Treat or Eat: The Impact of Medicaid Insurance on Food Insecurity among Low-Income Families

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Context: Research on Medicaid typically focuses on insurance coverage, utilization, expenditures, and health. The possibility that Medicaid had positive consequences beyond medicine – reverberating into other aspects of daily life – has not been sufficiently explored.

Objective: To estimate the impact of Medicaid insurance on adult and child food insecurity for low-income American families.

Design, Setting, and Participants: An instrumental variable method is used to evaluate the effect of gaining Medicaid, due to eligibility expansion under the Affordable Care Act in 2014, on family food insecurity. Because states that expanded Medicaid maybe different from those that opted out of the expansion, entropy balancing is used to achieve covariate balance between families in expanded states and non-expanded states. Data come from the Current Population Survey 2006-2016 and include 40,006 family units (unweighted, response rate 78.85%) whose income is below 138% of the federal poverty guideline. All analyses are at the family level and control for sociodemographic characteristics and historical trends.

Main Outcome Measures: Self-reported food insecurity based on 18 questions in the Core Food Security Module.

Results: Before the expansion in 2006-2013, the entropy-balance weighted prevalence of Medicaid coverage were similar for families in expanded and non-expanded states (33.3%). After the Medicaid expansion in 2014, families in expanded states experienced an increase of 11.2 percentage points ($p<0.001$) in Medicaid coverage, compared to those in non-expanded states. Such increase in coverage translates to a decline of 2.2 percentage points ($p<0.01$) in the overall food insecurity, 2.07 percentage point ($p<0.01$) in adult food insecurity, and 7.9 percentage point ($p<0.05$) in child food insecurity. The effect diminishes as the severity of food insecurity increases. Further assessments indicate that the Medicaid effect on food insecurity is due to families increasing their food expenditure as a result of declining out-of-pocket medical spending, not because they are encouraged to apply for food assistance programs when signing up for Medicaid.

Conclusion: There exists a potential tradeoff between food and healthcare among poor families, and policies that reduce healthcare out-of-pocket spending could generate additional benefits of reducing food insecurity. Future research should approach food policies in a broader way. Non-food policies, including those that subsidize for housing, transportation, healthcare, or utility bills, might also have a meaningful and unintended impact on reducing food insecurity.

I.   Introduction and Literature Review

In 2016, 12.3 percent of American families suffered from food insecurity, meaning that at least one family member experienced a reduction in quality, variety, or desirability of diet in the past year because the family lacked money for food (Coleman-Jensen et al. 2017). Research on food security often focuses on food stamps, without sufficiently investigating the zero-sum nature of family expenditures and the tradeoff among basic needs (Gundersen and Oliveira 2001, Hook and Balistreri 2006, Gundersen, Kreider, Pepper 2011). Given limited resources, pressure from one good due to increased prices or needs may lead to reductions in food consumption, causing food insecurity (Bhattacharya et al. 2002). The extent to which this tradeoff is causal requires further examination.

This paper investigates whether Medicaid – a federal insurance program for low-income families – alleviates the tradeoff between food and healthcare, two goods that represent important daily needs. In 2016, a majority of poor families spending is allocated to food and healthcare, only after housing and transportation (Bureau of Labor Statistics 2015). The average expenditure of low-income families is much higher than their after-tax income, meaning that they accrue debt and an increase in expenditure of one good such as healthcare can reduce resources for other necessities (Bureau of Labor Statistics 2015). Majerol et al. (2016) find that Medicaid low-income families allocate a smaller share of their total expenditure on healthcare and a larger share on housing and food than their non-Medicaid counterparts. It is possible that healthcare crowds out resources for other goods and influences food scarcity, but, surprisingly, previous research has not adequately addressed this issue.

I assess the causal impact of having Medicaid insurance on food insecurity in low-income families. However, directly estimating this effect will encounter three sources of bias – namely selection bias, reverse causation, and measurement error. First, selection bias implies that the decision to enroll in Medicaid may depend on unobservable factors that simultaneously influence food insecurity. Second, reverse causation suggests that the direction of the effect may be reversed, such that food insecure families tend to apply for Medicaid to offset healthcare costs so that they can spend more on food. Third, measurement error on self-reported Medicaid coverage in surveys is well-documented (Call et al. 2013, Boudreaux et al. 2015), causing underestimation of the true effect. I use the Medicaid expansion in 2014 under the Affordable Care Act (ACA) as a natural experiment to examine the effect of Medicaid coverage on food insecurity and address these bias sources. The ACA aims to expand Medicaid eligibility to nonelderly adults with family incomes at or below 138% of the federal poverty level. The decision to expand Medicaid eligibility is optional for states and is arguably unrelated to the decision of Medicaid enrollment at the individual level. Taking advantage of such geographical variation, I first use the difference-in-differences method to assess whether Medicaid coverage increases for low-income families in expanded states compared to those in non-expanded states after the expansion. I then use the instrumental variable method to investigate if such increase in Medicaid coverage translates to reductions in food insecurity. Previous studies have shown that states that expanded Medicaid experienced a significant increase of 15.6 percentage points in Medicaid coverage (Miller and Wherry 2017), and a decline of $344 in total out-of-pocket healthcare spending for

low-oncome adults (Blavin et al. 2018). Therefore, such decline in healthcare spending may provide additional resources for other non-health consumption.

