School's out, Lunch's out?
The Effect of Summer Break on Student's Body Size

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Abstract

School meal programs in the US have been shown to improve nutritional intake and test scores. The onset of summer break reduces the operative scale of these programs, which may mitigate some of the positive effects of these programs. We use data from National Health Interview Survey (NHIS) to examine the effect of the short-term unavailability of the school meal program on the height and weight of students aged 12-17 from low socio-economic status (SES) families. Exploiting the random timing of the survey month, we employ the difference-in-difference strategy to identify the summer effect on students who are recipients of the school meal program. We show that summer break, July and August, has a significantly positive effect on the probability of being overweight for low-SES students, while post-summer break, September and October, does not have a similar effect. Moreover, most low-SES students aged 13 to 17 are less likely to skip meals. The results suggest the increase in becoming overweight during summer break may be driven by the difference in nutrition and calories of meal content when the school meal program is absent.

Keywords: Health, School Meal Programs, Body Size

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1 Introduction

School meal programs such as the National School Lunch Program (NSLP) and the School Breakfast Program (SBP) have been serving students enrolled in public and private non-profit schools since the enactment of the National School Lunch Act in 1945 and the Child Nutrition Act in 1966. In 2015, USDA estimated that NSLP benefited 30.5 million students and the SBP has benefited 14 million students each day (USDA, 2015).[1] The objective of these programs is to serve as a compensatory mechanism for children who are from low socioeconomic status (SES) households, by ensuring that their diet remains balanced. This would then enable improvement in their academic as well as health outcomes. However, in the summer break, when school is not in session, the coverage of these programs is reduced. Even though the Summer Food Service Program (SFSP) is in operation, the free meals under the program are offered only in select locations. The SFSP served only about 2.8 million students in July 2015, hence catering to fewer people than in the school year[2]. It is possible that this nutritional deficiency in the summer may mitigate the positive effect that the school meal programs have on the health outcomes of low SES children.

This paper attempts to study the effect of short-term unavailability of the school meal program on the height and weight measures of school-going children. Using the National Health Interview Survey (NHIS) dataset, we use eligibility for the Supplemental Nutrition Assistance Program (SNAP)[3] and the Temporary Assistance for Needy Families (TANF)[4] to evaluate the effect of the summer break on the health outcomes of children from low SES households. The eligibility for these programs allows us to identify those eligible for the school meal programs since eligibility for SNAP or TANF ensures automatic eligibility for the school meal programs. The outcome vari-

[1] If income is below 130% of the Federal poverty line, the child is eligible for the free meal. If income is between 130% and 185% of the Federal poverty line, the child is eligible for a reduced-price meal and cannot be charged more than 40 cents per meal.

[2] It is not necessary for children to be enrolled in summer school to avail of this scheme. Meal sites can be open or enrolled. Open sites operate in low-income areas and serve everyone on the site. Enrolled sites provide free meals to children enrolled in an activity program at the site. Camps may also participate in SFSP. They receive payments only for the meals served to children who are eligible for free and reduced-price meals, (USDA, 2015).

[3] SNAP is available to low-income households and they must have monthly gross income less than 130% of the Federal poverty guidelines

[4] TANF provides temporary financial assistance to low-income individuals, till they can do without such assistance.

ables we look at here are the z-score of height, weight, BMI, the probability of skipping meals, the probability of being overweight and the probability of being obese.

We employ a difference-in-difference strategy with summer as the treatment variable. Our identification strategy relies on the random timing of the survey month. The results show that the summer break, July and August, has a significant impact on the probability of overweight. We also find that children aged 14 experienced a significant gain in weight, and their probability of being obese also increases significantly by 0.106. However, in the months of July and August, there is a reduction in the probability of skipping meals for children in all age groups except for age 15.

The rest of the paper is organized as follows. Section 2 provides a brief review of the existing literature, Section 3 introduces the dataset and gives descriptive statistics, Section 4 describes the empirical strategy, Section 5 explains the conceptual framework, Section 6 discusses the results and Section 7 discusses our findings and gives concluding remarks, Section 8 is the appendix graph.

2 Review of Literature

Several studies have analyzed the effects of the school meal programs on health outcomes and school performance. The programs have been successful in improving academic achievement as well as cognitive ability (Imberman and Kugler (2014); Frisvold (2015)); as well as improving nutritional intake and countering obesity (Millimet et al. (2010); Hinrichs (2010); Bhattacharya et al. (2006)). Schanzenbach and Zaki (2014) use USDA data to study the short run impact of two interventions: universal free breakfast at school and breakfast provision in the classroom. Their results show an increase in the shift of consumption of breakfast from home to school but little effect on nutrition and health. Corcoran et al. (2016) study the breakfast in classroom program in New York City using longitudinal data from the New York City Department of Education (NYCDOE) to examine its effects on body mass index (BMI), educational attainment, the participation of in-class breakfast program and the school attendance. They find an increase both in participation of breakfast program as well as school attendance, but a relatively insignificant impact on test scores.

