Health Insurance Coverage Gaps in Non-Elderly United States Adults before and After the Implementation of the Affordable Care Act

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ABSTRACT

National Health Interview Survey Data from Integrated Public Use Microdata Set (2010-2017) were used to examine associations between health insurance coverage gaps and poverty, non-white race, and unmarried status before and after the implementation of the Affordable Care Act (ACA) in 2014. The 140,341 survey respondents represented 138 million adults over eight years annually, with 15.7% reporting inconsistent health coverage from 2010-2013 and 9.9% from 2014-2017. Survey design adjusted multivariable logistic regression indicated modest changes post ACA. There were limited changes for people of color experiencing insurance gaps after 2014, although American Indians/Alaskan Natives were more likely to experience gaps post ACA. Pre and post ACA divorced adults were more likely to have insurance gaps, while adults below 200% FPL and those in the West/Northeast improved compared to the South. Generally, odds of experiencing coverage gaps were higher for marginalized populations and slightly declined after 2014, suggesting the need to prioritize expanded eligibility.

Key Words: Health coverage gaps; Affordable care act; Disparities

INTRODUCTION

The United States historically spends a large portion of its budget on healthcare services, but nonetheless ranks low in population health outcomes and life expectancy compared to the rest of the industrialized world [1]. Health coverage and care is linked to the overall life expectancy for individuals, and the odds of dying are higher for uninsured people compared to those with health coverage [2]. Lack of health coverage is also associated with lower use of preventive health services and decreased survival from illness and disease [3]. The ongoing healthcare crisis in the United States spurred the passage of the Patient Protection and Affordable Care Act (ACA) by President Obama in 2010 with full implementation effective 2014. The ACA required health coverage for most people, but also expanded options and provided financial assistance through state healthcare exchanges. Despite consistent attempts to repeal the law since its passage, the ACA is in effect even though the individual mandate requiring coverage was eliminated starting in 2018.

The ACA was partly intended to address the issue of health coverage affordability. It provided financial assistance to people in the form of Premium Tax Credits with incomes between 100 and 400% of the Federal Poverty Level (FPL) or approximately $ 12,000-$ 48,000 annual income for a single person, and also expanded Medicaid coverage to any U.S. citizen with annual incomes below 138% of the FPL ($16,500) without restriction [4]. However, twelve states declined to expand Medicaid coverage as allowed through the ACA policy and many people remain uninsured. Overall, the number of uninsured, nonelderly people in the United States dropped from 32 million to 27 million between 2015 and 2017 due to the implementation of the Affordable Care Act (ACA) [5].

Challenges related to health coverage and access to services remains especially difficult for marginalized and vulnerable

populations. Social disparities in health, including differences associated with varying levels of social position, put vulnerable groups such as people of color or those living under poverty at further disadvantage with respect to their health [6]. Inconsistent or inadequate health insurance coverage can influence overall population health results and remains an ongoing threat to the public health and budget of the United States.

Health coverage gaps stretch across all age, race, and income groups, and include millions of people with chronic conditions and special health needs that require necessary ongoing care [7,8]. Health coverage and equitable access to services were in a steady decline before the implementation of the ACA. For example, private insurance coverage rates dropped annually before finally increasing in 2014, and public coverage rates showed a steady increase over time [9]. Low income adults in the U.S. were less likely to be insured and more likely to avoid medical care due to cost before the ACA [10]. In addition, low income populations living with chronic conditions or disabilities were likely to be particularly sensitive to any instances without insurance since they are likely to need and utilize services consistently. Thus, states that expanded Medicaid after the ACA reduced the gap in health coverage of low income people by 46%, while non-expansion states saw the coverage gap fall by only 23% [11].

In states which expanded Medicaid coverage, studies have noted that increased access to care was associated with increased preventive care and improved self-reported health, especially for low income and unmarried people [12,13]. Further, expanded health coverage was shown to increase the job mobility of unmarried people, particularly single parents, and contributed to increased economic stability of families overall [14]. There is a consistent association in the literature between marital status and health outcomes across multiple illnesses and diseases, supporting the claim that single people are a part of a vulnerable population [15-17].

