

Affordable Care Act (ACA): Impact on U.S. Emergency and Preventive Healthcare

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We provide an analysis of the Affordable Care Act (ACA) and the impact this legislation has had on the quality of healthcare service in the United States. To assess the quality of healthcare service, we focused on three facets of healthcare: emergency room costs, wait times and preventive care. These three measurable factors can be used to gauge quality and effective value of healthcare service. We looked at data spanning a few years prior to rollout of the ACA, through full implementation and the years since implementation. We investigated the relationship between emergency room costs and the implementation of the ACA using regression analysis to control for other factors. Next, we analyzed emergency room and physician wait times. To look at coverage of essential testing, we looked at routine tests for those living with diabetes and we checked if the ACA impacted the number of individuals who had routine testing.

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I. INTRODUCTION

The Patient Protection and Affordable Care Act (ACA) is a comprehensive care reform law that was enacted in March of 2010. The law was

brought about to address the lack of healthcare coverage seen in the American population and provide better health security. The law had 3 primary goals when passed (Healthcare.gov):

- 1) Increase the availability of health insurance to more people by ways of a tax credit (or subsidy), ensuring that the cost for those with incomes ranging between 100% - 400% of federal poverty level saw a lower cost for coverage.
- 2) Expansion of the Medicaid program to ensure coverage of all adults whose income is below 138% of the federal poverty level.
- 3) Lower overall cost of healthcare through the support of new medical care techniques and methods.

Additional items of note that the ACA addressed and/or improved are (Medicaid.gov):

- Ability of young adults to remain on their parent's insurance plans until age 26.
- Ability of consumers to acquire coverage regardless of certain pre-existing conditions.
- Ability of special populations to access healthcare.
- Emphasis on preventative healthcare - going so far as to require coverage for a certain set of recommended screenings.
- All consumers were required to have healthcare, whether through state funded avenues or private insurance. Those that did not have coverage were subject to a fee penalty.

From the introduction of ACA, Medicaid has enrolled millions of Americans who are low income, with disabilities, pregnant, elderly, and even children - all of whom receive benefits under the program. These benefits include a variety of inpatient and outpatient services including hospital, physician, laboratory, x-ray, and home health. With such a large undertaking, we sought to understand the actual expansion of services and coverage. In addition to this, we

worked to understand the improvement (or lack thereof) on quality of healthcare services since the inception of the ACA. Data collected indicates that as many as 20 million Americans gained coverage under the expansion of the ACA, leaving approximately 27 million individuals still uninsured and with significant barriers to healthcare. With the potential repeal of the ACA, recent data suggests that as many as 24 million persons currently with healthcare would lose their coverage and the services that come along with it (McMorrow and Polsky, 2016). These details and projections are especially important and have been a motivation for our analysis.

To our knowledge, a national level analysis on the effect of ACA on Emergency healthcare has not been done in the literature. Our observations on this topic are as follows: First, while coverage has increased under ACA we did not observe a noticeable increase in emergency room costs due to the implementation of ACA. Second, after reviewing emergency and physician wait times, we observe that the introduction of ACA was not followed by an increase in wait times for emergency services. Third, our analysis lead to the conclusion that ACA has not had a significant impact on number of ED visits related to heart conditions or mental disorders. We also observed that emergency department services as a percentage of hospital services shows a consistent percentage, implying that the growth in actual number of department services is in line with the growth of total hospital services in general. From all the above results, we have reached the conclusion that despite an increased number of population coverage, the emergency department services of hospitals have not had any disruption due to an uptick in demand. Finally, we observed that when patients had insurance, there was a greater frequency of participation in routine tests for

the secondary conditions caused by living with diabetes. The ACA can thus play an important role in getting patients to seek preventive care through expansion of coverage.

The rest of the paper is organized as follows: We summarize related literature in the next section. We explore the increase in coverage in Section 3. Then in Section 4, we discuss the impact of ACA on the cost of Emergency Department (ED) services. We analyze the utilization of ED and physician wait times and investigate if there has been a noticeable change after the introduction of ACA in Section 5. We explore changes in volume of ED services after ACA was introduced in Section 6. We explore if ACA has had a positive impact on preventative care in Section 7.

II. LITERATURE REVIEW

McMorrow and Polsky (2016) give a thorough and concise summary of the provisions and history of the years following the ratification of the Affordable Care Act and the opposition it faced at the state and federal level as well as some of its effect on coverage and access. They review the timeline for some of the more controversial topics involving women's health and contraception, Medicaid expansion, and pre-existing conditions, specifically how provision implementation was delayed due to state opposition and judicial contestation at the Supreme Court level. Kocher and Adashi (2011) describe strategies embedded in the ACA to reduce hospital readmission rates.

The effect of ACA on health insurance coverage has been extensively analyzed in the literature. Those who became insured from 2010 - 2015 under the tenure of the Affordable Care Act are broken down by Garrett and Gangopadhyaya (2016) into demographic groups based on age, gender,

race/ethnicity, education status, and state. Approximately 19 million under the age of 65, nearly three million of which were ages 18 and under, five million women ages 19 - 44 (childbearing years) obtained insurance. Among them 43% were non-Hispanic white and 87% were without a college degree. States which saw the greatest decline in uninsured populations had opted for Medicaid expansion.

Sommers et al. (2013) show how ACA has not only increased coverage but has also had a positive impact on access to care for young adults. Barnett and Vornovitsky (2016) give a deeper demographic breakdown in a shorter timeframe of the most recent years. Zammitti et al. (2016) bridge the gap of long-term insurance trends with a recent snapshot of 2010-2015 and Q1 2016 and highlight trends among the uninsured and recently insured. Chen et al. (2016) demonstrate a reduction in racial and ethnic disparities in health care access and coverage post ACA implementation.

A number of researchers have also looked at policy implications regarding the implementation of ACA. Blumenthal et al. (2015) review the effect of ACA on insurance expansion and reforms of the healthcare delivery system at the end of 5 years. Abrams et al. (2015) discuss payment reforms at the end of 5 years. Croft and Parish (2013) describe how ACA can help integrate behavioral and physical health care for people with co-occurring serious mental illness and substance use disorders.

The effect of ACA on utilization of healthcare services, which is the focus of our analysis, has also been investigated in the existing literature. Hernandez-Boussard et al. (2014) take a closer look at the young adult (19-25) segment of the uninsured population and uses evidence from three states to show their effect on emergency departments. Felland et al. (2016) also take a closer look

but from the perspective of hospitals that serve as safety nets for low socioeconomic status populations that most utilize their services, as well as the effect of the ACA expanded coverage on the institution's resources. Lassman et al. (2017) look at resources spent from state to state under ACA.

