
eMethods.
eTable 1. Interrupted Time-Series Models for Coverage, Access, and Health after the ACA’s First Open Enrollment Period
eTable 2. Difference-in-Differences Analysis of the Medicaid Expansion, Using Alternative Approaches to Defining the Low-Income Sample
eTable 3. Pre-ACA Trends in Coverage, Access to Care, and Health Among Low-Income Adults in Medicaid Expansion versus Non-Expansion States

eFigure 1. Interrupted Time-Series Analysis of Not Having a Personal Doctor
eFigure 2. Interrupted Time-Series Analysis of No Easy Access to Medicines
eFigure 3. Interrupted Time-Series Analysis of Inability to Afford Care
eFigure 4. Interrupted Time-Series Analysis of Fair or Poor Self-Reported Health
eFigure 5. Interrupted Time-Series Analysis of Percentage of Days with Activities Limited by Poor Health

This supplementary material has been provided by the authors to give readers additional information about their work.
Regression Equations:

Changes in Coverage, Access, and Health Trends, with Multivariable Adjustment

Uninsured\(_{ist}\) = \(\beta_0 + \beta_1 TimeTrend_{it} + \beta_2 Q4 2013_t + \beta_3 Q1 2014_t + \beta_4 Q2 2014_t + \beta_5 Q3 2014_t + \beta_6 Q4 2014_t + \beta_7 Q1 2015_t + \beta_8 UnemploymentRate_{ist} + \beta_s X_i + \Omega State_s + \pi CalendarMonth_t + \varepsilon_{ist}\)  

Equation (1)

where \(i\) indexed person, \(s\) state, and \(t\) date. \(TimeTrend\) was a linear variable measuring the number of months since the beginning of the study period (January 2012). \(X_i\) was a vector of sociodemographic variables (age, self-reported race/ethnicity, urban vs. rural residence\(^*\), marital status, sex, income, and employment status). \(UnemploymentRate\) was the state-year specific unemployment rate, from the U.S. Bureau of Labor Statistics. \(\Omega\) was a vector of state fixed effects, and \(\pi\) was a vector of binary indicators for the 12 calendar months to adjust for seasonality. The coefficients \(\beta_2\) through \(\beta_7\) captured the quarterly changes in the uninsured rate compared to the pre-existing trend, since the beginning of the first open enrollment period in October 2013. All models were survey-weighted linear regressions.

The models for access to care measures and self-reported health used the same equation, other than the dependent variable.

Interrupted Time-Series Model

Uninsured\(_{ist}\) = \(\beta_0 + \beta_1 TimeTrend_{it} + \beta_2 PostACA\_TimeTrend_{it} + \beta_3 UnemploymentRate_{ist} + \beta_s X_i + \Omega State_s + \pi CalendarMonth_t + \varepsilon_{ist}\)  

Equation (2)

\(^*\) Rural residence was defined based on living in a zip code classified as “rural” by the Federal Office of Rural Health Policy in the U.S. Department of Health and Human Services.
where \(i\) indexed person, \(s\) state, and \(t\) date. The coefficient of interest is \(\beta_2\), which captured the change in slope of the monthly time trend since the beginning of the first open enrollment period in October 2013 (the variable \(PostACA\_TimeTrend_t\)). The remaining variables were defined similarly as in Equation 1. All models were survey-weighted linear regressions.

Differences-in-Differences Analysis of Coverage for Low-Income Adults:

\[
Uninsured_{ist} = \beta_0 + \beta_1 MedicaidExpansion_{st} + \beta_2 UnemploymentRate_{st} + \beta_x X_i + \Omega States + \partial Month-Year_t + \epsilon_{ist}
\]

Equation (3)

\(MedicaidExpansion\) was equal to 1 for observations in states in which the Medicaid expansion was in effect as of the first of the month, and 0 for all other observations; this approach allows for differential start dates of the Medicaid expansion by state. State fixed effects (\(\Omega\)) captured any state-level differences in outcomes across the full study period, including the direct impact of living in an expansion state. Month-year fixed effects (\(\partial\)) captured any nationwide differences in outcomes for each month during the study, including the direct impact of the post-ACA period. \(\beta_1\) was the differences-in-differences estimate for how much the uninsured rate changed in Medicaid expansion states in 2014-2015, compared to non-expansion states. The remaining variables were defined similarly as in Equation 1. All models were survey-weighted linear regressions.