Behavioral Model of Health Services use

Andersen's Behavioral Model of Health Services Use is a conceptual tool used to identify factors that have different impacts on health behaviors and outcomes for individuals Source: Author adapted Andersen's Model based on Andersen, Davidson, and Baumeister [18].

The model proposes that individual and contextual factors associated with health service use can be grouped into three categories: predisposing characteristics, enabling factors, and need, suggesting that health care utilization is dependent on individuals' propensity to use services, the ability to access services, and the need or illness level [19]. As the links between health outcomes and contextual factors are often complex and involve feedback loops, Andersen's Model has been used to examine multiple factors and outcomes [20-21].

This study applies the Andersen Model to examine inadequate health coverage and aims to determine how race, poverty status, and marital status factors are associated in relation to the ACA (**Figure 1**). For the measurement model of particular interest is whether the ACA was associated with improved health care access for unmarried individuals, non-white people, and those living under poverty.

Figure 1: Theoretical framework: andersen's behavioral model of health services use

METHODS

Data Source

Retrospective, cross-sectional analysis was completed using Integrated Public Use Microdata Set (IPUMS) as the source of National Health Interview Survey (NHIS) data. NHIS is an ongoing face to face household survey that uses a complex, multi-stage probability sampling design that incorporates stratification, clustering, and oversampling of some subpopulations e.g., Black, Hispanic, and Asian [22]. Survey responses were combined into two time based groups (2010-2013 and 2014-2017) to examine associations before and after implementation of the ACA. This study is exempt from IRB review (IRB#5200362).

This study included adults between the ages of 26 to 64 years. Exclusion criteria were age 25 years and younger to avoid dependent students who might remain on their parent's plan up to age 25, and people above age 65 who are mostly covered by Medicare. Non-citizens were excluded since they were not covered by the ACA, as were active duty Armed Forces personnel. By definition, NHIS excludes residents in long term care facilities, persons in correctional facilities, and U.S. nationals living abroad.

Study Measures

The health coverage outcome measure from NHIS was "experienced a gap in health coverage past 12 months" (yes/no). Main study variables included race and ethnicity (based on NHIS definitions of White, Latino, African American, Asian, American Indian/Alaskan Native, multiple/other races), household income (collapsed to less than 100% FPL, 100%-199% FPL, 200% FPL and over), and marital status (married, widowed, divorced, separated, never married).

Additional demographic and contextual variables in the study included gender (male and female), age (individual years grouped into 26-35, 36-45, 46-54, 55-64 years of age), education level (collapsed to no high school diploma, high school grad, some college, college grad, graduate school), geography (four Census regions of residence), employment status (unemployed, work with pay, work without pay, with job but not at work, and not

in labor force), health status (Excellent, Very Good, Good, Fair, Poor), and public and private insurance coverage.

Statistical Analysis

After applying exclusion criteria there were 151,850 adults with completed outcomes data. Of these 11,509 (7.6%) had missing data for key independent variables, particularly poverty level (where missing poverty accounted for 5.2% of all dropped cases). Those individuals with missing data were excluded from analysis. In comparing frequencies of dropped cases, the distribution of individual level variables between people with missing values and those with complete values was similar. The final sample size included 140,934 individuals, with 69,934 survey respondents before ACA implementation and 70,407 after ACA implementation, exceeding the calculated 61,991 total size needed for 80% power at 0.05 significance.

Descriptive analysis using cross tabulation with design adjusted Chi-Square on categorical variables and multivariable regression models were utilized to examine the association between the independent and dependent study variables before and after ACA implementation. Not shown, poverty status, educational attainment, employment status, and health status had Pearson r correlations around 0.30, indicating non-problematic collinearity. The stratification approach of the odds ratio analysis examined the association of the independent variables pre and post ACA based on 95% CI to analyze differences and determine significance. Statistical analysis was conducted using SAS 9.4 (SAS Institute, Cary, North Carolina).