II.   Data

Data comes from the Current Population Survey (CPS) in 2006-2016. Information on food insecurity is from the Food Security supplement fielded annually within December. Households with incomes above 185% of poverty are asked two screening questions about food stress: whether the household ran short of money for food and whether the household had enough to eat or enough of the kinds of foods they wanted to eat. Households reporting no food access problems are screened out of the food security supplement. All lower income households and higher income households reporting food access problems continue the supplement. The supplement uses 18 questions (10 questions for adults and 8 for children, Appendix A) to identify households that experience limited access to adequate food for economic reasons in the entire year. On average, about 54,000 households are interviewed each year, 84% of which completed the supplement. Responses are dichotomized to construct a food insecurity score ranging from 0 to 18, with higher scores representing more-severe food insecurity. Following recommendations from the U.S. Department of Agriculture (Coleman-Jensen et al. 2017), I classify households into four mutually exclusive groups: food security (score 0, "households had no problems or anxiety about consistently accessing adequate food"), marginal food security (score 1-2, "households had problems at times, or anxiety about, accessing adequate food, but the quality, variety, and quantity of their food intake were not substantially reduced"), low food security (score 3-5 for households without children or score 3-7 for those with children, "households reduced the quality, variety, and desirability of their diets, but the quantity of food intake and normal eating patterns were not substantially disrupted"), and very low food security (score 6-10 for households without children or score 8-18 for those with children, "at times during the year, eating patterns of one or more household members were disrupted and food intake reduced because the household lacked money and other resources for food"). I use three measures of food insecurity – namely risk of food insecurity (marginal food security, low food security, and very low food security vs. food security), threat of food insecurity (low food security and very low food security vs. food security and marginal food security), and a continuous food insecurity score (log+1). The first measure indicates any incident of food insecurity while the second includes only more-severe food insecure families. Results are consistent across three measures.

The Food Security supplement, however, lacks information on Medicaid insurance. Insurance coverage is instead available in the Annual Social and Economic (ASEC) supplement fielded in March of the following year, which asks respondents of their coverage in the previous year. I restrict the sample to include only 25% of respondents in the December Food Security supplement that are re-interviewed in the ASEC supplement to verify their insurance status (Drew et al. 2014, Pacas and Flood 2018). Further examination indicates that there are no systematic differences between matched and unmatched respondents.

Although food insecurity is measured at the household level, the unit of analysis is the health insurance unit[1] (referred to as family hereafter) that identifies individuals who would likely be

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[1] It is possible to have multiple health insurance units (or families) in one household.

considered a "family unit" in determining Medicaid eligibility (State Health Access Data Assistance Center 2012). I select 50,731 families whose total income is below 138% of the federal poverty guideline because they are most likely affected by the Medicaid expansion. I eliminate 3,745 families that have any members aged 64 or younger with Medicare coverage because these individuals mostly qualify for Medicare because of their disability and their unobservable characteristics maybe different from others. I then exclude families with missing information on food insecurity; Medicaid coverage; characteristics of the family reference person such as age, gender, race, ethnicity, marital status, education, and employment status. The final sample includes 40,006 families (78.85% response rate). Finally, I classify families into two distinct groups based on the likelihood that the Medicaid expansion affected their Medicaid coverage. The eligible group includes families that live in 32 states that expanded Medicaid while the ineligible group include families that live in 19 states that opted out of the expansion (Appendix B).

III.   Empirical Framework

Although the decision to expand Medicaid is optional to states, families living in expanded states maybe systematically different from those living in non-expanded states. This paper uses the entropy balance method to obtain covariate balance between eligible and ineligible groups by reweighting units appropriately and keeping the weights as close as the existing sampling weights to prevent the loss of information (Hainmueller 2012, Zhao and Percival 2017). Unlike other matching methods that eliminate observations that are not matched, entropy balance maintains the full sample to avoid bias. I use all control variables mentioned earlier and the outcome variable in baseline (before 2014) to create entropy weight. This weight is then applied to all subsequent analyses.