Sommers et al. (2015) use a regression analysis and find that ACA's two enrollment periods were associated with increased access to primary care and health using self-reported survey data. They focus on low-income adults and compare and contrast those in states that expanded Medicaid and those in states that did not expand Medicaid. Holahan et al. (2012) discuss the cost implications by state depending on their decision to adopt Medicaid expansion. Angier et al. (2015) find a 40% decrease in the rate of uninsured community health center visits in the post-expansion period. Wherry and Miller (2016) evaluate changes in access and utilization of health care with Medicaid expansion. They find increased visits to physicians, overnight hospital stays, and rates of diagnosis of diabetes.

We hope to contribute to this growing body of literature by performing a national level analysis on the effect of ACA on Emergency healthcare.

III. HEALTH INSURANCE COVERAGE – ACA'S CONTRIBUTION

After the introduction of ACA, a significant number of people were afforded public insurance and enrolled into Medicaid despite delays, resistance from certain states,

and delays with a Supreme Court ruling. The number of people afforded public insurance nearly doubled in count. Given the current U.S. political climate, there are large potential implications if the ACA is repealed including the reduction of significant items such as: coverage for children until they are 26, out of pocket expense caps and guaranteed essential health benefits.

Even though ACA was widely attributed as the reason behind millions of people getting coverage, some critics argued that it was simply following a trend. In this section we seek to compare the predicted coverage without ACA with the actual number of people enrolled after the implementation of ACA.

We compare the Medicaid data from Centers for Medicare & Medicaid Services (CMS, 2011) from 1991 through 2009, prior to ACA implementation, and 2010 through 2016, after ACA implementation. We used data from years prior to ACA implementation to predict the alternate version of Medicaid growth without the expansion ACA. We used regression analysis to forecast the enrollment. The output from our regression analysis is presented in the Appendix (Table A1). The forecasted enrollment number and the actual count of enrolled members under the plan are compared in Figure 1.

Based on the comparison, we see a difference of 16 million more of actual enrollments from projected enrollments, implying the positive impact of ACA's resources set aside for Medicaid expansion. In the literature review this is further supported with findings of total new Medicaid enrollment near 18 million (Carman et al., 2015).

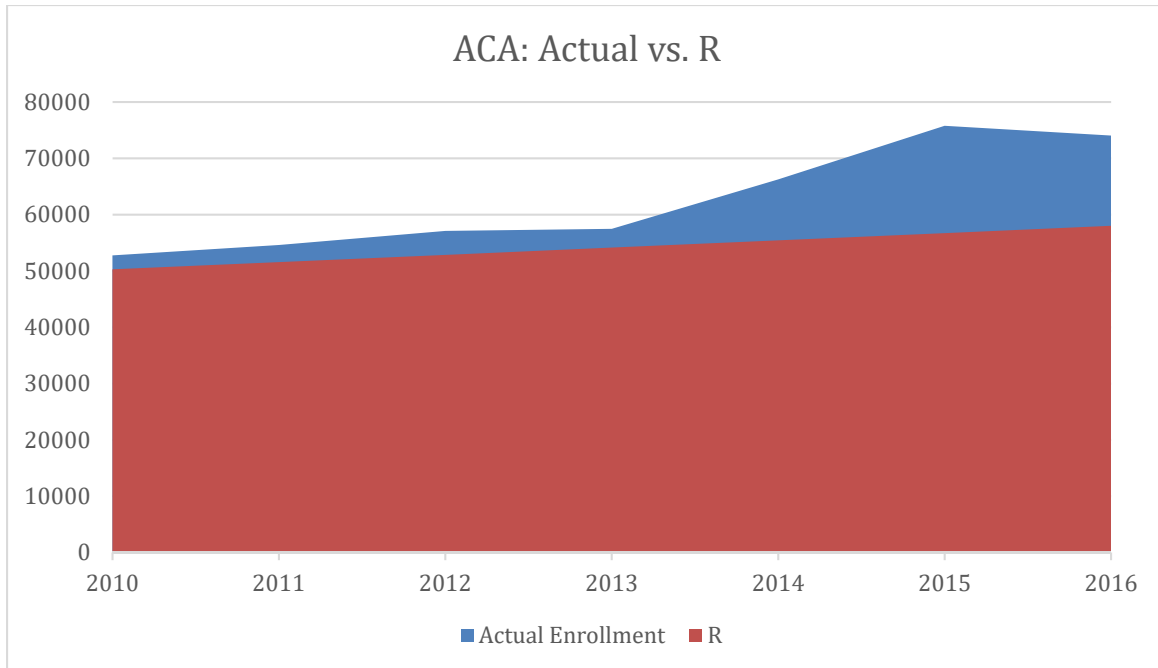


FIGURE 1. ACTUAL VS. PREDICTED (R) ENROLLMENT

IV. COST OF EMERGENCY DEPARTMENT SERVICES

In this section, we seek to analyze the cost of Emergency Room (ER) services to understand the impact of the ACA on the overall cost. We chose to look at ER services in particular because of the central role the ER holds in the U.S. healthcare system. As noted in a research study by Moranti et al. (2013) on the evolving role of ER services U.S. health care, emergency rooms function to diagnose patients who are displaying symptoms and either serve as a source for hospital admission or as a filter that prevents unnecessary hospital admissions by patients who can receive the care they need in a more cost-effective setting. The study also noted how the emergency room carries importance for serving patients who lack other affordable options for care, particularly those patients who are uninsured.

As one part of this analysis, we decided to look at the average price paid by consumers for emergency room services to see if implementation of the ACA has had an effect on the resources expended for emergency departments. This is often a point of contestation between proponents and opponents of the ACA as opponents will often cite the potential scenario in which emergency departments have to absorb a greater amount of costs due to increased enrollment by an increased number within the high-risk population that require services.

We obtained data from the Medical Expenditure Panel Survey from 2006-2014, spanning 4 years prior to ACA and nearly all the way through full implementation. From a cursory glance it is clear that the costs for ER services have continued to rise in spite of increased insurance coverage as also observed by Agency For Healthcare Research & Quality in its report (Feb 19, 2017). While ER services increase in cost to

the consumer each year, we ran a regression with the dependent variable being the average cost per person for ER services. In an effort to isolate the cause of the continued increase, we controlled for the following other independent variables: median income, percent of U.S. population uninsured, and percent living below poverty. Data for the independent variables were obtained from American Fact Finder, 2006-2014 (Barnett

and Vornovitsky, 2014). The data is presented in Table 1. We included a dummy variable to denote the time at which ACA started to get introduced. We tested the following hypothesis.

H₀: The average ER cost per person is the same post implementation of the ACA

H₁: The average ER cost per person is different post implementation of the ACA.