RESULTS

A total of 140,934 survey respondents from 2010-2017 represented an estimated annual population of 138 million and included 69,934 adults from 2010-13 and 70,407 from 2014-17. Of those, gaps in health coverage were reported by 15.7% of respondents before the ACA and declined to 9.9% after the ACA. The study variables with a p<.001 from binary analysis using a 2-sided Chi-Square test included race, ethnicity, poverty status, marital status, age, educational attainment, employment status, and coverage gaps. The estimated population% age for people of color was approximately 20% before and after the ACA. In addition, people earning below 200% of the Federal Poverty Level was around 30%, and single or unmarried people accounted for roughly 40% of the population in both time periods in the study. Differences in distribution for age before and after the ACA were not large despite significance (p<.0001), likely due to the large sample size. The population% age for educational attainment was 6% for no high school diploma, 24% for high school graduates, 32% for adults with some college, 22% for college graduates, and 12% for graduate school. Adults working for pay were a majority of the sample at 70%, with 20% not in the labor force. Adults reporting health coverage gaps were approximately 15% before the ACA and 10% after the ACA (**Table 1**). For a full list of variables and survey respondent characteristics.

The unadjusted regression model in shows race, Hispanic ethnicity, poverty status, and marital status predicting insurance gaps (**Table 2**). All races except Black/African American and Asians experienced increased odds of health coverage gaps after the ACA compared to Whites. Especially, the American Indian/Alaskan

Native population had about two times higher odds of health coverage gaps before the ACA compared to Whites (OR=2.13, 95% CI=1.59, 2.85, p<.0001). The odds, however, were more than three times higher after the ACA (OR=3.59, 95% CI=2.93, 4.39, p<.0001). People who self-identified as Hispanic ethnicity experienced 78% higher odds of health coverage gaps before the ACA compared to Whites and the odds stayed about the same after the ACA (OR=1.78, 95% CI=1.67, 1.90, p<.0001; and OR=1.76, 95% CI=1.58, 1.96, p<.0001 respectively). The odds of experiencing insurance gaps were much higher for people living under 200% FPL, although the odds significantly decreased after the implementation of the ACA. For example, people living below 100% FPL had OR=5.66, 95% CI=5.29, 6.05, p<.0001 before the ACA and OR=4.07, 95% CI=3.71, 4.46, p<.0001 after the ACA. Adults living between 100%-199% FPL had OR=5.28, 95% CI=4.96, 5.63, p<.0001 before the ACA and OR=3.61, 95% CI=3.34, 3.90, p<.0001 after the ACA. Marital status also showed higher odds of health insurance gaps before and after the ACA, with slight decreases after implementation. For example, divorced adults were two and a half times more likely to experience health coverage gaps with OR=2.57, 95% CI=2.40, 2.74, p<.0001 before the ACA and OR=2.27, 95% CI=2.09, 2.48, p<.0001 after the ACA compared to married individuals. Never married people were almost three times more likely than married people to experience coverage gaps with OR=2.98, 95% CI=2.79, 3.18, p<.0001 before the ACA and OR=2.82, 95% CI=2.61, 3.05, p<.0001 after the ACA.

Table 1: Demographic characteristics of u.s. adults aged 26-64a before and after the implementation of the affordable care act (nhis ipums)b (n=140,341).