This paper first uses the difference-in-differences method to estimate the impact of the Medicaid expansion on Medicaid coverage and other food insecurity outcomes:

$$\text{Outcome}_{ft} = \beta_0 + \beta_1\, \text{Eligible}_{ft}*\text{Post}_{ft} + \beta_2\, \text{Eligible}_{ft} + \beta_3\, \text{Post}_{ft} + \beta_4 X_{ft} + \varepsilon_{ft} \qquad (1)$$

where Outcome_{ft} indicates whether family f has any member with Medicaid coverage or if the family experiences food insecurity in year t, Eligible_{ft} takes the value of 1 if a family lives in expanded states, and 0 if living in non-expanded states. Post_{ft} indicates if the family was interviewed after the Medicaid expansion[2]. X_{ft} includes control sociodemographic variables of the family reference person such as gender, age, race (white, black, Asian, or others), marital status (married, divorced/widowed/separated, or never married), Hispanic ethnicity, education (less than high school, high school graduate or equivalence, or college and above), employment status (employed, unemployed, or not in labor force), and family characteristics such as number of members and poverty level. I also control for year and state fixed effects to account for secular trends that affect both food insecurity and Medicaid coverage. Standard errors are clustered by states and pre/post expansion periods to account for autocorrelation in cross-sectional data.

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[2] Although most states that expanded Medicaid did so on January 1st, 2014, some states expanded Medicaid in later years. Thus, this variable is turned on in the year that a state expanded Medicaid.

However, the ultimate goal is to estimate a more-direct relationship between Medicaid coverage and food insecurity:

$$\text{FoodInsecurity}_{ft} = \delta_0 + \delta_1 \text{Medicaid}_{ft} + \delta_2 X_{ft} + \sigma_{ft} \tag{2}$$

where FoodInsecurity$_{ft}$ is a binary variable indicating whether family f experiences food insecurity in year t, Medicaid$_{ft}$ specifies whether any family member has Medicaid coverage. All other control variables are similar to equation (1). Directly estimating this equation would result in bias because the unobserved determinants of food insecurity are likely to be correlated with Medicaid coverage. I use the family's eligibility for Medicaid expansion, Eligible$_{ft}$*Post$_{ft}$, as an instrument for Medicaid coverage. The instrumental variable is valid because it is solely based on residence and time, and it should only impact food insecurity through its effect on Medicaid coverage after controlling for other covariates and applying the entropy weight.

IV.   Results
1.   Trends
Figure 1 demonstrates the weighted and unadjusted trends in Medicaid coverage and food insecurity for low-income families from 2006 to 2016. Before the expansion in 2014, about 30-33% of low-income families in both expanded and non-expanded states have at least one family member with Medicaid coverage. This trend diverged after 2014 when families in expanded states experienced a considerable increase in their Medicaid coverage. Coincidentally, the prevalence of food insecurity (risk of food insecurity, threat of food insecurity, and food insecurity score) slightly declined for families in expanded states, while it increased for those in non-expanded states. This implies that gaining Medicaid coverage might have reduced the prevalence of food insecurity for families in expanded states.

2.   Descriptive Statistics
Table 1 presents the weighted descriptive statistics of sociodemographic characteristics of the family reference person in the study. Overall, there are no significant differences between families in expanded and non-expanded states before and after the expansion. The family reference person is on average 42 years of age; 52-55% are female; 74% are white; 14-16% are black; 21-24% are Hispanic; 16-17% are married; 41-44% are college educated; 38-39% are employed, and the average poverty ratio is 61%. These low-income families are generally more likely to be non-white, non-married, unemployed, and live below the federal poverty guideline than an average American family.

3.   The Impact of Medicaid Expansion on Medicaid Coverage and Food Insecurity
Table 2 illustrates the impact of the Medicaid expansion on Medicaid coverage and food insecurity using the difference-in-differences approach (equation 1). The outcome in column (1) indicates whether any family is covered by Medicaid. Column (2) is the overall family food insecurity using all 18 questions for both adults and children (Appendix A). Column (3) represents adult food insecurity using the first 10 out of 18 questions. Lastly, the outcome in column (4) is child food insecurity that is derived from the last 8 questions in the module. Within each column 2 to 4, I assess different measurements of food insecurity as mentioned earlier. Risk

of food insecurity include all types of food insecurity while threat of food insecurity indicates only more-severe food insecure cases.

In Panel A, the results suggest that following the expansion families in expanded states enjoyed an increase in Medicaid coverage by 11.2 percentage points (p<0.001), a decrease of overall food insecurity by 2.5-3.7 percentage points across all three measurements (p<0.01, column 2), a decrease in adult food insecurity by 1.8 to 3.6 percentage points across all measurements (p<0.01 and p<0.05, column 3). The result for child food insecurity is mixed, such that the Medicaid expansion only reduces the probability of experiencing threat of food insecurity by 9.2 percentage points (p<0.05), but not the continuous score of food insecurity (column 4).

In Panel B, I assess the parallel assumption of the difference-in-differences approach by interacting variable indicating whether a family lives in expanded or non-expanded state with every single year. There are no differences between families in expanded and non-expanded states prior to the expansion in 2014, suggesting that the divergence in the outcome after 2014 is solely due to the Medicaid expansion. Additionally, the effect of the expansion on food insecurity is stronger in 2014 when it first took place than in subsequent years.