TABLE 1. DATA FOR REGRESSION ANALYSIS OF AVERAGE ER COST

Year	Cost of ER Services	Pre-ACA (0) vs. ACA (1)	Median Income	% In U.S. Below Poverty	% In U.S. Uninsured
2006	\$993.00	0	\$ 48,451.00	13.30%	15.80%
2007	\$ 1,038.00	0	\$ 50,740.00	13.00%	15.30%
2008	\$ 1,265.00	0	\$ 52,029.00	13.20%	15.40%
2009	\$ 1,318.00	0	\$ 51,425.00	14.30%	15.10%
2010	\$ 1,349.00	1	\$ 51,914.00	15.30%	15.50%
2011	\$ 1,354.00	1	\$ 52,762.00	15.90%	15.10%
2012	\$ 1,390.00	1	\$ 53,046.00	15.90%	14.80%
2013	\$ 1,423.00	1	\$ 53,046.00	15.80%	14.50%
2014	\$ 1,533.00	1	\$ 53,482.00	15.50%	11.70%

The regression model was run using all the above variables and a 95% CI. The result was an adjusted R² of 84%, noting that percentage of variation in ER cost can be explained by the chosen variables. The correlation values are presented in Table A2 in Appendix. The ANOVA significance factor was 0.0162, showing that at least one of the chosen independent variables has an effect on the cost of ER services. The variable we were particularly interested in was implementation of the ACA which had a p-value of 0.442. Therefore, we fail to reject the

null hypothesis, concluding that the ACA implementation is not a significant factor in changing (or increasing) the cost of ER services. However, none of the other variables in the regression was also significant. We ran another regression controlling just for the time period. This regression still had an adjusted R² of 84% and an ANOVA significance factor of 0.002. Time was a significant variable (p-value=0.009) and the ACA variable continued to be non-significant (p-

value=0.578). The regression summary is presented in Table 2.

TABLE 2. REGRESSION ANALYSIS ON AVERAGE COST OF ER

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	980.5	57.07519	17.17909	2.49E-06
Time	69.2	18.04876	3.834058	0.008618
Post-ACA	-55.1	93.78411	-0.58752	0.578279

We can conclude from this analysis that it is not the implementation of ACA that is driving up average costs of ER services, but instead it is positively affected by a time trend (or inflation), as also observed in the increasing median U.S. incomes.

V. EMERGENCY DEPARTMENT AND PHYSICIAN WAIT TIMES

In this section, we analyze Emergency Department and Physician wait times to better understand the availability (or lack thereof) of these services. Emergency rooms are in some cases seen as a place of last resort for persons that do not have medical insurance as demonstrated by Hernandez-Boussard (2014) and Felland et al. (2016). Those that forego regular routine healthcare are forced to go to emergency rooms once they have exhausted other options available. We are interested in looking at wait times for persons needing emergency room services as well as the time they spent waiting to see a physician once processed by the department. We look at these factors as another means of examining how the implementation of the ACA and increased enrollment in Medicaid has impacted emergency departments via a different finite resource that of waiting time

(as an addition to our cost analysis in Section 4).

We obtained data from the National Hospital Ambulatory Medical Care Survey. Figure 2 shows the distribution of wait times as a percentage of the overall visits made to the emergency room. There is a definite difference in the spread of wait times prior to 2010 as well as after, with the shift occurring in a fashion that shows that per the data available, persons visiting the Emergency Room spent less time waiting to see a physician. The numbers also show that the time a person spends in the emergency department also has a slight difference, though not as pronounced. This demonstrates that our population waited less time to see a physician but it did not necessarily translate to a shorter time period spent in the emergency room with the physician.

The numbers in Table 3 compare the distribution of wait times as a percentage of the overall visits made to the emergency room in thousands before and after ACA implementation on average. We next analyze using the data to determine whether the proportions of the various categories significantly changed after the implementation of ACA. We took the average of 3 years from 2008 to 2010 for a measure of the proportion before ACA implementation and we took the average of

proportions from 2011 to 2013 for an after-implementation measure. The z-scores and p-values for a 2-tailed difference in proportion tests are reported in Table 3. We observe that significantly more people waited for less than 15 minutes or, in other words, significantly more people were able to receive care

quickly. Also, the proportion of people spending less time at the ED was also significantly more. This shows that the introduction of ACA did not increase the load on emergency services. Future research could investigate if this is because of enhanced coverage for patients with ACA.

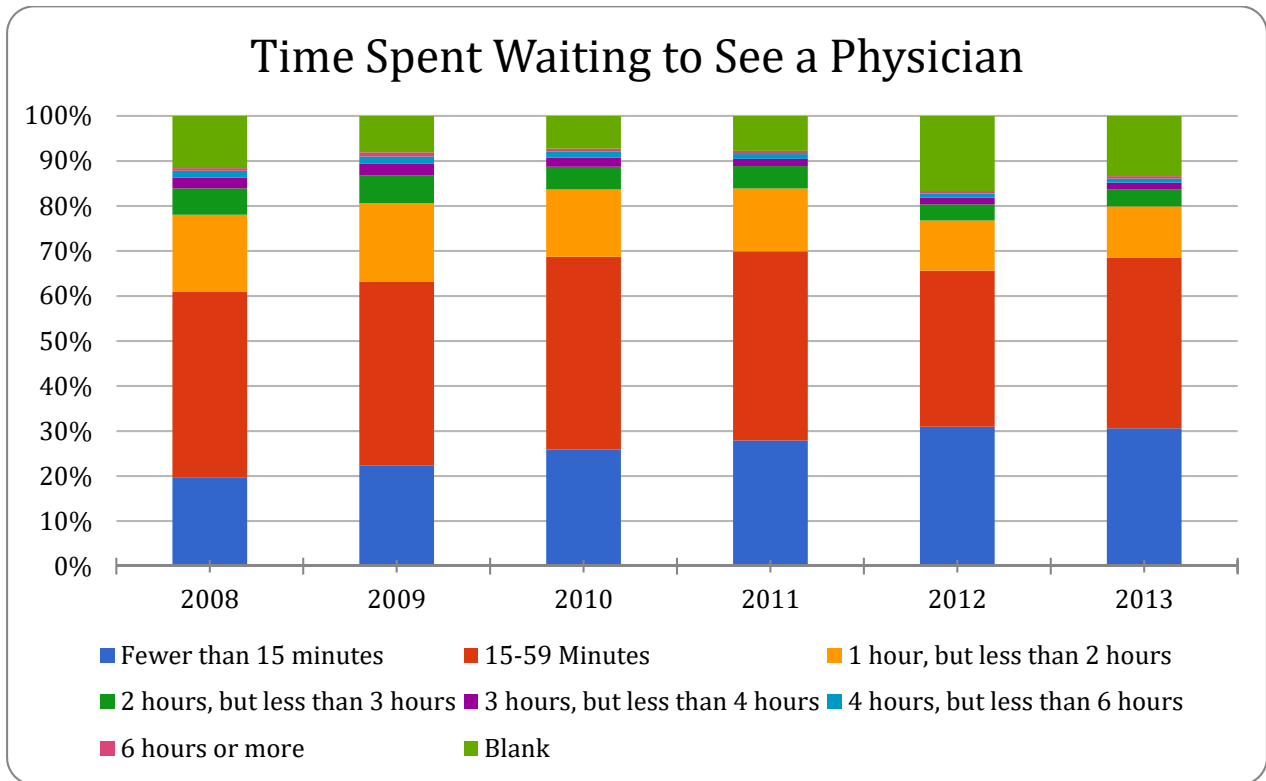


FIGURE 2. WAIT TIMES FOR EMERGENCY DEPARTMENT VISITS

We must note here that the number of visits increased after the ACA implementation (see Total visits in Table 3). One could expect the load to disrupt the services and delay care. In contrast, more patients are able to see a physician quicker. Future research can explore if there is an efficient triage system behind this improvement.