-	Before the ACA	After the ACA
	2010-2013	**2014-2017**
Estimated annual N:	N=138,708,094	N=140,997,568
Survey n:	n 69,934	n=70,407
Characteristics	Est. Pop % (95% CI)	Est. Pop % (95% CI)
*Race		
White	80.8 (80.3, 81.4)	79.2 (78.5, 80.0)
Black/African Amer.	12.4 (11.9, 12.9)	12.9 (12.3, 13.5)
Amer/Indian/Alaskan Native	0.7 (0.6, 0.8)	0.9 (0.7, 1.1)
Asian	4.2 (3.9, 4.4)	4.8 (4.5, 5.1)
Other race	1.6 (1.5, 1.8)	2.0 (1.8, 2.1)
*Hispanic		
Yes	10.0 (9.6, 10.4)	11.6 (10.9, 12.2)
No	89.9 (89.5, 90.3)	88.3 (87.7, 89.0)
*Poverty status		
Less than 100% FPL	9.6 (9.2, 10.0)	9.2 (8.9, 9.6)
100-199% FPL	13.1 (12.7, 13.5)	14.1 (13.7, 14.5)
200% FPL and over	71.1 (70.5, 71.7)	72.6 (72.0, 73.2)
*Marital status		
Married	61.5 (60.9, 62.2)	60.6 (60.0, 61.2)
Widowed	2.0 (1.9, 2.1)	2.1 (1.9, 2.2)
Divorced	14.1 (13.7, 14.4)	13.8 (13.4, 14.1)

Separated	2.8 (2.7, 3.0)	2.6 (2.4, 2.7)
Never married	19.3 (18.9, 19.8)	20.8 (20.3, 21.2)
*Age		
26-34	22.6 (21.1, 23.0)	23.2 (22.7, 23.6)
35-44	24.3 (23.9, 24.8)	23.8 (23.3, 24.2)
45-54	28.2 (27.8, 28.7)	26.5 (26.1, 27.0)
55-64	24.7 (24.3, 25.1)	26.3 (25.9, 26.8)
Gender		
Male	48.7 (48.2, 49.2)	48.5 (48.0, 49.1)
Female	51.2 (50.7, 51.7)	51.4 (50.8, 51.9)
*Educational attainment		
No high school diploma	6.76 (6.4, 7.0)	6.3 (6.0, 6.6)
High school grad	24.5 (24.0, 25.0)	22.8 (22.3, 23.3)
Some college	32.0 (31.5, 32.6)	31.4 (30.8, 31.9)
College grad	22.2 (21.7, 22.7)	23.6 (23.1, 24.1)
Graduate school	12.2 (11.8, 12.7)	13.9 (13.4, 14.3)
*Employment		
Not in labor force	20.9 (20.4, 21.4)	21.1 (20.6, 21.5)
Work for pay	70.2 (69.6, 70.8)	72.4 (71.9, 72.9)
Unemployed	5.8 (5.6, 6.1)	3.7 (3.5, 3.9)
With job, not at work	2.9 (2.8, 3.1)	2.6 (2.5, 2.8)
Health status		
Excellent	28.5 (28.1, 29.0)	28.2 (27.7, 28.7)
Very good	33.4 (33.0, 33.9)	33.7 (33.2, 34.2)
Good	25.5 (25.1, 25.9)	25.8 (25.3, 26.3)
Fair	9.3 (9.0, 9.6)	9.2 (8.9, 9.6)
Poor	3.0 (2.9, 3.2)	2.9 (2.7, 3.0)
Region of residence		
Northeast	17.6 (17.0, 18.2)	17.6 (16.8, 18.7)
North central/ Midwest	23.9 (23.2, 24.6)	23.4 (22.5, 24.3)
South	36.5 (35.6, 37.3)	36.6 (35.3, 37.8)
West	21.8 (21.1, 22.6)	22.2 (21.1, 23.2)
*Coverage gaps past12 no.		
No	84.2 (83.8, 84.7)	90.0 (89.7, 90.3)
Yes	15.7 (15.2, 16.1)	9.9 (9.6, 10.2)

Note: a Study also excludes nursing home residents, people in the military, non-naturalized citizens

b Data are from National Health Interview Survey from Integrated Public Use Microdata Set (IPUMS) 2010-2017

*Variable with P-Value <.001 from binary analysis using a 2-sided Chi-square test

Abbreviations:

(N): population estimate pre-ACA is 554,835,614/4; post-ACA is 563,990,272/4

(n): number of participants in sample after inclusion/exclusion

(Est. Pop. %(95% CI)): Estimated population percentage and 95% confidence interval

Table 2: Un-adjusted binary logistic regression analysis of the association of health coverage gaps on poverty, race, ethnicity, and marital status before and after the implementation of the aca from the ipums dataset 2010-2017.