Pre-ACA Trend Comparison for Expansion versus Non-Expansion States in the Differences-in-Differences Analysis

\[
Uninsured_{ist} = \beta_0 + \beta_1 TimeTrend_t + \beta_2 ExpansionState_s*TimeTrend_t + \beta_3 UnemploymentRate_{st} \\
+ \beta_x X_i + \Omega States + \epsilon_{ist}
\]

Equation (4)
A key assumption in a differences-in-differences analysis is that the pre-policy period trends between the two comparison groups are similar. This analysis (presented in Appendix eTable3) tested the pre-ACA trends in expansion vs. non-expansion states. Using data limited to the Pre-ACA period (Q1 2012-Q3 2013), we modeled each outcome as a function of a monthly time trend and an interaction term for the monthly time trend and whether a state ever expanded Medicaid during the study period (ExpansionState). \( \beta_2 \) identified any diverging pre-ACA trend in expansion states, compared to non-expansion states. All models were survey-weighted linear regressions.

**Income Estimates and Defining the Low-Income Sample:**

To convert income from the survey’s ten discrete categories into a percentage of the federal poverty level, we converted each income category into a dollar term using the midpoint of the category range (e.g. $9000 for people reporting income between $6000 and $12,000), and used multivariable regression to impute missing income for the 12% of the sample that did not report income, based on sex, age, race/ethnicity, education, marital status, household size, employment, and state of residence. This differs from the imputation method in a prior analysis of Gallup data (reference 8 in the manuscript), which incorporated insurance and other health measures into the imputation model; here, we excluded our study outcomes from the imputation process used to identify the low-income sample. Missing values for household size were imputed using the same regression approach. We then used household size and the U.S. federal poverty guidelines to convert income into a percentage of FPL.

Our regression-based imputation model had an R-squared of 0.35, with sex, age, race/ethnicity, education, marital status, household size, employment, and state of residence all
highly significant predictors (p<0.001) of income. Prior research (see Skopec et al., 2014) showed that regression-based imputation for missing values in the Gallup WBI produces an income distribution closer to that observed in Census survey data (particularly for the fraction of low-income adults), compared to omitting missing values.

In sensitivity analyses, we treated each income category as the lowest value in the respective category (e.g. $6000 for people reporting income between $6000 and $12,000), which produced a higher proportion of individuals with incomes below 138% of FPL, and we also considered the impact of excluding observations with missing values for income. See Appendix eTable 2 for these results.

Additional Details on the Gallup WBI Methods and Comparison to Federal Survey Data

Skopec et al. (2014) conducted a systematic comparison of national and state estimates of health insurance coverage, access to care, and self-reported health status in the Gallup WBI compared to the following federal surveys: Current Population Survey (CPS), the American Community Survey (ACS), the Medical Expenditure Panel Survey (MEPS), the National Health Interview Survey (NHIS), and the Behavioral Risk Factor Surveillance System (BRFSS). Key findings were as follows:

- The WBI provides similar though slightly lower estimates of the national uninsured rate (approximately 2 percentage-points lower) compared to other surveys, though the correlation in national trends in the uninsured rate over time was high: 0.87 with the CPS, 0.85 with the ACS, and 0.82 with the NHIS. Estimates of type of coverage (Medicaid, private, Medicare, or other) were less reliable in the WBI, particularly for public coverage types.
• WBI state-level estimates of the uninsured rate showed very high correlation with Census surveys, with correlation coefficients of 0.95 with the ACS and 0.89 with the CPS.

• Estimates related to access to care and self-reported health in the WBI generally fell within the range of estimates from the federal surveys that measured these variables, including the BRFSS, NHIS, and MEPS. However, the WBI sample had a slightly higher proportion of individuals in fair or poor health (14.8% and 5.6% respectively, vs. 11.8% and 4.3% in the BRFSS, for instance).

• The sample size for the WBI from 2008-2012 (the time period used for analysis by Skopec et al.) was approximately 1000 adults per day, which was reduced to 500 per day in 2013. This change only affected the sample size, not the sampling frame or weighting procedures. While this reduced the precision of the data for the study period analyzed here, it should not have introduced any systematic bias to the surveys’ estimates.

• Prior to June 2013, the WBI sample frame used random-digit dialing (RDD) for cell phones and then randomly selected households from listed landlines. At that time, roughly 3% of households were estimated to have unlisted landlines, which could have introduced bias since these households were not eligible for the survey unless they were also cell phone users. If anything, this bias was more likely to affect high-income households, who are presumably more likely to pay a fee for unlisted status. Accordingly, the impact on our estimates of the uninsured rate and barriers to health care – outcomes concentrated among lower-income households – was likely minimal.

