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Impact of Affordable Care Act on gender specific HPV Vaccine coverage: Analysis using NIS-Teen Data from 2008-2016

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An abstract of A thesis submitted to the Faculty of the Rollins School of Public Health of Emory University in partial fulfillment of the requirements for the degree of Master of Public Health in Global Health

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Abstract

Impact of Affordable Care Act on gender specific HPV Vaccine coverage: Analysis using NIS-Teen Data from 2008-2016.

By Palak Patel

Background: The Affordable Care Act (ACA) was one of the biggest health reforms in American history. Key aim of ACA was to require insurance coverage for immunization services recommended by the Advisory Committee on Immunization Practices with no cost sharing, while also providing a means to expand Medicaid coverage for states that choose to do so. We assessed the impact of Medicaid expansion on human papillomavirus vaccine uptake, following passage of the ACA.

Methods: We analyzed National Immunization Survey-Teen (NIS-Teen) data from 2008 to 2016, using Poison Regression to calculate the average annual change in rates of HPV vaccine coverage, among states that expanded Medicaid, compared to those that did not expand Medicaid, relative to the year of expansion.

Results: States that expanded Medicaid had a lower average annual rate of change for HPV vaccine coverage during the pre-expansion years compared to the non-expansion states in the same years, but had a higher average annual rate of change for HPV vaccine coverage in the post-expansion years compared to non-expansion states after stratification by poverty status.

Conclusions: HPV vaccine coverage increased more rapidly in the states that expanded Medicaid though with limited years of follow-up post-Medicaid expansion, we were limited in our ability to assess statistical significance of these findings. Continued monitoring of changes in HPV vaccine rates post-ACA is needed to understand continuing barriers to HPV vaccine uptake.

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I would like to dedicate this project to my fiancé, Kadam Patel, without whom a career in Public Health would not have turned into reality.

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CHAPTER I:
MANUSCRIPT

Introduction

Human papillomavirus (HPV) affects approximately 80 million Americans with about 14 million becoming newly infected each year . Although 9 out of 10 HPV infections tend to heal on their own, the ones that last can lead to certain cancers and conditions [1]. HPV causes approximately 30,700 cancers annually, these include cervical, vaginal or vulvar cancers in women, penile cancer in men as well as anal and throat cancers [1].

The Advisory Committee on Immunization Practices (ACIP) recommends vaccination against human papilloma virus to prevent against HPV infections and related conditions at age 11 or 12 years. HPV vaccine coverage has been suboptimal, with an initial surge in uptake between 2006 till 2011 followed by a levelling effect to around 60-65% up till 2016 for at least one dose of HPV vaccine amongst females [2]. HPV vaccine coverage tends to differ by gender as well, due to the vaccine being recommended for females only initially.

A study by Holman et all reported that providers often stated cost of vaccination and parental concerns as leading barrier for the vaccine uptake [3]. Another study done in a high cervical cancer rate area discovered that 68 % of medical practices reported concerns with inadequate reimbursement, concerns regarding high patient cost for vaccine and burden of determining insurance coverage were reported by 66% of the practices [4], thus highlighting that financial barriers may contribute to the continued suboptimal vaccine coverage [3,4].

In March 2010 the Affordable Care Act (ACA) was passed to provide health care reform. It aimed to make health insurance available to increased number of people and at affordable rates along with expanding the Medicaid program to cover individuals with income less than 138% of federal poverty level [5]. Many states opted for extension throughout the year 2010-2015,

however certain states chose not to take part in Medicaid Expansion and continue to do so at present (Figure 1). Since 2013, approximately 16 million Americans that were previously uninsured have been able to obtain health insurance by 2016 [6]. The states that chose not to participate in Medicaid expansion still continue to have 10% of its population on an average uninsured [6]. The ACA covers a wide range of preventive services including vaccination for HPV [7]. HPV vaccine has proven to be an essential preventive measure. However, the uptake rate continues to lag behind other vaccines even though the uptake has increased in recent years.