-	Before the ACA 2010-2013 n=69,934	
	Odds ratio	**95% Confidence interval**
Race		
Black/African American	1.62	1.51, 1.74
Amer. Indian/Alaskan Native	2.13	1.59, 2.85
Asian	0.88	0.79, 1.00
Other race	1.4	1.19, 1.64
White	Ref	-
Hispanic		
Yes	1.78	1.67, 1.90
No	Ref	-
Poverty status		
<100% FPL	5.66	5.29, 6.05
100-199% FPL	5.28	4.96, 5.63
>200% FPL	Ref	-
Marital status		
Widowed	2.08	1.82, 2.38
Divorced	2.57	2.40, 2.74
Separated	2.95	2.64, 3.30
Never married	2.98	2.79, 3.18
Married	Ref	-

Table 3: Multiple logistic regression analysis of the association of health coverage gaps on poverty, race, ethnicity, and marital status before and after the implementation of the aca from ipums dataset 2010-2017.

-	Before the ACA 2010-2013 n=69,934			After the ACA 2014-2017 n=70,407		
	Odds ratio	95% Confidence interval	p-value	Odds ratio	95% Confidence interval	p-value
Race						
Black/African American	0.84	0.78, 0.92	0.0001	0w.73	0.66, 0.81	<.0001
Amer. Indian/ Alaskan Native	1.2	0.85, 1.71	0.28	2.14	1.70, 2.70	<.0001
Asian	1.09	0.95, 1.26	0.18	0.99	0.80, 1.22	0.93
Other race	0.9	0.75, 1.09	0.3	1.04	0.83, 1.31	0.67
White	Ref	-				
Hispanic						
Yes	1.21	1.12, 1.31	<.0001	1.27	1.14, 1.42	<.0001
No	Ref	-				
Poverty status						
<100% FPL	3.22	2.95, 3.52	<.0001	2.38	2.12, 2.67	<.0001
100-199% FPL	3.61	3.35, 3.90	<.0001	2.36	2.16, 2.57	<.0001
>200% FPL	Ref	-				
Marital status						

Widowed	1.7	1.45, 1.98	<.0001	1.64	1.35, 2.00	<.0001
Divorced	2	1.85, 2.16	<.0001	1.86	1.70, 2.04	<.0001
Separated	1.56	1.37, 1.78	<.0001	1.5	1.27, 1.77	<.0001
Never married	2.07	1.93, 2.23	<.0001	2.01	1.84, 2.20	<.0001
Married	Ref	-				
Age						
35-44	0.82	0.75, 0.88	<.0001	0.9	0.81, 0.98	0.03
45-54	0.74	0.69, 0.80	<.0001	0.75	0.67, 0.83	<.0001
55-64	0.61	0.56, 0.66	<.0001	0.56	0.51, 0.64	<.0001
26-34	Ref	-				
Gender						
Male	1.25	1.18, 1.33	<.0001	1.37	1.28, 1.46	<.0001
Female	Ref	-				
Educational attainment						
No high school diploma	1.24	1.13, 1.35	<.0001	1.27	1.14, 1.42	<.0001
Some college	0.78	0.73, 0.84	<.0001	0.74	0.68, 0.81	<.0001
College grad	0.42	0.38, 0.46	<.0001	0.35	0.31, 0.40	<.0001
Grad school	0.25	0.22, 0.29	<.0001	0.24	0.21, 0.29	<.0001
High school grad	Ref	-				
Employment						
Not in labor force	0.81	0.75, 0.88	<.0001	0.83	0.75, 0.92	0.0007
Unemployed	3.89	3.51, 4.31	<.0001	3.01	2.62, 3.45	<.0001
With Job, not at work	0.77	0.64, 0.93	0.007	0.94	0.74, 1.19	0.63
Work for Pay	Ref	-				
Health status						
Very Good	0.98	0.91, 1.05	0.66	1.02	0.93, 1.11	0.63
Good	1.12	1.04, 1.20	0.002	0.98	0.88, 1.08	0.71
Fair	0.89	0.80, 1.00	0.05	0.81	0.70, 0.93	0.003
Poor	0.62	0.52, 0.74	<.0001	0.52	0.41, 0.65	<.0001
Excellent	Ref	-				
Region of residence						
North Central/Midwest	0.64	0.59, 0.69	<.0001	0.57	0.51, 0.63	<.0001
Northeast	0.51	0.47, 0.56	<.0001	0.39	0.34, 0.45	<.0001
West	0.82	0.76, 0.89	<.0001	0.54	0.49, 0.60	<.0001
South	Ref	-	-	-	-	-