4. The Impact of Medicaid Coverage on Food Insecurity

Table 3 reports results from the instrumental variable method that investigates the more-direct effect of Medicaid coverage on food insecurity, using the Medicaid expansion as an instrumental variable (equation 2).

Panel A demonstrates a naïve analysis that regresses each outcome of food insecurity on an indicator of whether a family has any member with Medicaid coverage. The results indicate that families with Medicaid coverage are more likely to experience food insecurity (p<0.001 across all outcomes). These results, however, suffer from selection bias because although most families in this study qualify for Medicaid, those that apply and receive Medicaid benefits maybe fundamentally different from those without Medicaid.

Panel B report results that using the Medicaid expansion as an instrumental variable for whether a family receives Medicaid coverage. An increase in 10 percentage points in Medicaid coverage reduces the overall food insecurity by 1.8 to 3.4 percentage points across three measurements (p<0.01, column 1) and reduces adult food insecurity by 1.6 to 3.2 percentage points across three measurements (p<0.01 and p<0.05, column 2). Results for child food insecurity is mixed, such that Medicaid coverage only has a meaningful effect on threat of food insecurity but not the continuous score of food insecurity. Further assessments reveal that the F-statistics in the first stage ranges from 50 to 74, which is higher than the conventional level of 10, implying that the instrumental variable of Medicaid expansion is valid. The endogeneity test indicates that estimates obtained from a linear regression is biased, and an instrumental approach is necessary.

5. Mechanisms

Finally, in Table 4 I examine the mechanisms for the effect of Medicaid on food insecurity. Panel A investigates 10 questions that were used to construct the adult food insecurity score. Gaining Medicaid coverage due to the Medicaid expansion reduces the probability of adults being worried that food would run out before they could buy more ($p<0.01$), the probability that they ran out of food and could not afford to buy more ($p<0.05$), and the probability that adults could not afford to eat balance meals ($p<0.1$). Results in Panel B suggest that Medicaid has no impact on different aspects of food insecurity for children, and it even increases the probability that a child skipped meals at least one month in the past year ($p<0.05$).

In Panel C, I examine whether families that gain Medicaid due to the expansion enjoy a reduction in food insecurity because they are more likely to enroll in food assistance programs. Those who apply for public health insurance are often encouraged by case workers to apply for other public assistance programs such as food stamps if they qualify (Finkelstein et al. 2012), which may explain why food insecurity declines for families that benefit from the Medicaid expansion. However, I find that there is no effect of Medicaid coverage on the probability of a family receiving food stamp; assistance from a food bank; or free/low-cost lunch at school, Head Start, or a day-care program. In fact, Medicaid insurance even reduces the likelihood that children in a family receive free/low-cost breakfast at school. Therefore, it is unlikely that families that gain Medicaid coverage experience a decline in food insecurity due to their increasing enrollment in food assistance programs.

In Panel D, I investigate whether food expenditures increase as a result of having Medicaid insurance. The results suggest that Medicaid increase total food expenditure in general, food expenditures at grocery stores or supermarkets, food expenditures at specialty shops or convenience stores, and the usual weekly amount that a household spends on food. This suggests that having Medicaid coverage might have reduced out-of-pocket medical expenditures (Blavin et al. 2018) that crowd out food consumption, thus reduces food insecurity.

V. Conclusion

This paper suggests that there exists an important tradeoff between food and healthcare for low-income families. The central findings are threefold. First, Medicaid coverage increases for families living in expanded states compared to those in non-expanded states. Second, this increase in coverage translates to a reduction in food insecurity. Third, the effect of Medicaid on food insecurity is due to families increasing their food expenditures, not because of the increasing enrollment in food assistance programs.

The study makes several important contributions. First, no prior studies have examined the effect of Medicaid, or health insurance in general, on food insecurity. Despite previous research on Medicaid and healthcare utilization, expenditures, and health (Finkelstein et al. 2012), the possibility that Medicaid had positive consequences beyond medicine – reverberating into other aspects of daily life – has not been sufficiently explored. Second, the food stamp program is not the only pathway to reducing food insecurity. Subsidizing other non-food consumption such as healthcare through Medicaid or other public health insurance can also reduce food insecurity. Future research should approach food policies in a broader way. Non-food policies, including those that subsidize for housing, transportation, healthcare, or utility bills, might also have an unintended impact on reducing food insecurity.