VI. EMERGENCY VISITS WITHIN TOTAL HOSPITAL SERVICES

We noted an increase in ER visits post ACA implementation (see Table 3). Hernandez-Boussard et al. (2014) found that the young adult (19-25) segment of the uninsured population in New York, Florida, and California had a decrease in ED visits. To further investigate our hypothesis about the implementation of ACA and its impact on emergency department services, we analyze the effects of ACA on the number of people seeking emergency department services from two different perspectives. First, we review the effect of ACA on number of people

seeking emergency visits related to prominent conditions such as heart disease and mental disorders when compared to number of people seeking any service related to these prominent conditions. The second perspective is broader in that we examine number of people seeking emergency

services in general in the context of total hospital services. Both analyses help understand if increased number of insured has impacted the emergency department services of hospitals with an abnormal change in demand.

TABLE 3. WAIT TIMES FOR EMERGENCY DEPARTMENT VISITS

	Before ACA	After ACA	Overall Average	Difference in proportions	
				z-score	p-value
Total Visits (in '000)	389676	397519			
Time spent waiting to see a physician					
Fewer than 15 minutes	21.61%	28.92%	25.30%	-74.58	0.00
15-59 Minutes	39.56%	37.12%	38.33%	22.27	0.00
1 - 2 hours	15.70%	11.83%	13.75%	49.79	0.00
2 - 3 hours	5.42%	3.98%	4.69%	30.02	0.00
3 - 4 hours	2.20%	1.49%	1.84%	23.37	0.00
4 - 6 hours	1.44%	0.94%	1.19%	20.34	0.00
6 hours or more	0.70%	0.59%	0.64%	5.99	2.08E-09
Not seen by a physician	4.96%	2.96%	3.95%	45.57	0.00
Blank	8.42%	12.16%	10.31%	-54.57	0.00
Time spent in emergency department					
Less than 1 hour	11.53%	11.98%	11.76%	-6.19	6.14E-10
1 - 2 hours	23.91%	24.07%	23.99%	-1.61	1.08E-01
2 - 4 hours	34.40%	34.09%	34.24%	2.94	3.26E-03
4 - 6 hours	15.26%	14.65%	14.95%	7.53	4.97E-14
6 - 10 hours	8.18%	7.27%	7.72%	15.13	0.00
10 - 14 hours	1.59%	1.61%	1.60%	-0.61	5.40E-01
14 - 24 hours	1.01%	1.17%	1.09%	-6.54	6.12E-11
24 hours or more	0.42%	0.72%	0.57%	-17.55	0.00
Blank	3.69%	4.45%	4.08%	-17.00	0.00

6.1. Treatment Services for Prominent Conditions

We used data from the Medical Expenditure Panel Survey (MEPS) beginning 1996 to 2014 taking annual data over the course of nearly two decades. We focused specifically on prominent conditions (i.e. heart and mental disorders) and compare different types services provided for those conditions, specifically all services, provider visits, and emergency department. While MEPS data was available from 1996 for heart

conditions it was only available from 2001 for mental disorders.

Figures 3-6 display a continued rising trend for number of people seeking services with the 2010 implementation period set as the benchmark (vertical line in the charts). In juxtaposition, we see number of people seeking emergency department services for these conditions remain relatively flat over the decades including post 2010 (Figures 3 and 5) and even as a percentage of all services provided, it does not show an upward trend post 2010 (Figures 4 and 6).