Beginning in June 2013, however, the WBI shifted to an RDD approach for both landlines and cell phones. To examine the potential impact of this change, we tested the effect of adding a binary variable to our regressions indicating pre- or post June 2013.
The results of our analyses were essentially unchanged, offering reassurance that this potential source of bias did not substantially impact our findings.

**Survey Questions for Study Outcomes**

A) Do you have health insurance coverage?
   1 Yes
   2 No

B) Do you have a personal doctor?
   1 Yes
   2 No

C) In the city or area where you live, is it easy or not easy to get medicine?
   1 Easy
   2 Not easy

D) Have there been times in the past twelve months when you did not have enough money to pay for health care and/or medicines that you or your family needed?
   1 Yes
   2 No

E) Would you say your own health, in general, is___?
   1 Excellent
   2 Very good
   3 Good
   4 Fair
   5 Poor

F) During the past 30 days, for about how many days did poor health keep you from doing your usual activities?
   0-30 days, open-ended response *(converted to percentage by dividing by 30)*
**Table 1: Interrupted Time-Series Models for Coverage, Access, and Health after the ACA’s First Open Enrollment Period**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-ACA Period (Q1 2012-Q3 2013)</th>
<th>Post-ACA Period (Q4 2013-Q1 2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly Trend</td>
<td>95% CI</td>
</tr>
<tr>
<td>Uninsured</td>
<td>0.10%</td>
<td>0.07, 0.13</td>
</tr>
<tr>
<td>No personal doctor</td>
<td>0.13%</td>
<td>0.10, 0.17</td>
</tr>
<tr>
<td>No easy access to medicine</td>
<td>0.10%</td>
<td>0.07, 0.12</td>
</tr>
<tr>
<td>Cannot afford care</td>
<td>0.13%</td>
<td>0.09, 0.16</td>
</tr>
<tr>
<td>Fair/poor health</td>
<td>0.13%</td>
<td>0.10, 0.17</td>
</tr>
<tr>
<td>% of last 30 days in which activities were limited by poor health</td>
<td>0.05%</td>
<td>0.03, 0.07</td>
</tr>
</tbody>
</table>

**Notes:**

“95% CI” = 95% confidence interval.
Sample contains adults ages 18-64, n=507,055 minus item non-response for each row (see Table 2 in text for sample sizes).

“Monthly trend” based on multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.
## Table 2: Difference-in-Differences Analysis of the Medicaid Expansion, Using Alternative Approaches to Defining the Low-Income Sample

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>Alternative Model 1</th>
<th>Alternative Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>95% CI</td>
</tr>
<tr>
<td>Uninsured</td>
<td>-5.1%</td>
<td>-7.8, -2.4</td>
</tr>
<tr>
<td>No personal doctor</td>
<td>-1.8%</td>
<td>-3.5, -0.2</td>
</tr>
<tr>
<td>No easy access to medicine</td>
<td>-2.4%</td>
<td>-3.9, -0.9</td>
</tr>
<tr>
<td>Cannot afford care</td>
<td>-1.4%</td>
<td>-3.8, -1.1</td>
</tr>
<tr>
<td>Fair/poor health</td>
<td>-0.1%</td>
<td>-1.8, 1.5</td>
</tr>
<tr>
<td>% of last 30 days in which activities were limited by poor health</td>
<td>-0.0%</td>
<td>-0.9, 0.9</td>
</tr>
</tbody>
</table>

### Analysis Details

<table>
<thead>
<tr>
<th>Analysis of Income Category for % FPL</th>
<th>Median Point of Income Category</th>
<th>Lowest Dollar Value in Income Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imputation of Missing Values?</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Sample Size</td>
<td>81,977</td>
<td>118,826</td>
</tr>
</tbody>
</table>

**Notes:**

“95% CI” = 95% confidence interval.

Sample contains adults ages 18-64 with incomes estimated to be below 138% of the federal poverty level, depending on the imputation methods described in the table. Sample excludes the fourth quarter of 2013 as a washout period, and excludes observations with non-response for a given outcome. Analyses adjusted for state, month and year, age, sex, marital status, race/ethnicity, urban vs. rural residence, employment status, income, and state-year unemployment rate. Analyses used robust standard errors clustered by state.
cTable 3: Pre-ACA Trends in Coverage, Access to Care, and Health Among Low-Income Adults in Medicaid Expansion versus Non-Expansion States