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Figure 1: Unadjusted Trends of Medicaid Coverage and Food Insecurity of Health Insurance Units (HIU) With Federal Poverty Threshold <138% By Medicaid Expansion Status

Data Source: Current Population Survey, 2006-2016
Estimates are weighted using entropy matching balance in each period (Pre-ACA, Post-ACA, Implemented)
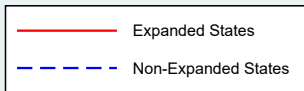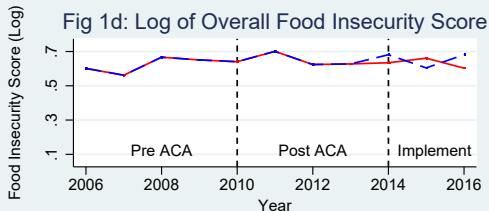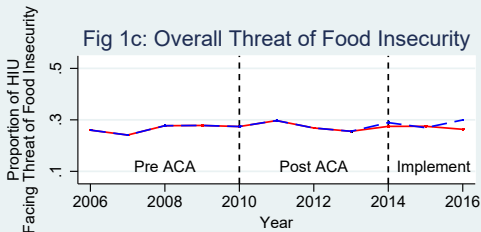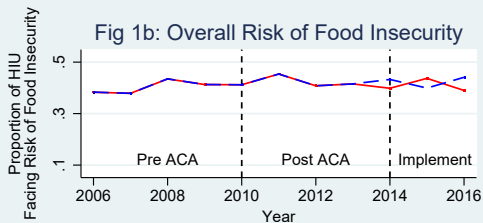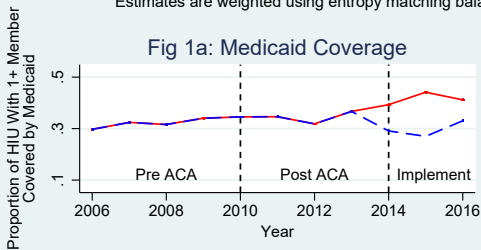
Table 1: Descriptive Statistics of Low-Income Families in Expanded and Non-Expanded States Before (2006-2013) and After (2014-2016) the Medicaid Expansion.

	Before Expansion (2006-2013)			After Expansion (2014-2016)		
	Non-Expanded States	Expanded States	p-value	Non-Expanded States	Expanded States	p-value
Characteristics of health insurance unit's reference person						
Any member is covered by Medicaid (0/1)	0.333	0.333	p=0.981	0.298	0.419	p<0.001
Age (continuous)	41.98	42.01	p=0.993	43.81	43.46	p=0.995
Female (0/1)	0.523	0.523	p=0.986	0.549	0.551	p=0.999
Race:						
White (0/1)	0.743	0.741	p=0.999	0.738	0.737	p=0.963
Black (0/1)	0.162	0.163	p=0.896	0.152	0.145	p=0.996
Asian (0/1)	0.0658	0.0653	p=0.885	0.0677	0.0757	p=0.976
Others (0/1)	0.0295	0.0298	p=0.946	0.0420	0.0421	p=0.958
Hispanic (0/1)	0.219	0.217	p=0.933	0.236	0.238	p=0.982
Marital status:						
Married (0/1)	0.171	0.171	p=0.943	0.160	0.159	p=0.992
Divorced/separated/widowed (0/1)	0.293	0.293	p=0.987	0.312	0.304	p=0.984
Singler/never married (0/1)	0.536	0.536	p=0.945	0.528	0.537	p=0.988
Educational attaintment:						
Less than high school (0/1)	0.242	0.242	p=0.928	0.221	0.217	p=0.995
High school graduate or equivalent (0/1)	0.339	0.340	p=0.972	0.336	0.337	p=0.933
College or above (0/1)	0.418	0.418	p=0.974	0.443	0.445	p=0.906
Employment status:						
Employed (0/1)	0.391	0.391	p=0.986	0.381	0.388	p=0.950
Unemployed (0/1)	0.107	0.107	p=0.960	0.0725	0.0703	p=0.964
Not in labor force market (0/1)	0.502	0.502	p=0.996	0.546	0.542	p=0.932
Health insurance unit's total income relative to federal poverty guideline (%)	61.26	61.25	p=0.983	60.89	60.41	p=0.999

	Before Expansion (2006-2013)			After Expansion (2014-2016)		
	Non-Expanded States	Expanded States	p-value	Non-Expanded States	Expanded States	p-value
Characteristics of household						
Number of household members	3.113	3.259	p=0.357	3.085	3.238	p=0.464
Number of household children	0.768	0.798	p=0.663	0.708	0.751	p=0.993
Number of health insurance units	10854	19294		3941	5917	

Note: p-value indicates whether the estimates for health insurance units in non-expanded states and in expanded states are statistically different from each other.

[a]: Estimates are obtained from a subsample of health insurance units with children under 18 years of age.

Table 2: Difference-in-Differences Estimates of the Impact of Medicaid Expansion on Medicaid Coverage and Food Insecurity for Low-Income Families, 2006-2016 Current Population Survey.