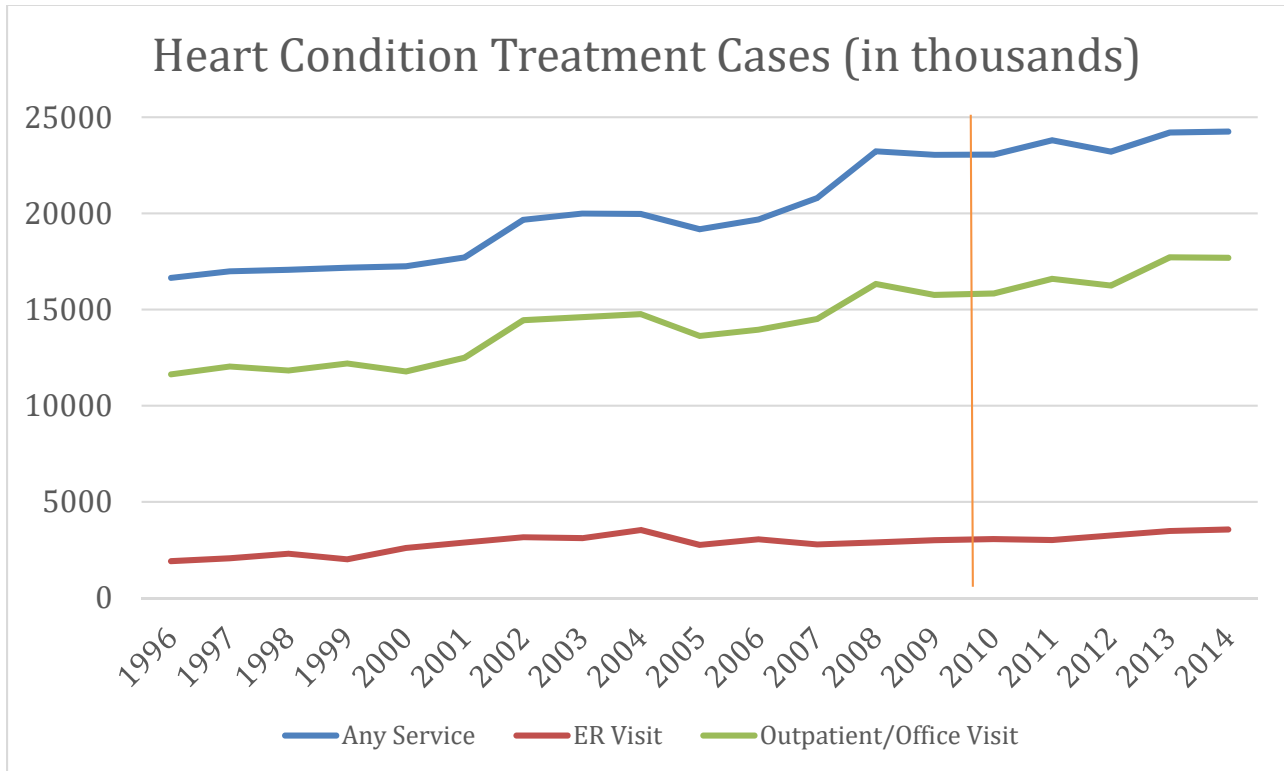


FIGURE 3. TOTAL NUMBER OF PATIENTS WITH HEART RELATED CONDITION SEEKING HEALTHCARE SERVICE (IN ‘000) 1996-2014

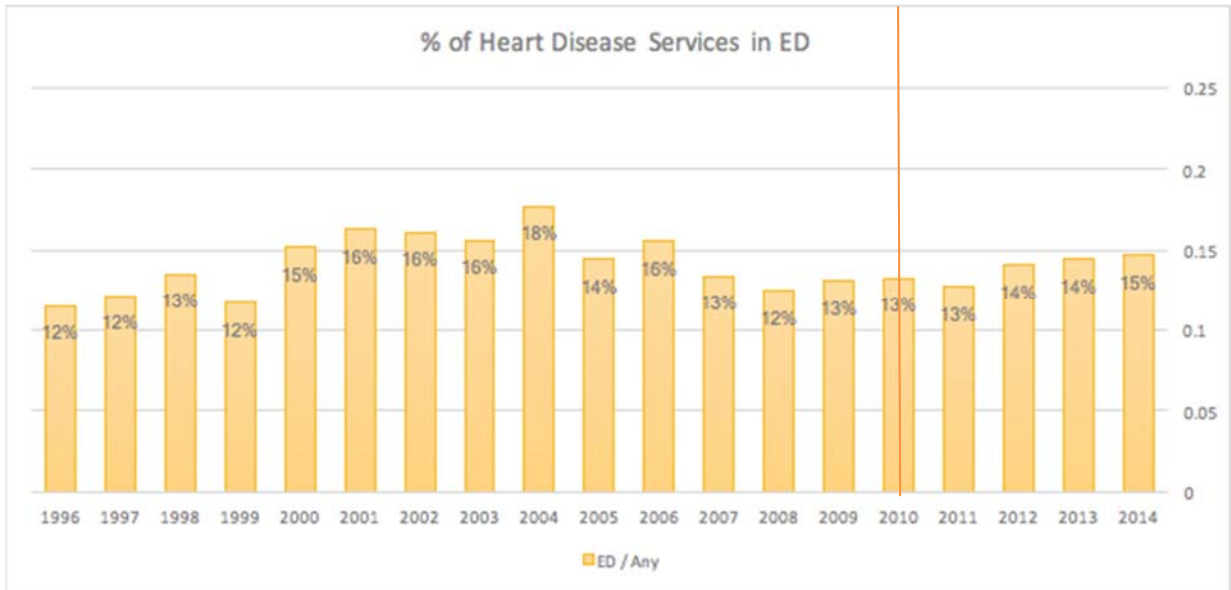


FIGURE 4. PERCENT OF PATIENTS WITH HEART CONDITION RELATED CONDITION SEEKING ED VISITS 1996-2014

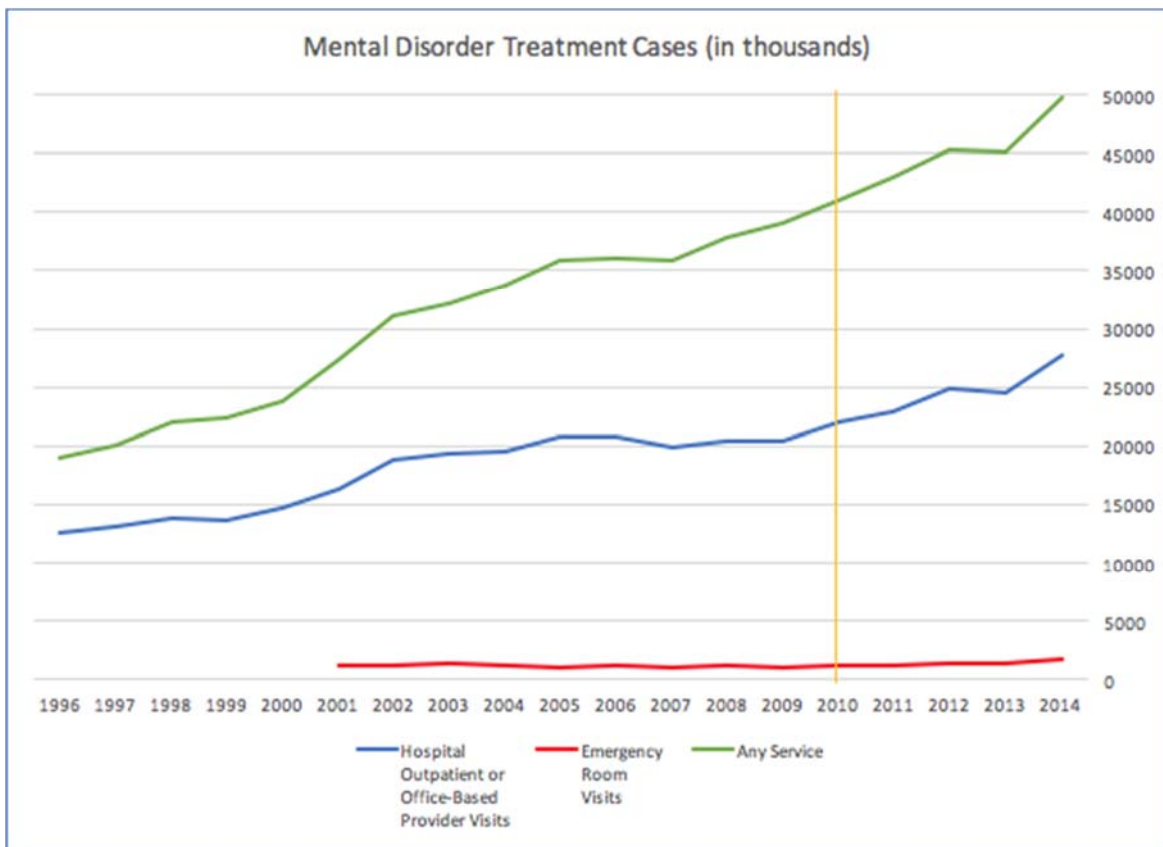


FIGURE 5. TOTAL NUMBER OF PATIENTS WITH MENTAL DISORDER RELATED CONDITION SEEKING HEALTHCARE SERVICE (IN '000) 2001-2014

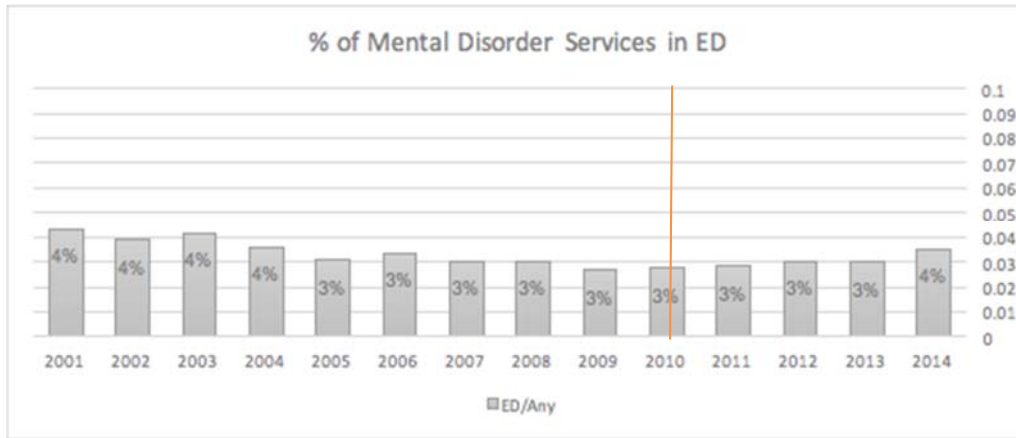


FIGURE 6. PERCENT OF PATIENTS WITH MENTAL DISORDER RELATED CONDITION SEEKING ED VISITS 2001-2014

We also checked the robustness of our observation with a regression analysis on both number of people with heart related condition seeking ED visits and number of people with mental disorder related condition seeking ED visits controlling for time period and ACA implementation (dummy variable with “1” from 2010 and “0” before 2010). The regression summary is presented in Tables 4 and 5 respectively. The time trend was significant for number of people with heart related condition seeking ED visits (p-value=0.0006) but not for number of people

with mental disorder related condition seeking ED visits (p-value=0.94). The implementation of ACA did not significantly affect both the variables (p-value=0.319 and 0.164 respectively). This suggests that an increase in number of people seeking ED visits related to heart conditions post 2010 is just following the trend and is not related to the implementation of ACA. Similarly, the implementation of ACA has no impact on number of people seeking ED visits related to mental disorders.

TABLE 4. REGRESSION ANALYSIS ON NUMBER OF PATIENTS WITH HEART CONDITION SEEKING ED VISITS

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	2081.241	173.1098	12.02266	2E-09