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>Sample Size</th>
<th>Differential Trend in Medicaid Expansion States (vs. Non-Expansion States)</th>
<th>Coefficient</th>
<th>95% CI</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>56,570</td>
<td></td>
<td>0.01%</td>
<td>-0.15, 0.16</td>
<td>0.92</td>
</tr>
<tr>
<td>No personal doctor</td>
<td>56,420</td>
<td></td>
<td>0.04%</td>
<td>-0.11, 0.19</td>
<td>0.62</td>
</tr>
<tr>
<td>No easy access to medicine</td>
<td>55,825</td>
<td></td>
<td>0.03%</td>
<td>-0.10, 0.16</td>
<td>0.70</td>
</tr>
<tr>
<td>Cannot afford care</td>
<td>56,160</td>
<td></td>
<td>0.17%</td>
<td>0.01, 0.32</td>
<td>0.04</td>
</tr>
<tr>
<td>Fair/poor health</td>
<td>56,570</td>
<td></td>
<td>-0.08%</td>
<td>-0.23, 0.07</td>
<td>0.32</td>
</tr>
<tr>
<td>% of last 30 days in which activities were limited by poor health</td>
<td>55,360</td>
<td></td>
<td>0.04%</td>
<td>-0.05, 0.14</td>
<td>0.38</td>
</tr>
</tbody>
</table>

Notes:
“95% CI” = 95% confidence interval.
Sample contains data from prior to the fourth quarter of 2013 for adults ages 18-64 with incomes estimated to be below 138% of the federal poverty level. Each row excludes item non-response for that outcome.
Analyses adjusted for a linear time trend, state, age, sex, marital status, race/ethnicity, urban vs. rural residence, employment status, income, and state-year unemployment rate.
“Differential Trend” shows the coefficient on the interaction between a linear monthly time trend and an indicator for Medicaid expansion state.
eFigure 1: Interrupted Time-Series Analysis of Not Having a Personal Doctor

Notes: Sample contains adults ages 18-64.
The solid red lines show the adjusted time trends for the pre-ACA (January 1, 2012-September 30, 2013) and post-ACA (October 1, 2013-March 31, 2015) periods. The dashed red line shows the predicted trajectory if there had been no change in slope in the post-ACA period. The vertical dashed black line shows the beginning of the ACA’s first open enrollment period in October 2013. The blue dots show the adjusted monthly mean values for the outcome, based on a multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.
eFigure 2: Interrupted Time-Series Analysis of No Easy Access to Medicines

Notes: Sample contains adults ages 18-64. The solid red lines show the adjusted time trends for the pre-ACA (January 1, 2012-September 30, 2013) and post-ACA (October 1, 2013-March 31, 2015) periods. The dashed red line shows the predicted trajectory if there had been no change in slope in the post-ACA period. The vertical dashed black line shows the beginning of the ACA’s first open enrollment period in October 2013. The blue dots show the adjusted monthly mean values for the outcome, based on a multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.
Notes: Sample contains adults ages 18-64. The solid red lines show the adjusted time trends for the pre-ACA (January 1, 2012-September 30, 2013) and post-ACA (October 1, 2013-March 31, 2015) periods. The dashed red line shows the predicted trajectory if there had been no change in slope in the post-ACA period. The vertical dashed black line shows the beginning of the ACA’s first open enrollment period in October 2013. The blue dots show the adjusted monthly mean values for the outcome, based on a multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.
eFigure 4: Interrupted Time-Series Analysis of Fair or Poor Self-Reported Health

Notes: Sample contains adults ages 18-64. The solid red lines show the adjusted time trends for the pre-ACA (January 1, 2012-September 30, 2013) and post-ACA (October 1, 2013-March 31, 2015) periods. The dashed red line shows the predicted trajectory if there had been no change in slope in the post-ACA period. The vertical dashed black line shows the beginning of the ACA’s first open enrollment period in October 2013. The blue dots show the adjusted monthly mean values for the outcome, based on a multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.
eFigure 5: Interrupted Time-Series Analysis of Percentage of Days with Activities Limited by Poor Health

Notes: Sample contains adults ages 18-64. The solid red lines show the adjusted time trends for the pre-ACA (January 1, 2012-September 30, 2013) and post-ACA (October 1, 2013-March 31, 2015) periods. The dashed red line shows the predicted trajectory if there had been no change in slope in the post-ACA period. The vertical dashed black line shows the beginning of the ACA’s first open enrollment period in October 2013. The blue dots show the adjusted monthly mean values for the outcome, based on a multivariable regression model controlling for state, age, sex, race/ethnicity, marital status, urban vs. rural residence, employment status, income, state-year unemployment rate, and calendar month.