The adjusted regression analysis in **Table 3** shows that although the ACA did not substantially change the odds for experiencing gaps in health coverage for adults of most races, the odds significantly increased for American Indian/Alaskan Native people compared to Whites (OR=1.20, 95% CI=0.85, 1.71, p=0.28; to OR=2.14, 95% CI=1.70, 2.70, p<.0001). Blacks/African Americans had a 16% lower likelihood of missing coverage before (OR=0.84, 95% CI=0.78, 0.92, p=0.0001) and 27% lower odds after (OR=0.73, 95% CI=0.66, 0.81, p<0001) ACA implementation. However, Hispanics retained 21% and 27% higher odds before and after the ACA (OR=1.21, 95% CI=1.12, 1.31, p<.0001, and OR=1.27, 95% CI=1.14, 1.42, p<.0001, respectively). The odds were significantly decreased after the ACA based on poverty level, although odds were still much higher compared to adults>200% FPL after the ACA. Adults living below 100% FPL had OR=3.22, 95% CI=2.95, 3.52, p<.0001 before the ACA and OR=2.38, 95% CI=2.12, 2.67, p<.0001 after the ACA. Adults between 100%-199% FPL were also significantly more likely to experience health coverage gaps compared to those above 200% FPL (OR=3.61, 95% CI=3.35, 3.90, p<.0001; and OR=2.36, 9% CI=2.16, 2.57, p<.0001). In addition, there was a slight, non-significant decrease for all marital status categories after the ACA. For example, compared to married individuals, those who were divorced before the ACA had OR=2.00, 95% CI=1.85, 2.16, p<.0001 and OR=1.86, 95% CI=1.70, 2.04, p<.0001 after the ACA.

Educational attainment did not show changes in the odds of experiencing health coverage gaps after the ACA for all categories compared to adults with a high school diploma when examining confidence intervals and p values of the time periods. Except for adults without a high school diploma (OR=1.24, 95% CI=1.13, 1.35, p<.0001; 1.27, 95% CI=1.14, 1.42, p<.0001 respectively), all educational categories had an OR below 1.00 before and after the ACA. For example, adults who completed graduate school had 76% decreased odds of experiencing health coverage gaps after the ACA (OR=0.24, 95% CI=0.21, 0.29, p<.0001). Regarding employment, the data show that unemployed people had significantly reduced odds after the ACA although these adults were still at higher odds after the ACA compared to those working with pay (OR=3.89, 95% CI=3.51, 4.31, p<.0001, and OR=3.01, 95% CI=2.62, 3.45, p<.0001, respectively).

The results of **Table 3** also indicate that males had 25% and 37% increased odds of health coverage gaps before and after the ACA compared to females (OR=1.25, 95% CI=1.18, 1.33, p<.0001, and OR=1.37, 95% CI=1.28, 1.46, p<.0001 respectively). In addition, there were slight changes for the various age categories. The analysis of this data set further suggests that the ACA made modest differences in health coverage gaps of people by region of residence. Both before and after the ACA, the Northeast, North Central/Midwest, and West regions had reduced odds of experiencing health coverage gaps compared to those living in the South. Those living in the West had significantly decreased odds (46%) of experiencing health coverage gaps after the ACA; OR=0.82, 95% CI=0.76, 0.89, p<.0001 before the ACA and OR=0.54, 95% CI=0.49, 0.60, p<.0001 after the ACA. Adults living in the Northeast experienced 49% reduced odds before the ACA and 61% decreased odds after the ACA compared to the South region (OR=0.51, 95% CI=0.47, 0.56, p<.0001; and OR=0.39, 95% CI=0.34, 0.45, p<.0001 respective-