The purpose of this study is to examine the difference in HPV vaccine uptake before and after Medicaid Expansion in the United States amongst female adolescents. We hypothesize that the HPV vaccine uptake rates would increase more rapidly in the states that expanded Medicaid compared to those that did not expand Medicaid.

Methods:

Analysis were conducted using the National Immunization Survey-Teen (NIS-Teen) data from 2008 through 2016[8]. The Centers for Disease Prevention and Control conduct the NIS-Teen survey to collect coverage data on vaccines recommended by the ACIP. It is a cross-sectional household survey done via random digit dialing of parents or guardians of teens 13-17 years of age that reside in the United States at the time of the interview, followed by a questionnaire mailed to vaccination provider to obtain vaccination history upon consent from the parent or legal guardian [8].

SAS, version 9.4 (SAS Institute, Inc., Cary, North Carolina), was used to perform the analysis using PROC GENMOD and PROC SURVEYFREQ along with appropriate sampling weights using all the instructions provided in the data user's guide [9]. As the variables differed over time, to allow for consistent comparison as indicated in the data user's guide, new variables

were created to allow consistent analysis over multiple years datasets. We grouped states according to whether or not they participated in Medicaid expansion, by the year they expanded Medicaid [10,11]. To allow utilization of all available pre-ACA data, we restricted analysis to females, for whom HPV vaccine was recommended since 2006. We excluded Connecticut (Medicaid expansion in 2010) and States that expanded Medicaid in 2015 from the analysis due to limited data before and after expansion, respectively [10,11].

We used Poisson Regression to calculate the average annual difference in vaccine coverage rates for the pre- and post-Medicaid expansion periods for both HPV and Tdap vaccine uptake. For the states that did not expand Medicaid, we considered them as a separate group coded for analysis against each group of Medicaid expansion states by year. For example, for the 2012 expansion states, we considered 2008 to 2011 as the pre-expansion period, and 2013 to 2016 as the post-expansion period. Similarly, for this comparison, we considered non-expansion states stratified in the same fashion (2008-2011 and 2013-2016) (Figure 1). We computed the ratios and confidence intervals of the average annual rates of change to allow for comparison, in both unadjusted models and in regression models adjusted for potential confounders such as parent's education level, race and ethnicity and whether the child had a 11-12-year-old check up with the provider.

Additionally, we stratified the analysis by poverty status (at/above poverty versus below poverty). Since the study was designed to conduct secondary analysis using previously collected publicly available de-identified dataset, it did not require an Institutional Review Board approval as it was considered to be non-human subject research.

Results:

The average annual rate of change for HPV vaccine uptake in states that expanded Medicaid in 2012, in the pre-expansion period, was 8.8% lower than in states that did not expand Medicaid, for the same period. However, for states that expanded in 2013 and 2014, the average annual rate of change for HPV vaccine uptake was 1.1% lower and 0.3% higher respectively, compared to Non-Medicaid expansion states. For individuals above or at poverty level, the expansion states had an 9.4% (2012), 1.4% (2013), and 1.2% (2014) lower average annual change than non-expansion states for those same periods. For individuals below the poverty level, the expansion states had an 0.6% (2012), 0.7% (2013) lower and 7.2% (2014) higher average annual change than non-expansion states for those same periods.

In the post-expansion period, the average annual rate of change was 4.1% higher than in states that did not expand Medicaid, for the same period. However, for states that expanded in 2013 and 2014, the average annual rate of change for HPV vaccine uptake was 3.2% higher and 0.3% lower respectively, compared to Non-Medicaid expansion states. For individuals above or at poverty level, the expansion states had an 3.3% (2012), 3.9% (2013), and 2.3% (2014) higher average annual change than non-expansion states for those same periods. For individuals below the poverty level, the expansion states had an 5.5% (2012), 2.6% (2013) higher and 3.5% (2014) lower average annual change than non-expansion states for those same periods.