Time	85.46316	20.2313	4.224304	0.000645
ACA	-258.514	251.6454	-1.0273	0.319562

TABLE 5. REGRESSION ANALYSIS ON NUMBER OF PATIENTS WITH MENTAL DISORDER SEEKING ED VISITS

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	1176.15	102.2487	11.50284	1.79E-07
ACA	223.8872	150.2507	1.490091	0.164305
Time	-1.2967	17.85945	-0.07261	0.943423

6.2 Emergency Visits vs. Total Services

In addition to the services specific to prominent conditions such as heart disease and mental disorders, below we take data from the Medical Expenditure Panel Survey (MEPS) to look at emergency departments in the context of total hospital services to show a more comprehensive picture than that of specific conditions.

Using this alternative lens, we look at total number of persons seeking emergency room visits in millions. Figure 7 showcases the numbers from 1996-2014. We checked if the dip in 2013 is an outlier with respect to the slope from 1996-2014 (and also from 2010-2014). The standardized residual score is -1.03 (-1.6) and hence we conclude that it is not an outlier.

Figure 8 further supports our hypotheses that there is no additional burden on emergency departments after the implementation of ACA. The chart displays number of persons seeking ER visits as a percentage of number of persons seeking any hospital service. The percentages remain consistent beyond 2010 despite the uptick in actual number of persons seeking ER visits (Figure 7), indicating that this uptick in actual number of persons seeking ER visits is merely a component of an uptick in total number of persons seeking any hospital service.

Again, we checked the robustness of our observation with a regression analysis and the summary is presented in Table 6. The ACA implementation turned out to be insignificant (p-value=0.22) when controlled for time trend.