ly). In addition, there was no significant differences in coverage gaps based on health status after the ACA, even though people with very good status increased odds slightly (OR=0.98, 95% CI=0.91, 1.05, p=0.66; and OR=1.02, 95% CI=0.93, 1.11, p=.63 respectively).

DISCUSSION

The results of this study suggest that most marginalized populations retained odds of experiencing health coverage gaps after the implementation of the ACA. Specifically comparing the unadjusted and adjusted regression models shows that poverty status (**Tables 2 and 3**), education, employment, and marital status had bigger impacts on health insurance coverage than race. Significant increases in odds of health coverage gaps after the ACA included the American Indians/Alaskan Native population with odds getting worse, and the Northeast and West region with improved odds. Poverty status and unemployed categories also had significant improvement. Specifically regarding race and Hispanic ethnicity, there was no significant odds reduction for Hispanics and Asians after the ACA. However, Blacks/African Americans showed better coverage compared to whites. A possible explanation for Blacks/African Americans not showing increased odds of experiencing health coverage gaps Table 3 could be due to the effects of poverty status in determining coverage gaps.

The ACA resulted in improvements of health coverage status for those under 200% Federal Poverty Level (FPL) as well. This was likely due to expanded Medicaid eligibility and extra financial assistance provided to low income adults to help pay for health insurance through the ACA. There were no significant changes based on marital status, though the odds ratios were slightly decreased in all categories after the ACA implementation. Unmarried adults continued to experience higher odds of health coverage gaps compared to those with a spouse or significant other.

Except for poverty status, the findings of this research do not support the hypothesis that there were significant improvements for marginalized groups after the implementation of the ACA overall. Some evidence suggests that economic and racial disparities in health coverage and care showed modest improvements after health reform was signed into law. For example, national health quality measures collected in 2014 showed some improvements for some racial groups including Blacks and African Americans [23]. Further, economic and racial differences in insurance coverage and health related life expectancies were significantly reduced for non-elderly U.S. adults, including low income people of color from 2008-2014 [24]. While this study shows that Blacks/African Americans had decreased odds of coverage compared to whites regardless of the ACA, this result could be due to the strong effects of poverty status erasing the effect of race in this analysis. The unadjusted model shows high odds for all racial groups.

Research suggests that rates of health coverage slightly improved across all racial and ethnic groups after the ACA, but disparities remained. For example, Hispanic adults maintained the highest rates of uninsurance compared to non-Hispanic whites [25]. And African American people continued to be more likely than white people to remain uninsured overall after the ACA was implemented [26]. This could be partly due to Blacks/African American and Hispanic people likely living under poverty and residing in states where Medicaid eligibility expansion was not implemented [27]. These findings support the results of this study for Hispanics and all race categories except Blacks/African Americans. However, Table 2 showing the un-adjusted binary regression of race predicting coverage gaps resulted in 62% and 42% increased odds ratio results for Blacks and African Americans before and after the ACA (OR=1.62, 95% CI=1.51, 1.74, p<.0001; and OR=1.42, 95% CI=1.30, 1.55, p<.0001 respectively), indicating other variables such as poverty status erased the effects of race on coverage gaps. The odds of health coverage gaps were shown to significantly increase odds after the ACA for American Indian/Alaskan Native (AI/AN) populations from 20% to 214% odds in this study. Literature also shows that racial minority groups and uninsured people with incomes below Federal poverty levels make up approximately 15% of the overall population in the United States, and are most likely to report their overall health status as fair or poor [9,28]. Racial and ethnic disparities in health coverage continue to be significant barriers to improved health outcomes despite health reform and the implementation of the ACA.

