 24 observations in the 18-25 poor health partially insured sample and a combined 308 in the 55-64 poor health uninsured and partially insured samples. The larger samples approach a Normal distribution due to the Central Limit Theorem, which states that if a sample is sufficiently large enough then the distribution of the sample means

follow a Normal distribution. The Central Limit Theorem does not apply to the smaller sample sizes, causing the distributions to be less normalized. Further modeling for these age-health groups would need to be conducted to see if the estimated coefficients were statistically different from zero using larger sample sizes.

The estimated marginal effects associated with providing full insurance coverage to the uninsured are consistently greater than the estimated marginal effects for the partially insured. For those in very good health, the marginal effects of moving from partially insured to fully insured led to a per capita increase in costs of $29.71 (ages 18-25) to $101.53 (ages 55-64), whereas the marginal effects for the uninsured with very good health were in the range of $258.71 (ages 18-25) to $566.76 (ages 55-64). Similarly, for those in good health, the marginal effects of moving from partially insured to fully insured led to a per capita increase in costs of $87.96 (ages 26-34) to $ 183.95 (ages 35-54) while the marginal effects for the uninsured with good health were in the range of $845.88 (ages 18-25) to $1,368.77 (ages 55-64). Likewise, for those in poor health, the marginal effects of moving from partially insured to fully insured led to a per capita increase in costs of $177.90 (ages 35-54) to $640.59 (ages 26-34) which are significantly lower than the marginal effects of moving from uninsured which range from $1,304.62 (ages 35-54) to $4,324.51(ages 26-34). All of the marginal effects for the uninsured group are at least 5.5 times larger than those of the partially insured group within the same age-health sample suggesting that the total additional cost for providing full coverage is driven primarily from the uninsured population. In addition, the marginal effects become larger in magnitude as the health status declines for both those with partial and no insurance.

To estimate the incremental aggregate cost, the estimated populations were used in conjunction with marginal effects. Within each age-health sample, the estimated populations for

the partially insured and uninsured are relatively similar. The uninsured population is slightly larger for all but the 18-25 Poor and 26-34 Poor samples. The 35-54 age group has higher estimated populations which is consistent with the larger age range and size of the surveyed sample. The surveyed sample of individuals 35-54 years old is more than twice that of any other age group in the data.

Table 7: Marginal Effects Based on Insurance Status for Ages 18-25

Health Status	Insurance Status	Marginal Effects in Relation to Fully Insured	Estimated Population	Additional Cost for Full Insurance Coverage
Very Good	Partial	$29.71	10,498,038	$311,854,421
	Uninsured	$258.71	10,064,204	$2,603,660,898
Good	Partial	$95.08	6,503,309	$618,306,746
	Uninsured	$845.88	6,035,554	$5,105,318,667
Poor	Partial	NOT SIGNIFICANT	145,073	-
	Uninsured	$7,018.84	123,167	$864,486,153

Table 8: Marginal Effects Based on Insurance Status for Ages 26-34

Health Status	Insurance Status	Marginal Effects in Relation to Fully Insured	Estimated Population	Additional Cost for Full Insurance Coverage
Very Good	Partial	$29.86	9,857,281	$294,334,815
	Uninsured	$350.91	11,084,806	$3,889,748,940
Good	Partial	$87.96	7,923,633	$696,939,937
	Uninsured	$916.99	9,472,487	$8,686,218,674
Poor	Partial	$640.59	278,215	$178,222,274
	Uninsured	$4,324.51	228,577	$988,483,455

Table 9: Marginal Effects Based on Insurance Status for Ages 35-54

Health Status	Insurance Status	Marginal Effects in Relation to Fully Insured	Estimated Population	Additional Cost for Full Insurance Coverage
Very Good	Partial	$62.58	10,064,160	$629,773,581
	Uninsured	$444.80	13,649,084	$6,071,174,874
Good	Partial	$183.95	13,230,455	$2,433,775,575
	Uninsured	$1,081.03	20,177,821	$21,812,723,250
Poor	Partial	$177.90	1,157,342	$205,885,916
	Uninsured	$1,304.62	1,168,306	$1,524,194,260