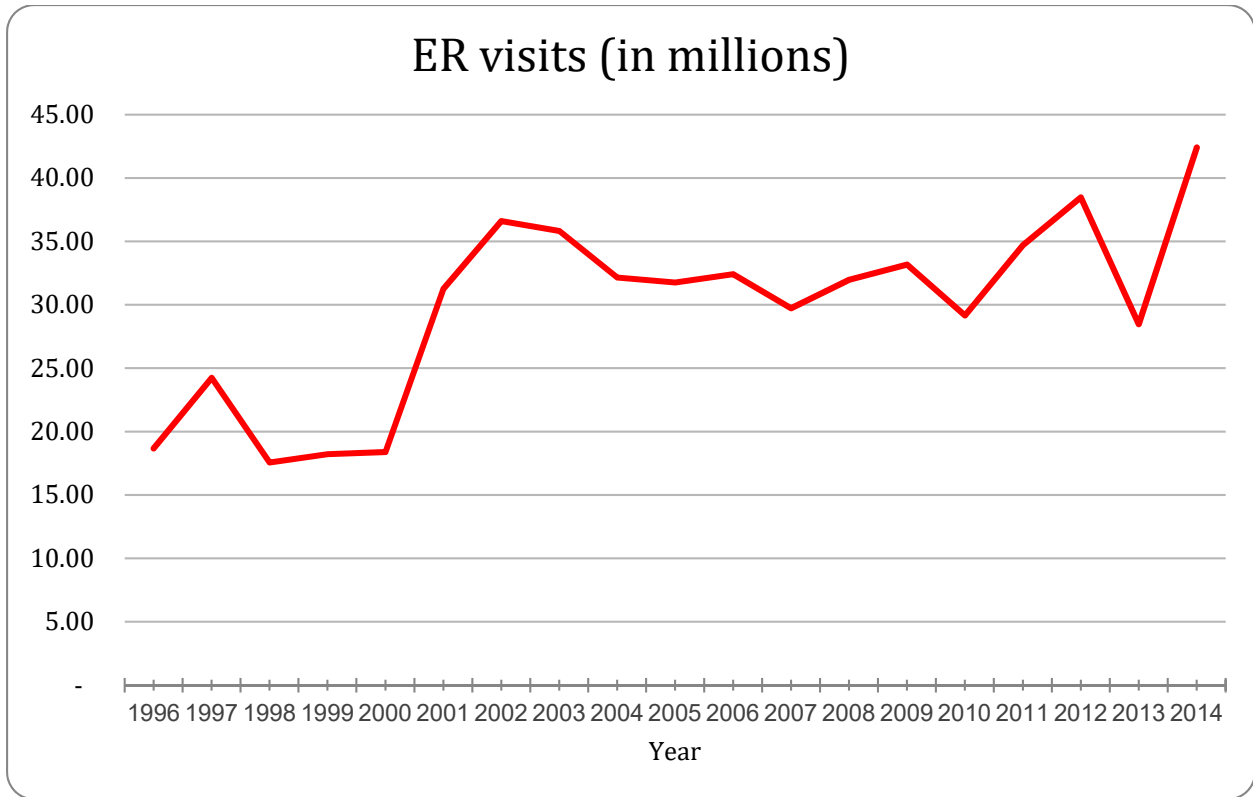


FIGURE 7. ER VISITS IN MILLIONS 1996-2014

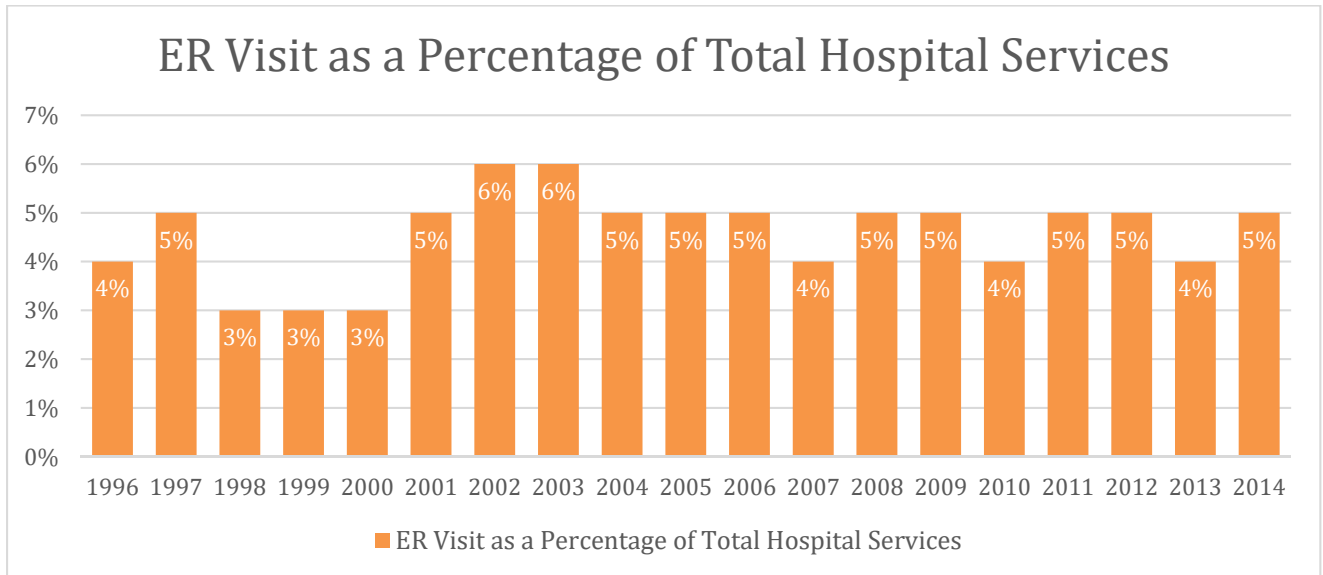


FIGURE 8. ER VISITS AS PERCENTAGE OF TOTAL HOSPITAL SERVICES 1996-2014

TABLE 6. REGRESSION ANALYSIS ON TOTAL ED VISITS

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>
Intercept	18.65967	2.827156	6.600156	6.11E-06
Time	1.245663	0.330409	3.770065	0.001675
ACA	-5.18794	4.109765	-1.26235	0.224915

VII. COVERAGE AND PREVENTATIVE CARE

In this section, we seek to analyze the behavior of people in terms of the measures they take toward preventive care. One aspect to consider in judging the quality of healthcare services in the US is whether those living with chronic health concerns are able to afford routine tests that are appropriate for their condition. For this study, we chose to consider tests for people living with diabetes. This was our focus due to the prevalence of people with diabetes. Per the American Diabetes Association, 1.4 million Americans get diagnosed with diabetes every year. Diabetes is the seventh leading cause of death and there are various secondary complications which lower quality of life including and not limited to: toe, foot, or leg amputation.

Specifically, we investigate if there are any differences in routine examination rates of those with and without insurance. Additionally, we compare the forecasted number of this demographic expected to be examined prior to implementation of the

ACA in juxtaposition with the actual numbers that were reported after the implementation of the ACA.

7.1. Routine Exams for Diabetics

Routine examinations are crucial in preventing and minimizing specific complications in chronic conditions. We obtained data from the Medical Expenditure Panel Survey (MEPS) on diabetes and the specific service of foot examinations. In reviewing the number of patients with diabetes who had a routine foot examination compared with those who did not 5 years before and after the 2010 ACA implementation (see Figure 9), two observations are made. First, the number of patients who had a routine exam has been steadily increasing from 2005 and more or less remained the same after 2010. Second, patients who were uninsured are less likely to have an exam when compared to patients who have insurance (whether private, public, or Medicare). Having insurance is therefore likely to be a crucial factor in people with diabetes receiving the care they need.

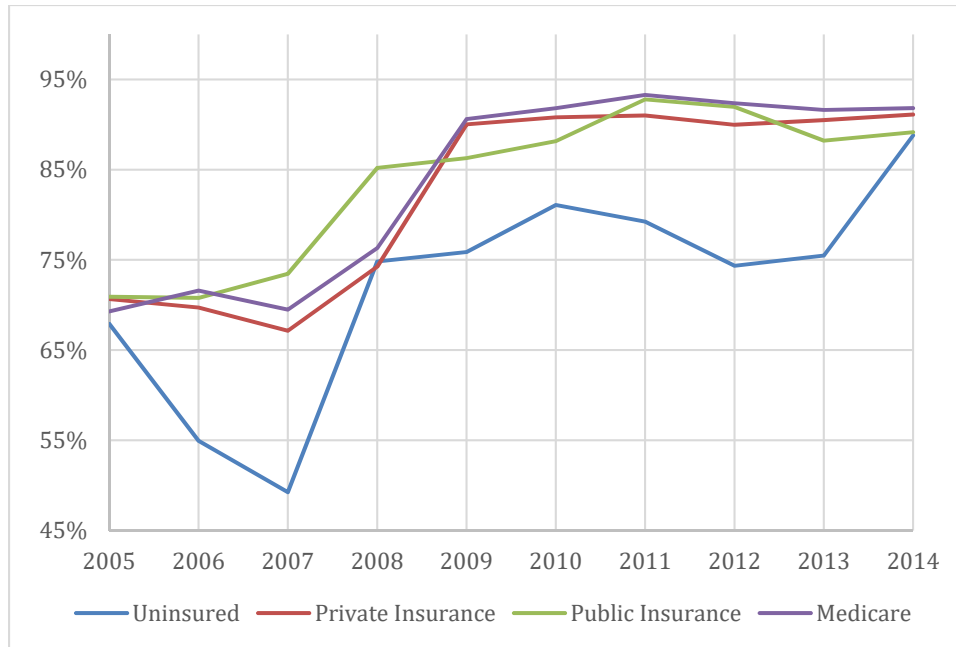


FIGURE 9. PERCENTAGE OF DIABETES PATIENTS WHO HAD A FOOT EXAM

We next perform statistical tests to confirm the robustness of our observations. To compare the percentage of patients taking the exam for those with insurance (whether public, private, or Medicare) with those without insurance, we tested the following hypothesis.