	Outcomes at Health Insurance Unit Level								
	(1) Medicaid	**(2)** Overal Food Insecurity			**(3)** Adult Food Insecurity			**(4)** Child Food Insecurity	
	Any Member Has Medicaid (0/1)	Risk of Food Insecurity (0/1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)	Risk of Food Insecurity (0/1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)
Panel A: Difference-in-Differences Estimates									
Expansion * Post-Policy	**0.112***	**-0.025**	**-0.020**	**-0.037**	**-0.023**	**-0.018***	**-0.036**	**-0.092***	**-0.017**
	(0.012)	**(0.009)**	**(0.007)**	**(0.014)**	**(0.009)**	**(0.008)**	**(0.013)**	**(0.043)**	**(0.019)**
Expansion (0/1)	0.052*	-0.007	-0.016	-0.027	-0.000	-0.011	-0.008	-0.135	-0.110***
	(0.021)	(0.012)	(0.016)	(0.030)	(0.010)	(0.021)	(0.029)	(0.135)	(0.021)
Post-Policy (0/1)	-0.008	-0.073*	-0.047*	-0.131**	-0.066+	-0.049*	-0.130**	-0.107	0.014
	(0.034)	(0.034)	(0.023)	(0.050)	(0.034)	(0.024)	(0.048)	(0.150)	(0.032)
Mean of outcome	0.339	0.414	0.272	0.638	0.405	0.254	0.592	0.902	0.291
No. health insurance units	40006	40006	40006	40006	40006	40006	40006	18789	18789
Panel B: Difference-in-Differences and Year Fixed-Effect Estimates									
Expansion * 2006	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)	(ref.)
Expansion * 2007	0.002	-0.002	-0.002	-0.003	-0.001	-0.002	-0.003	0.000	-0.000
	(0.027)	(0.029)	(0.029)	(0.049)	(0.030)	(0.028)	(0.045)	(0.108)	(0.052)
Expansion * 2008	-0.005	-0.011	-0.008	-0.018	-0.010	-0.008	-0.017	-0.022	-0.004
	(0.027)	(0.033)	(0.035)	(0.063)	(0.035)	(0.033)	(0.058)	(0.123)	(0.057)
Expansion * 2009	0.004	-0.006	-0.004	-0.009	-0.006	-0.004	-0.009	-0.019	-0.006
	(0.028)	(0.025)	(0.030)	(0.048)	(0.025)	(0.031)	(0.045)	(0.110)	(0.055)
Expansion * 2010	-0.002	-0.007	-0.007	-0.013	-0.007	-0.007	-0.013	-0.026	-0.007
	(0.024)	(0.035)	(0.030)	(0.056)	(0.036)	(0.030)	(0.052)	(0.088)	(0.056)
Expansion * 2011	-0.003	-0.011	-0.010	-0.020	-0.011	-0.010	-0.020	-0.044	-0.010
	(0.033)	(0.035)	(0.029)	(0.056)	(0.033)	(0.027)	(0.050)	(0.096)	(0.066)
Expansion * 2012	-0.007	-0.010	-0.007	-0.016	-0.010	-0.007	-0.015	-0.010	-0.004
	(0.030)	(0.022)	(0.023)	(0.040)	(0.020)	(0.025)	(0.035)	(0.088)	(0.056)

Expansion * 2013	-0.000	-0.007	-0.006	-0.013	-0.008	-0.005	-0.013	-0.023	-0.007
	(0.033)	(0.025)	(0.024)	(0.046)	(0.025)	(0.025)	(0.041)	(0.120)	(0.046)
Expansion * 2014	**0.075****	**-0.058***	**-0.033**	**-0.089+**	**-0.054+**	**-0.041**	**-0.086+**	**-0.158**	**-0.023**
	(0.025)	**(0.028)**	**(0.027)**	**(0.052)**	**(0.028)**	**(0.027)**	**(0.046)**	**(0.135)**	**(0.061)**
Expansion * 2015	**0.152*****	**0.021**	**-0.007**	**0.028**	**0.022**	**0.003**	**0.033**	**-0.007**	**-0.032**
	(0.032)	**(0.026)**	**(0.026)**	**(0.045)**	**(0.026)**	**(0.026)**	**(0.041)**	**(0.126)**	**(0.055)**
Expansion * 2016	**0.099*****	**-0.043**	**-0.029**	**-0.062**	**-0.044**	**-0.023**	**-0.066**	**-0.138**	**-0.010**
	(0.026)	**(0.029)**	**(0.027)**	**(0.050)**	**(0.028)**	**(0.028)**	**(0.046)**	**(0.112)**	**(0.065)**
No. health insurance units	40006	40006	40006	40006	40006	40006	40006	18789	18789

Note: $+p<0.1$, $*p<0.05$, $**p<0.01$, $***p<0.001$. Robust standard errors are in parenthesis and are clustered by state and pre/post expansion. Each column by panel is a separate linear probability model regression at the health insurance unit (HIU) level and controls for state fixed-effect, year fixed-effect, characteristics of the reference person in the HIU such as age (every singe dummy for age), marital status (married, widowed, divorced, separated, or single), gender, race (white, black, asian, or others), Hispanic ethnicity, and employment status (employed, unemployed, not in labor force), as well as characterisitcs of the household and HIU such as the number of household members (single dummy for every value) and the poverty level of the HIU as compared to the federal poverty guideline.