Research after ACA health reform also suggests that married individuals were still more likely to be insured compared to singles, especially compared to divorced people [28]. The data from this study show that not being married continues to result in higher odds of experiencing gaps in health coverage. Considering that health insurance is primarily based on being employed with generous employer sponsored benefits, people who are non-spouses, those with less generous benefits, and those changing jobs continue to be at a disadvantage for consistent health insurance coverage.

Those with self-perceived health status of "very good" had increased odds of coverage gaps, and that reported "fair" and "poor" health status showed slightly decreased odds for experiencing gaps in health coverage after the ACA compared to people with an excellent status. Although the changes were small, e.g., very good status category only increased 4%, this data support the assertion that the ACA's elimination of preexisting condition restrictions and other guaranteed insurance protections of the ACA was helpful for U.S adults who knew they had poor health [29].

Compared to individuals living in the South region of the United States, other regions experienced a decrease in the odds of health coverage gaps after the ACA, especially people living in the Northeast and West regions. The ACA provided states with the option to expand Medicaid health coverage eligibility, however only 36 states and DC-primarily from the Northeast and West regions accepted federal funding by 2018 to expand Medicaid under the ACA [30]. The states that did not expand health coverage as allowed under the ACA include: Alabama, Florida, Georgia, Kansas, Michigan, Mississippi, North Carolina, South Carolina, South Dakota, Tennessee, Texas, Wisconsin, and Wyoming. Almost half of the states included in the South Census region of residence did not expand Medicaid (Florida, Georgia,

North Carolina, and South Carolina) and may have been a contributing factor to the decreased odds of coverage gaps after the implementation of the ACA for other regions of residence.

The application of Andersen's Health Services Use model in this study suggests that the contextual and predisposing factors of the ACA implementation and coverage requirement partly reduced the odds of experiencing health coverage gaps for marginalized populations. Predisposing and enabling structural factors did not necessarily support increased health behavior use through insurance coverage, however, the full effects of the individual mandate and health insurance requirement is unclear. The data in this study showed reductions in the odds of experiencing health coverage gaps after the implementation of the ACA for most vulnerable groups, but the changes were not enough to reduce disparities. These results highlight the urgent need to prioritize increased expansions of low or no cost coverage with culturally appropriate outreach and enrollment efforts to racially marginalize and economically at risk populations. For example, some studies suggest that health insurance remains uneven for vulnerable groups due to continued affordability issues after the implementation of the ACA specifically related to types of coverage, e.g., narrow provider network in Medicaid and higher cost sharing in private coverage.

Strengths and Limitations

The benefits of using the IPUMS NHIS data set for health coverage analysis included no cost access to large and representative U.S. data with high response rates. In addition to high quality and validity, the data simplified access across multiple years and files, and produced consistent comparisons across time for generalization. Limits to the data and study exist, however, and includes recall bias issues with self-reported data and other biases; potential collection and reporting errors; and the inability to establish causal relationships due to the cross sectional study design of the IPUMS survey. Further, insurance coverage gaps in prior year did not analyze the number of months without coverage experienced; and the study analysis did not allow for the direct comparison before and after the implementation of the ACA since the participants in the time periods were not the same. Other factors potentially associated with individual health coverage gaps are not addressed in this study such as coverage gaps experienced when changing jobs, access and utilization rates, cost barriers to care, and could be used as a basis for outlining future research on healthcare disparity reduction by examining additional social determinates of health, such as culture, health literacy, Medicaid expansion and non-expansion states, and other variables [31].

CONCLUSION

Without consistent health insurance coverage, people may suffer, could die early, and population health deteriorates. Multiple individual and contextual factors such as race and poverty status are measures of lifetime exposures to health risks impacting outcomes, but few policies consider these issues of health disparities as major population threats. With the exception of poverty status, the results of this study suggest that the ACA did not significantly impact these factors by reducing the odds of experiencing gaps in health coverage, and should be further evalu-

ated to determine optimal paths to expand and strengthen ACA policies that improve population health coverage results for all, particularly for vulnerable and marginalized groups.

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