A similar, though weaker, pattern was observed for the pre-expansion average annual rate of change for Tdap vaccine uptake: expansion states had an 6.7% (2012), 0.9% (2013), and 1.5% (2014) lower average annual change than non-expansion states for those same periods. For individuals above or at poverty level, the expansion states had an 7.3% (2012), 1.0% (2013), and 2.2% (2014) lower average annual change than non-expansion states for those same periods. For

individuals below the poverty level, the expansion states had an 5.2% (2012), 1.2% (2013) and 0.9% (2014) lower average annual change than non-expansion states for those same periods.

In the post-expansion period, the average annual rate of change for Tdap vaccine uptake was 1.7% (2012) lower, 0.9% (2013), 2.1% (2014) higher in expansion states than non-expansion states for those same periods. For individuals above or at poverty level, the expansion states had an 2.1% (2012) lower, 0.8% (2013), and 4.2% (2014) higher average annual change than non-expansion states for those same periods. For individuals below the poverty level, the expansion states had an 0.3% (2012) lower, 4% (2013) higher and 2.5% (2014) lower average annual change than non-expansion states for those same periods.

Discussion

This study examined the potential impact of the Affordable Care Act Medicaid expansion provisions on HPV vaccine uptake. In our initial analysis, not adjusted for demographic and healthcare seeking factors, we observed that while states that did not expand Medicaid had a higher rate of vaccination during the pre-expansion period, states that expanded Medicaid demonstrated a larger increase in vaccine coverage rates in the post-expansion period (Table 1). Notably, this held true even after stratification by poverty status and accounting for different expansion timelines. Interestingly, when accounting for demographic and healthcare seeking factors, these associations were attenuated, potentially highlighting the increased impact of routine adolescent check-ups as part of preventive care services covered under the ACA, which were one of the factors accounted for [7].

Because HPV vaccine uptake has demonstrated a plateauing effect in recent years, we utilized a methodology to assess average annual change in vaccine coverage, rather than modeling raw vaccine coverage levels due to the non-linear nature of vaccine uptake over time.

This is in contrast to the study by Corriero et al. which only assessed the raw ACA implementation coverage rates using the National Health and Nutrition Examination Survey (NHANES) data, without accounting for timing [12]. Even with these different methodologies, our study similarly found a positive impact of Medicaid expansion on HPV vaccine coverage.

These findings are in-line with assessments of other preventive services related to Medicaid expansion, which found that females were more likely to opt for preventive services such as HPV vaccination rather than pap smears and mammography if the cost was substantially reduced or free [13,14]. Additionally, that study indicated that even though the increase in coverage maybe due to increased awareness regarding the HPV vaccine, it was likely not a major contributing factor to increase in uptake.

Insurance coverage is a key determinant of individuals accessing vaccination services. As cited by Lu et al., adult women with insurance were more likely to seek vaccinations such as TDAP, Td, Influenza, hepatitis A, Hepatitis B, Pneumococcal and HPV vaccine compared to women with no insurance [15]. Taken together with our findings, this highlights the importance of increasing access to health insurance coverage. This is important, as 19 states have not expanded Medicaid [10,11]. While not all 16.5 million adolescents residing in these states would be eligible for Medicaid, there is still a substantial proportion of the population who do not have access to increased preventive services due to non-expansion of Medicaid [16].