Table 3: Instrumental Variable Estimates of the Impact of Medicaid Coverage on Food Insecurity for Low-Income Families, 2006-2016 Current Population Survey.

	Outcomes at Health Insurance Unit Level							
	(1) Overal Food Insecurity			**(2)** Adult Food Insecurity			**(3)** Child Food Insecurity	
	Risk of Food Insecurity (0/1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)	Risk of Food Insecurity (0/1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)	Threat of Food Insecurity (0/1)	Ln(Food Insecurity Score +1)
Panel A: OLS Estimates								
Any HIU member has Medicaid (0/1)	**0.118*****	**0.090*****	**0.202*****	**0.114*****	**0.084*****	**0.185*****	**0.240*****	**0.089*****
	(0.007)	**(0.008)**	**(0.014)**	**(0.008)**	**(0.008)**	**(0.014)**	**(0.023)**	**(0.008)**
Mean of outcome	0.414	0.272	0.638	0.405	0.254	0.592	0.902	0.291
No. health insurance units	40006	40006	40006	40006	40006	40006	18789	18789
Panel B: Instrumental Variable Estimates								
Predicted value for whether any HIU member has Medicaid	**-0.222****	**-0.181****	**-0.335****	**-0.207****	**-0.162***	**-0.324****	**-0.793***	**-0.146**
	(0.080)	**(0.066)**	**(0.124)**	**(0.076)**	**(0.069)**	**(0.115)**	**(0.370)**	**(0.167)**
F-statistics (1st stage)	73.59	73.59	73.59	73.59	73.59	73.59	50.54	50.54
Endogeneity test (H_0: no endogeneity)	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.01$	$p < 0.01$	$p < 0.001$	$p < 0.05$	$p = 0.341$
Mean of outcome	0.414	0.272	0.638	0.405	0.254	0.592	0.902	0.291
No. health insurance units	40006	40006	40006	40006	40006	40006	18789	18789

Note: $+p<0.1$, $*p<0.05$, $**p<0.01$, $***p<0.001$. Robust standard errors are in parenthesis and are clustered by state and pre/post expansion.

Each column by panel is a separate regression at the health insurance unit (HIU) level and controls for state fixed-effect, year fixed-effect, characteristics of the reference person in the HIU such as age (every singe dummy for age), marital status (married, widowed, divorced, separated, or single), gender, race (white, black, asian, or others), Hispanic ethnicity, and employment status (employed, unemployed, not in labor force), as well as characterisitcs of the household and HIU such as the number of household members (single dummy for every value) and the poverty level of the HIU as compared to the federal poverty guideline.

Table 4: Instrumental Variable Estimates of the Impact of Medicaid Coverage on 18 Individual Food Insecurity Questions, Participation in Food Assistance Programs, and Food Expenditures for Low-Income Families, 2006-2016 Current Population Survey.

Outcomes at Health Insurance Unit Level		Independent variable: Medicaid Coverage	
Description	Mean	Coef.	S.E.
Panel A: 10 questions used to construct 12-month adult food insecurity scale			
Worried food would run out before able to afford more food (0/1)	0.357	-0.181*	(0.081)
Ran out of food and could not afford to buy more food (0/1)	0.297	-0.234**	(0.078)
Could not afford to eat balanced meals (0/1)	0.271	-0.179+	(0.092)
Adults skipped/cut meal size at least once because not enough money (0/1)	0.163	-0.077	(0.065)
(For those skipped/cut meal) frequency of doing so is almost every month (0/1)	0.0727	-0.008	(0.067)
Adults ate less than felt should at least once because not enough money (0/1)	0.170	-0.105	(0.082)
Adults felt hungry but didn't eat at least once because not enough money (0/1)	0.0947	-0.016	(0.059)
Adults didn't eat full day at least once because not enough money (0/1)	0.0431	-0.033	(0.054)
(For those didn't eat full day) frequency of doing so is almost every month (0/1)	0.0174	0.002	(0.025)
Adults lost weight because not enough money for food (0/1)	0.0556	-0.041	(0.044)
Panel B: 8 questions used to construct 12-month child food insecurity scale			
Relied on low-cost food for children because couldn't afford food (0/1)	0.211	-0.240	(0.160)
Couldn't afford to feed child balanced meals (0/1)	0.120	-0.176	(0.108)
Child didn't eat enough because couldn't afford food (0/1)	0.0620	-0.001	(0.091)
Child didn't eat for a full day because couldn't afford food (0/1)	0.00140	0.008	(0.009)
Cut size of child's meals at least 1 month because couldn't afford food (0/1)	0.0482	0.069	(0.108)
Child was hungry but couldn't afford more food (0/1)	0.0137	-0.017	(0.030)
Child skipped meals at least one month because couldn't afford food (0/1)	0.0260	0.096*	(0.048)
Child skipped meals at least one day last month because couldn't afford food (0/1)	0.0700	0.333	(0.289)
Panel C: Participation in food assistance programs			
Household received food stamp past 12 months (0/1)	0.390	0.165	(0.126)
Household received emergency food from a food bank/food pantry/church/others past 12 months (0/1)	0.179	0.157	(0.098)
Children aged 5-18 received free/low-cost breakfast at school past month (0/1)	0.807	-0.579***	(0.136)
Children aged 5-18 received free/low-cost lunch at school past month (0/1)	0.628	-0.004	(0.148)
Children aged 12 or younger received any free/reduced-cost food from Head Start or a day-care program past month (0/1)	0.132	0.061	(0.155)
Panel D: Household expenditures spent on food			
Ln(Total food expenditures last week +1)	4.515	0.757*	(0.361)
Ln(Total food expenditures at grocery stores/supermarkets last week +1)	4.459	0.366+	(0.213)
Ln(Total food expenditures at specialty shops/convinience stores last week +1)	3.093	2.752***	(0.532)
Ln(Usual weekly amount a household spends on food +1)	4.626	0.936***	(0.255)