Table 10: Marginal Effects Based on Insurance Status for Ages 55-64

Health Status	Insurance Status	Marginal Effects in Relation to Fully Insured	Estimated Population	Additional Cost for Full Insurance Coverage
Very Good	Partial	$101.53	3,348,405	$339,976,969
	Uninsured	$566.76	4,205,831	$2,383,710,478
Good	Partial	$120.53	5,257,688	$633,714,813
	Uninsured	$1,368.77	7,730,723	$10,581,590,366
Poor	Partial	NOT SIGNIFICANT	640,584	-
	Uninsured	NOT SIGNIFICANT	842,086	-

The model predicts an average aggregate increase of $70.85 billion in total expenditures to cover the additional costs associated with providing full insurance coverage to uninsured and partially insured individuals. A complete breakdown of additional costs predicted from the model are included in Table 11. The costs associated with providing coverage for the uninsured population total approximately $64.51 billion, which is over 90% of the aggregate total. This is due to the greater marginal effects in relation to fully insured that are observed with the uninsured. The additional cost for partially insured individuals makes up less than 9% of the total projection as it totals $6.34 billion.

Analysis by health status shows that average self-reported good health makes up 71.37% of the additional cost whereas 23.32% and 3.31% of the additional costs stem from very good

and poor health individuals respectively. Similar analysis by age shows that individuals aged 35-54 make up 46.12% of the additional cost while each of the other age groups make up less than 20% each. The 35-54 good age-health sample is the largest driver of additional cost making up 34.22% of the projected $70.85 billion. This is consistent with the 35-54 age group and the good average health status making up a significant proportion of cost by age and health respectively.

Table 11: Additional Cost for Full Insurance Coverage Breakdown

Age	Health	Partially Insured	Uninsured	Total	% of Total
18-25	Very Good	$311,854,421	$2,603,660,898	**$2,915,515,320**	4.11%
	Good	$618,306,746	$5,105,318,667	**$5,723,625,413**	8.08%
	Poor	-	$864,486,153	**$864,486,153**	1.22%
26-34	Very Good	$294,334,815	$3,889,748,940	**$4,184,083,755**	5.91%
	Good	$696,939,937	$8,686,218,674	**$9,383,158,611**	13.24%
	Poor	$178,222,274	$988,483,455	**$1,166,705,729**	1.65%
35-54	Very Good	$629,773,581	$6,071,174,874	**$6,700,948,455**	9.46%
	Good	$2,433,775,575	$21,812,723,250	**$24,246,498,825**	34.22%
	Poor	$205,885,916	$1,524,194,260	**$1,730,080,176**	2.44%
55-64	Very Good	$339,976,969	$2,383,710,478	**$2,723,687,446**	3.84%
	Good	$633,714,813	$10,581,590,366	**$11,215,305,179**	15.83%
	Poor	-	-	-	-
TOTALS		**$6,342,785,048**	**$64,511,310,016**	**$70,854,095,063**	
		(8.95%)	(91.05%)		

DISCUSSION

Covering Additional Costs

The projected $70.85 billion increase in total medical expenditures represents approximately a 2.02% increase in national health spending, which totaled $3.5 trillion in 2017. This increase assumes that the cost of healthcare remains constant and does not incorporate inflation. While 2% may seem negligible in aggregate, the financial implications on the individual basis are much more significant. To put this in perspective, on average, the uninsured and partially insured populations would spend an additional $918.91 per year on health services were they to be given full insurance coverage under this model. If the uninsured population's additional cost were isolated, each uninsured individual would spend approximately an average additional $1,474. The average take home annual income for the uninsured population is $17,591 which was obtained from the MEPS data and can be found in Table 1. The projected additional costs would range between 5.6% and 8.4% of that total take home income on top of income already allocated to medical spending. Similarly, if the partially insured population's additional cost were isolated, each member of the partially insured population would spend an average extra $190 on medical spending.

One of the major concerns with universal healthcare is finding a realistic solution to cover the additional costs associated with the improved coverage for the under-insured. Funding suggestions include redirecting current government spending and raising income taxes. If the projected $70.85 billion increase in total medical expenditures were to be spread out over the entire 18-64 population equally, the average increase in cost per person would be $363.64 based on this model. However, proposed tax plans would not rely on equal distribution of additional

costs, rather a percentage of annual income. Under a percentage plan, as annual income increases the lump sum contribution also increases.