This study had several limitations. First, we were limited in the number of years of follow-up data available, only up to 2016. Additionally, as a routine recommendation for HPV vaccination for males did not come until 2011, there was insufficient pre-expansion data to assess changes in HPV vaccination for males. Given how certain states expanded Medicaid later (Ex. 2014 or 2015), it was difficult to get data for years post expansion to see whether expansion

indeed had an effect on uptake. There should be continued monitored as more years of information post-expansion are available. Another factor was the coverage for HPV vaccination levelled off after the initial increase creating a plateau, which made it difficult to directly estimate the true effect of Medicaid expansion on overall coverage. NIS-Teen data assesses insurance coverage; however, the variables were inconsistent over the years, which precluded utilizing these data in the main analysis. Also, there were missing values for some of the variables that had to be accounted to estimate the effect of the expansion on coverage. Therefore, we were restricted to conducting a more of an ecological assessment at a state level due to these limitations. Using NIS-Teen dataset allowed us to generalize our findings to a larger population as it is a national survey occurring each year and the variables used had been verified by a provider, to avoid errors due self-reported data.

Overall, this study supports the hypothesis that Medicaid expansion was associated with greater increases in HPV vaccine uptake. Poverty level had an effect on coverage during the pre-expansion years as the annual average rate of change differ by the strata of poverty. However, it's effect diminishes in post-expansion years as the annual average rates of change were similar in at/above poverty and below poverty strata. More research is necessary in the future to assess trends specific to insurance variables as well continued trends monitoring especially by gender may prove beneficial. Hence this indicates that vaccination uptake could be affected by all these different factors and we need to continue to monitor for it in order to determine the populations that continue to remain underserved. As time passes with availability of more data, the clear benefits of ACA in the preventive services could be identified.

CHAPTER II:
PUBLIC HEALTH IMPLICATIONS

Although the limited availability of follow-up data may have been a major contributing factor in rendering the findings insignificant. The patterns that emerged are essential for recognizing the setbacks in quantifying the impact of Medicaid expansion. Since this study has the potential to be scaled up to include male adolescents with the availability of data over the years, the impact may become clearer.

One of the nuances highlighted by this study was the diminishing effect of poverty level on HPV vaccine uptake after Medicaid Expansion. Pre-expansion the coverage was variable across different poverty strata. However, post-expansion the variability within poverty levels reduced.

There are still 19 states that have not undertaken part in Medicaid Expansion, comprising of approximately 1.6 million adolescents that may potentially continue to remain uninsured (based on an average 10% rate of uninsured population under 65 years of age in these states) [6,14]. Even though not all of the uninsured adolescents may be eligible for Medicaid, a vast majority would benefit from it. It is possible that the true impact of ACA remains masked due to limitations with data availability. However, future areas of research can expand on the uptake status and explore if disparities exist by gender, type of insurance and ethnicity. This potential increase in data compilation could help identify underlying causes in a statistically significant way.

Efforts should be continued to increase awareness regarding HPV vaccine amongst parents and providers and mitigate possible barriers that arise in the process. With this, the plateauing effect of the HPV vaccine uptake may be overcome and an uptake rate above 80%

could be achieved. Future studies may also benefit from this study for comparison purposes. It may also provide insight to policy makers regarding the amount of time needed for the effect of a policy change to become visible. And thus, aid officials to weigh the consequences and effects of decision making regarding future policies or interventions.