Note: +p<0.1, *p<0.05, **p<0.01, ***p<0.001. Standard errors are clustered by states and and pre/post expansion periods.

Each row is a separate two-stage least squared regression that controls for state fixed-effect, year fixed-effect, characteristics of the reference person in the HIU such as age (quadratic and cubic terms), marital status (married, widowed, divorced, separated, or single), gender, race (white, black, asian, or others), Hispanic ethnicity, and employment status (employed, unemployed, not in labor force), as well as characterisitcs of the household and HIU such as the number of household members (quadratic and cubic terms), number of children (quadratic and cubic terms) and the poverty level of the HIU as compared to the federal poverty guideline (quadratic and cubic terms).

Appendix A: 18 Questions Used to Construct Food Insecurity Scale in the Current Population Survey 2006-2016.

Panel A: 10 questions used to assess adult food insecurity

1 "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?

2 "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

3 "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for you in the last 12 months?

4 In the last 12 months, did you or other adults in the household ever cut the size of your meals or skip meals because there wasn't enough money for food? (Yes/No)

5 (If yes to question 4) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

6 In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (Yes/No)

7 In the last 12 months, were you ever hungry, but didn't eat because there wasn't enough money for food? (Yes/No)

8 In the last 12 months, did you lose weight because there wasn't enough money for food? (Yes/No)

9 In the last 12 months did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

10 (If yes to question 9) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

Panel B: 10 questions used to assess child food insecurity

11 "We relied on only a few kinds of low-cost food to feed our children because we were running out of money to buy food." Was that often, sometimes, or never true for you in the last 12 months?

12 "We couldn't feed our children a balanced meal, because we couldn't afford that." Was that often, sometimes, or never true for you in the last 12 months?

13 "The children were not eating enough because we just couldn't afford enough food." Was that often, sometimes, or never true for you in the last 12 months?

14 In the last 12 months, did you ever cut the size of any of the children's meals because there wasn't enough money for food? (Yes/No)

15 In the last 12 months, were the children ever hungry but you just couldn't afford more food? (Yes/No)

16 In the last 12 months, did any of the children ever skip a meal because there wasn't enough money for food? (Yes/No)

17 (If yes to question 16) How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months?

18 In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

Appendix B: State Medicaid Expansion Decision By 2018

Expanded States		Non-Expanded States
States	Date of Expansion	States
Alaska	1/1/2014	Alabama
Arizona	1/1/2014	Florida
Arkansas	1/1/2014	Georgia
California	1/1/2014	Idaho
Colorado	1/1/2014	Kansas
Connecticut	1/1/2014	Maine
Delaware	1/1/2014	Mississippi
District of Columbia	1/1/2014	Missouri
Hawaii	1/1/2014	Nebraska
Illinois	1/1/2014	North Carolina
Iowa	1/1/2014	Oklahoma
Kentucky	1/1/2014	South Carolina
Maryland	1/1/2014	South Dakota
Massachusetts	1/1/2014	Tennessee
Minnesota	1/1/2014	Texas
Nevada	1/1/2014	Utah
New Jersey	1/1/2014	Virginia
New Mexico	1/1/2014	Wisconsin
New York	1/1/2014	Wyoming
North Dakota	1/1/2014	
Ohio	1/1/2014	
Oregon	1/1/2014	
Pennsylvania	1/1/2014	
Rhode Island	1/1/2014	
Vermont	1/1/2014	
Washington	1/1/2014	
West Virginia	1/1/2014	
Michigan	4/1/2014	
New Hampshire	8/15/2014	
Indiana	2/1/2015	
Louisiana	7/1/2016	
Montana	1/1/2016	