Some of the backlash for universal coverage comes from the upper and upper-middle class individuals that are already able to afford their own private insurance coverage. These individuals, which tend to have higher take home incomes, would then be responsible for greater contributions to cover the additional costs associated with universal coverage. The immediate effects of providing universal insurance to the uninsured and partially insured have little benefit to those that already purchase insurance coverage. The insured are generally satisfied with their own medical care, even if they think poorly of the system as a whole [19]. Latent effects like improved overall health and the ramifications on the economy as a whole would have more of an impact on individuals that were fully insured prior to the suggested expansion. The combination of limited personal benefit and greater lump sum contributions for the fully insured individuals prior to the expansion help to rationalize some of the resistance to universal coverage policies from this portion of the population.

The financial implications of paying for universal coverage poses more questions than answers. In general, the uninsured population is does not have insurance either because they choose to decline the insurance due to their health status or cannot afford to maintain insurance coverage. If a tax increase is required to cover the additional costs, how will some or all of the uninsured population, who could not previously afford to obtain insurance coverage, afford to pay higher income taxes? More of the additional cost would likely be placed onto the upper and upper-middle classes, especially those in top tax brackets.

Limitations and Improvements for Future Analysis

Healthcare is much more complex than derived for the purposes of this analysis. There were a variety of assumptions made throughout the modeling process due to the nature of the data available and the framework of the analysis. These assumptions can serve as limitations and the loosening of some of these assumptions would allow for improved future analysis related to the effects of universal coverage.

A key assumption under this model is that the uninsured and partially insured would spend similarly to fully insured individuals of similar demographic backgrounds if given full insurance coverage. A flaw of this assumption is that it ignores the potential overconsumption of health services by the uninsured and partially insured populations after receiving full insurance coverage. However, the consumption of health services is very subjective and there is no concrete method to predict the additional consumption beyond expected spending of a fully insured individual. Given the available data, the best estimation of additional medical spending occurs under the assumption that uninsured and partially insured would behave similarly to that of a fully insured individual if given full coverage. This model did not differentiate insurance coverage in any given month between public and private insurance. Further sensitivity studies could be completed to look at the difference in expenditures between fully public and fully privately insured individuals with similar demographics.

Another key assumption under this model is that universal coverage would follow the same payer mix as currently seen in the United States. This payer mixture is defined as the combination of expenditures covered by public insurance, private insurance, and paid out of pocket. There are multiple definitions of universal insurance with a similar overall premise and the incorporation of different payer mixes. For the purposes of this model, the payer mix is

assumed to remain constant as coverage is expanded to the uninsured and partially insured. As the only available data follows the current payer mix in the United States there is no frame of reference for the extent to which spending would differ under a new payer mix in the United States. In addition, if the payer mix were not to be kept constant, it would be difficult to differentiate between the compounding effects of universal coverage and the different payer mix.

This model also does not focus on any issues with the supply of health-related services. Similarly, to how the payer mix is assumed to remain constant under the expansion in coverage, the access to and availability of care at least in the short term, also remains constant. Due to the data that is currently available, there is no frame of reference for how spending may change if the infrastructure of the health industry could not keep up with the increased utilization under the coverage expansion. The estimates developed under this model rely on the assumptions that there are no issues on the supply side of healthcare given the increased coverage.

The model tries to account for health status as a gauge of medical spending, but may do so imperfectly. Health status is difficult to quantify as there is no single indicator of overall health. Further studies could flush out the definition of health status to include not only self-reported perceived health status but also smoking status, mental health status, and whether or not the individual has any chronic conditions. Similarly, insurance status is more complex than how it was defined for the purposes of this analysis. This model ignored issues with insufficient coverage where individuals are under-insured as they maintain coverage, but the benefits are less than generous. The MEPS data used indicates monthly coverage but does not disclose details regarding insurance plans or the quality of coverage. The model assumes a population weighted average of all insurance plans since better information is not available. The model also defines partial insurance to include any amount of insurance coverage spanning from 1 to 11 months.

Partial insurance could be further defined based on the number of months of coverage and the transition in and out of coverage. More comprehensive health and insurance status variables can improve the projection of total medical expenditures for future analysis.

Additional studies could be performed on the data to gain better insights on the drivers of total expenditures. This analysis looked at expenditures from individuals between the ages of 18 and 64, while further analysis could be completed for those uninsured over the age of 65. This is only a small portion of the total uninsured population in the United States but the behaviors affecting medical utilization and spending may differ with aging. Total expenditures by type of service could also be analyzed to see how the additional costs from providing full insurance coverage are distributed.