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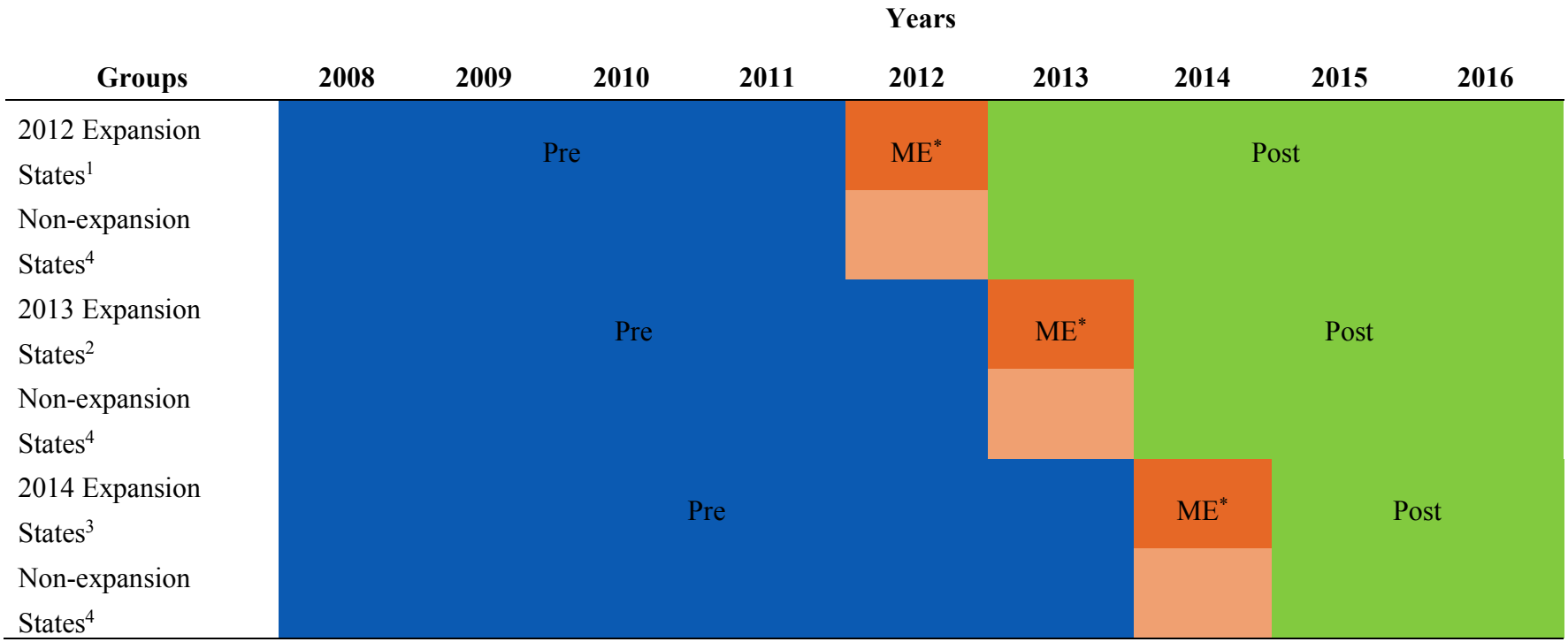
Table 1. Annual percent difference in vaccine coverage between Medicaid expansion states and non-medication expansion states before & after Medicaid expansion

ME Groups by Year	Stratification	HPV - Unadjusted				TDAP - Unadjusted			
		Pre		Post		Pre		Post	
		Annual Difference %	95% CI	Annual Difference %	95% CI	Annual Difference %	95% CI	Annual Difference %	95% CI
2012	Overall	12.3	(12.1,12.4)	-4	(-4.1, -3.8)	8.1	(7.9,8.3)	1.6	(1.4,1.7)
	Above/At Poverty	12.2	(11.9,12.4)	-5.1	(-5.3, -4.9)	7.8	(7.6,8.0)	1.6	(1.4.1.7)
	Below Poverty	7.5	(7.1,7.9)	-2.7	(-3.0, -2.4)	9.6	(9.2,9.9)	1.9	(1.6,2.2)
2013	Overall	1.7	(1.6,1.8)	-3.8	(-3.9, -3.7)	1.1	(1.0,1.2)	-0.7	(-0.8, -0.6)
	Above/At Poverty	2.1	(2.0,2.2)	-4.3	(-4.4, -4.2)	1.2	(1.1,1.3)	-0.6	(-0.7, -0.5)
	Below Poverty	3.5	(3.3,3.6)	-5.1	(-5.3, -4.9)	1.4	(1.2,1.6)	-3.2	(-3.4, -3.1)
2014	Overall	1.6	(1.5,1.8)	-3.7	(-3.9, -3.5)	0.9	(0.8,1.1)	-0.1	(-0.3,0.1)
	Above/At Poverty	2.7	(2.6,2.9)	-6.5	(-6.7, -6.3)	1.2	(1.0,1,3)	-1.8	(-2.0, -1.6)
	Below Poverty	-3.3	(-3.6, -3.1)	0.3	(0,1,0.7)	-0.1	(-0.3,0.2)	2.0	(1.6,2.3)
		HPV - Adjusted				TDAP - Adjusted			
2012	Overall	8.8	(3.2,14.8)	-4.1	(-8.6,0.5)	6.7	(1.8,11.9)	1.7	(-2.4,6.0)
	Above/At Poverty	9.4	(3.0,16.2)	-3.3	(-8.4,2.1)	7.3	(1.7,19.5)	2.1	(-2.5,6.9)