H₀: The average proportion of patients uninsured who take the exam is greater than or equal to that of the patients who are insured.

H₁: The average proportion of patients uninsured who take the exam is less than that of the patients who are insured.

Among patients who were uninsured 72% had a foot exam on average and the corresponding figure for those who had an insurance is 83%. The p-value for the 1-tailed test came out to be 0.02 and hence the difference in the average proportion is

significant and we reject the null hypothesis. Having insurance is therefore a significant factor in people with diabetes receiving the care they need.

Next, we compare the percentages before and after the implementation of ACA. We take the average of the percentage of patients who had an exam before ACA (2005-09) and compare it with the average after ACA (2010-14). The z-scores and p-values for a 2-tailed difference in proportion tests are reported in Table 7. We observe that significantly more patients took a routine exam after the implementation of ACA. Our finding is similar to that of Sommers et al. (2015) who found that ACA's two enrollment periods were associated with increased access to primary care and health using self-reported survey data.

TABLE 7: PERCENTAGE OF PATIENTS WHO HAD A FOOT EXAM

	Before ACA	After ACA	Overall Average	Difference in proportions	
				z-score	p-value
Overall	74.76%	90.52%	83.19%	77.97	0.00
Uninsured	64.77%	79.67%	72.74%	14.92	0.00
Private Insurance	74.42%	90.69%	82.52%	49.00	0.00
Public Insurance	77.48%	90.05%	84.63%	22.84	0.00
Medicare	75.95%	92.15%	84.98%	55.03	0.00

We note here that the percentage has improved even among the uninsured. Whether this is due to a structural change in awareness, a network effect (through friends), or other factors needs to be investigated further.

VIII. CONCLUSION

The Affordable Care Act remains a contentious topic throughout politics. It is impossible to deny the impact the ACA has made on the lives of Americans who never would have been eligible for insurance before the implementation of the ACA. We forecasted the Medicaid enrollment using pre-ACA data to simulate an alternative timeline with no ACA implementation and compared it with actual enrollment. Based on the comparison, we see a difference of 16 million more of actual enrollments from projected enrollments which implies the positive impact of ACA's resources set aside for Medicaid expansion. The additional individuals who were able to obtain coverage post ACA may lose their medical coverage should Congress repeal the ACA and its expansion of Medicaid.

One of the primary arguments for opposing the ACA assumes that additional patients would reduce or diminish the overall quality of healthcare in the form of resources stretched. We next tested this claim by analyzing emergency room costs and wait times.

First, emergency room costs revealed a steadily growing trend that began before the ACA was implemented. Using regression analysis and controlling for time we did not observe a noticeable increase in emergency room costs due to the implementation of ACA. We therefore attribute the rising emergency room costs to inflation (similar to the rising median income in the United States) and it is not the ACA that is driving up average costs of ER services.

Second, after reviewing emergency and physician wait times, we observe that our population waited less time to see a physician but it did not necessarily translate to a shorter time period spent in the emergency room with the physician. We next analyzed statistically if the proportions of patients spending various time intervals significantly changed after the implementation of ACA. We observe that significantly more people were able to receive care more quickly. Also,

the proportion of people spending less time at the ED was also significantly more. This shows that the introduction of ACA was not followed by an increase in wait times for emergency services. Future research can explore if an efficient triage system is behind this improvement.

Third, our analysis of the effects of ACA on the number of people seeking emergency department services related to prominent conditions such as heart disease and mental disorders, when compared to number of people seeking any service related to these prominent conditions, lead to the conclusion that ACA has not had a significant impact on number of people seeking ED visits related to heart conditions or mental disorders. We also examine the number of people seeking emergency services in general in the context of total hospital services. Here, we see number of people seeking emergency department services generally increase in the post-ACA era, however an examination of number of people seeking emergency department services as a percentage of number of people seeking any hospital service shows a consistent percentage, implying that the growth in actual number of people seeking department services is in line with the growth of number of people seeking any hospital service in general. From all the above results, we have reached the conclusion that despite an increased number of population coverage, the emergency department services of hospitals have not had any disruption due to an uptick in demand.

Finally, we analyze the behavior of people with diabetes, specifically for any differences in the routine examination rates of those with and without insurance. We observed that when patients had insurance, there was a greater frequency of participation in routine tests for the secondary conditions caused by living with diabetes. When these secondary health concerns such as foot

problems are managed early on, more expensive and intrusive procedures such as amputation can be prevented. Chronic conditions, if left unchecked, undermine healthcare costs in the long term and hence such preventive tests can go a long way in controlling healthcare costs. The ACA plays an important role in this issue.

We note here that our report examined data from an aggregated national level given the lack of more specific state-level data. It is not clear if states have established the appropriate infrastructure and information systems to collect the data given the recent implementation of the ACA (officially 2010 but in many places later due to contestation and political opposition). For a robust analysis heterogeneity among the different states will need to be incorporated. We also did not control for the total population when we looked at total number of people seeking ED service.

Further research is required from the complimentary viewpoint of costs absorbed not by the institutions but by the individuals in the form of out-of-pocket expenses. Similar to a granular analysis at the state level, while we examined prominent conditions such as heart disease and mental disorders, various other medical conditions could also be examined to breakdown which services have been affected most by the implementation of the ACA.

Healthcare is a more complex system than the factors we reviewed. There is an abundant amount of captured data points, numerous variables outside the institutions (i.e. financial and political), quantitative and qualitative, that are unknown. With the information extrapolated from our own data, we conclude that the Affordable Care Act did not negatively impact the overall healthcare service quality in the United States even though several individuals obtained coverage.

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APPENDIX

Table A1: Summary Output of Regression Analysis of Enrollment 1990-2009

Regression Statistics	
Multiple R	0.963225209
R Square	0.927802803
Adjusted R Square	0.923555909
Standard Error	2081.607762
Observations	19

ANOVA

	Df	SS	MS	F	Significance F
Regression	1	946633915.5	946633915.5	218.466204	3.91079E-11
Residual	17	73662544.91	4333090.877		
Total	18	1020296460			

	Coefficients	Standard Error	t Stat	P-value
Intercept	-2540006.895	174378.5633	-14.56605013	4.9287E-11
Medicaid enrollment	1288.705263	87.18895468	14.78060229	3.91079E-11

Table A2. Correlation Values for Regression Analysis on ER cost per person (2006-2014).

	Cost of ER services
Cost of ER services	1
Pre-ACA vs ACA	0.769
Median income	0.919
% Uninsured	-0.676
% Below poverty	0.827