Political Feasibility

Even if healthcare reform to provide universal coverage is economically feasible, there is one major barrier to implementation and that is the political feasibility. For example, the Affordable Care Act (ACA) took nearly five years to go into effect after introduction. While many of the initiatives were gradually enforced, the ACA was consistently challenged in court including a major Supreme Court decision that made expanding Medicaid optional for each state. Furthermore, the ACA was recently struck down and is now undergoing an appeal, but there is no guarantee that it would pass or that if passed would not be challenged again.

A political obstacle to health care reform is institutional fragmentation caused by both the structure of the federal government and politician's personal stances and policy priorities. This fragmentation adds difficulty in achieving consensus on a single piece of legislation. Even if a

congressional majority exists, it does not mean that majority support exists for any one plan [19]. Universal coverage, in particular, is a very broad term and the details of any given proposal may differ greatly. Consequently, there is also much variation amongst the outcomes of these proposals.

Health reform is a constant battle between two players: those that would benefit from reform and those that want to maintain a medical status quo. In particular those that are resistant to health care reform are physicians, hospitals, insurers, pharmaceutical companies, and suppliers of medical technology, because they are the ones that profit the most from the United States' current system. These groups are very well organized and have a significant voice in politics. In contrast, those that would benefit the most from a universal health care reform are uninsured Americans. Statistically, the uninsured are grouped together but in reality, they are an unorganized diverse group politically, geographically, and ethnically with few financial resources and political influence [19]. One of the main obstacles to the political feasibility of universal health care is that there is an imbalance in the politics of health reform.

CONCLUSION

The underlying question of this analysis is how spending would change if the uninsured and partially insured populations were to gain full insurance coverage. Since this analysis was not completed on any one proposed policy in particular, the distribution of additional costs is assumed to follow what coverage looks like today. This analysis suggests that universal health care is not feasible at this point of time due to the significant additional annual cost before normal growth in health spending.

The current healthcare system may struggle with handling the expected increased utilization at the rapid rate suggested by a complete expansion to universal coverage. A gradual approach to universal healthcare might be more realistic, allowing for the construction of better infrastructure within the health care industry to handle the increased utilization. This could be viewed as multiple expansions similar to that of the expansion under the Affordable Care Act. By spreading out the expansion to universal coverage, the additional costs for each expansion would not be as drastic.

A distinction between the United States and other countries that have been able to successfully implement universal coverage is the sheer cost of healthcare. A more pressing issue may be the rising costs of health care, as the average total expenditures for fully insured individuals grows over time the disparity between fully insured and uninsured individuals continues to widen. Further analysis on what is driving the rising costs of healthcare and potential solutions to curb the rate at which healthcare spending grows are relevant to future feasibility of universal healthcare in the United States.

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Contributed to various ad-hoc projects as a member of the Large Group Client Consulting team. Gained knowledge about core actuarial skills and the health insurance industry while developing technical skills in Excel, Visual Basic, and Access through practical work experience.

Korn Ferry Hay Group CMS Intern – Reston, VA *May 2018 - August 2018*

Reviewed CY2019 Medicare Advantage bids for the Centers for Medicare & Medicaid Services (CMS) as part of a large, multi-team effort. Analyzed health plan pricing development and Medicare plan data sets using large sophisticated tools and spreadsheets with goal of identifying and resolving outlying metrics, such as loss ratio, risk score, trend factors, and utilization factors.

Econ 104 Undergraduate Head Teaching Assistant *January 2017 - December 2018*

Partnered with senior Economics professor Adrienne Kearney LaPointe to assist in facilitating her undergraduate course by overseeing a team of fellow undergraduate TA's with various grading, proctoring, and in-class responsibilities.

Lifeguard at the YMCA of Centre County *May 2013 - December 2018*

Maintained the safety of the public aquatic facilities through active surveillance and maintenance of the pool and surrounding areas. Red Cross CPR and First Aid certified.

ACTIVITIES

Schreyer Honors College Orientation (SHO-TIME) Mentor *Fall 2017- Fall 2019*

Organized and executed an immersive three-day orientation for incoming first-year Schreyer scholars with Schreyer Honors College staff and fellow undergraduate students.

Penn State IFC/Panhellenic Dance Marathon (THON) *2016- 2019*

Volunteered on THON Rules & Regulations committee and Donor & Alumni Relations committee to help the dance marathon weekend run smoothly while raising funds and awareness to combat pediatric cancer.