ME Groups by Year	Stratification	HPV - Unadjusted				TDAP - Unadjusted			
		Pre		Post		Pre		Post	
		Annual Difference %	95% CI	Annual Difference %	95% CI	Annual Difference %	95% CI	Annual Difference %	95% CI
2013	Below Poverty	0.6	(-11.6,14.4)	-5.5	(-15.0,5.2)	5.2	(-7.4,19.5)	0.3	(-9.2,10.8)
	Overall	1.1	(-2.2,4.5)	-3.2	(-6.6,0.4)	0.9	(-1.9,3.9)	-0.9	(-3.9,2.2)
	Above/At Poverty	1.4	(-2.2,5.2)	-3.9	(-7.8,0.2)	1.0	(-2.1,4.2)	-0.8	(-4.2,2.8)
2014	Below Poverty	0.7	(-7.3,9.4)	-2.6	(-9.9,5.3)	1.2	(-6.2,9.5)	-4.0	(-10.6,3.2)
	Overall	-0.3	(-4.7,4.3)	2.3	(-4.3,9.4)	1.5	(-2.4,5.6)	-2.1	(-7.7,3.9)
	Above/At Poverty	1.2	(-3.8,6.5)	-2.3	(-9.6,5.6)	2.2	(-2.1,6.8)	-4.2	(-10.3,2.5)
	Below Poverty	-7.2	(-16.9,3.7)	3.5	(-10.6,19.9)	0.9	(-10.8,10.2)	2.5	(-10.6,17.6)

Figure 1. Medicaid expansion details



* Medicaid Expansion

[1] District of Columbia, Hawaii, Nevada, New York, Vermont

[2] Arizona, Arkansas, California, Colorado, Delaware, Illinois, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, North Dakota, Rhode Island, Washington, West Virginia

[3] New Hampshire, Ohio, Oregon, Pennsylvania

[4] Alabama, Florida, Georgia, Idaho, Kansas, Maine, Mississippi, Missouri, Nebraska, North Carolina, Oklahoma, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Wisconsin, Wyoming

Table 2. Observed Vaccination Coverage

Groups	Year								
	HPV Coverage %								
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
2012 Expansion States	47.3	49.0	55.5	49.6	57.5	60.1	58.7	64.4	73.5
2013 Expansion States	40.6	46.2	51.0	57.7	57.1	60.2	63.7	66.2	70.5
2014 Expansion States	38.2	48.4	49.0	53.1	56.9	58.9	64.4	63.2	64.8
Non-expansion States	31.6	39.7	45.2	49.3	49.1	53.7	56.2	59.3	58.5
	Tdap Coverage %								
2012 Expansion States	55.1	68.6	79.8	85.1	89.9	90.0	91.6	88.7	90.7
2013 Expansion States	40.8	57.2	69.8	79.0	86.1	87.7	88.4	85.0	89.9
2014 Expansion States	40.2	62.7	65.3	77.3	82.8	87.0	88.7	88.7	89.1
Non-expansion States	38.8	52.1	64.6	75.6	82.4	83.0	87.0	87.2	87.5