However, few studies have studied the effects that temporary unavailability of school meals might have on program participants. This is important in light of some studies that have shown that meals served at home have less nutritive value as compared to meals served at school (Devaney and Stuart., 1998). Waehrer (2008) compares differences in breakfast patterns between weekdays and weekends for both participants and non participants of the program using time-diary data from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). She finds a counter intuitive result wherein the SPB reduces breakfast intake. She attributes this to students not being able to avail of free meals due to tight bus schedules and lack of supervision at the cafetaria.

Herbst (2013) uses the summer break as an instrumental variable to measure the impact of parental care versus non parental care. Non parental care is defined as the institutional care given to children, which mainly consists of child care at school. His results are inconclusive, with the OLS results showing that non parental care is more effective than parental care, but the IV results showing that non parental care was actually detrimental to children and they are worse off during the summer when school is not in operation. von Hippel et al. (2007) use Early Childhood Longitudinal Survey (ECLS) data and find that students tend to gain weight in the summer months, when school is not in operation, and they find this effect to be worse for black and Hispanic children. Zhang et al. (2011) find no significant effect of the summer break on the BMI of Indian American children whose measurements were taken under a school based obesity prevention trial, and find that it may be more related to the growth spurt age.

In addition, the impact of the summer break on the height of children is important, as certain studies have shown that the poor nutrition could lead to delays in the growth spurt Marshall and Tanner (1969). Height has been shown to have a causal impact on future earnings (Case and Paxson, 2008) and the height premium is the highest in the teen years. Specifically, it has been found that at age 16, height is a major determinant of the teen premium (Nicola Persico and Silverman, 2004). Our paper is a contribution to the existing literature on the impact of the summer break, We also try to assess the effect of this temporary break in the supply of food on the anthropometric measures of the children (height for age, weight for age and BMI for age) from low SES and high SES backgrounds. In addition, we also attempt to examine the impact of the summer break on height at different ages and the age at which the impact of the summer break is the most adverse, along with how it influences the probabilities of being obese, being overweight and whether it has any impact on skipping meals.

3 The Data

This project uses annual data from National Health Interview Survey (NHIS) from 2008 to 2014, which provides self-reported information regarding height and weight for children aged 12 to 17, together with their family characteristics. We choose to use this dataset for two main reasons. First, it provides variation in the timing of survey month. As shown in Table 1, the average observations per month across our sample period are about 1,463, and the average observations per year are about 4,388. Second, the age variation in children surveyed allows us to identify the heterogeneous effects on height for age and weight for age.

Our goal is to compare the children who receive free meals from school meal programs with those who do not, before and after the summer break. Though the direct question on whether children receive free lunch or breakfast from the school food program is not included in the survey, NHIS asks if any family member receives TANF and SNAP.[5] As mentioned before, parents who receiving TANF or SNAP, their children are automatically eligible for free school meals. Therefore, we use receiving SNAP/TANF as a proxy for receiving free meals from school meal programs. Table 2 shows the summary statistics by receiving SNAP/TANF or not. The stars next to the standard errors mean the significance of difference between the two groups.[6] As we can see, children from families receiving SNAP/TANF are more likely to be African-American, living in a larger family with more kids, their mothers are less educated, and they tend to be shorter, obese, overweight,

[5] Before 2010, NHIS only asked if any family member receives TANF; Since 2011, NHIS asked both whether receiving TANF and SNAP.

[6] From the website of CDC, obsesity is defined as BMI greater or equal to 95th percentile by gender and age, and overweight is defined as BMI less than 95th percentile and greater or equal to 85th percentile.

and are more likely to skip meals. We include the plots for outcome variables by month and by whether receiving SNAP/TANF or not in the appendix.

For our identification to be valid, the timing for the survey month should be random for observed characteristics. For example, if the families with low-income are less likely to be surveyed during the summer because they work more during the summer break, we would worry that the estimates are biased in that case. We thus perform a balanced check, where we regress a dummy for certain month on receiving SNAP/TANF or not and the observed characteristics. The results are presented in Table 3. For column (1) to (12), the dependent variable is a dummy for the month; for column (13), the dependent variable is a dummy with 0 if surveyed in May, June, September and October, 1 if surveyed in July and August; for column (13), the dependent variable is a dummy with 0 if surveyed in May to July, 1 if surveyed in September and October. As shown in the table, being surveyed in January and December seem to be significantly correlated with receiving SNAP/TANF or not. Moreover, in Table 1, January and December also have smaller sample size. This raises concerns for selection bias in families surveyed in January and December. To avoid the possible selection problems in surveyed month and also to exclude the effect of winter breaks on the body measures, we thus restrict our sample on May to October for the analysis.

4 Empirical Strategy

Exploiting the random timing of the survey, we employ a difference-in-difference (DD) methodology to estimate the effect of summer on the body measures of children from families receiving SNAP or TANF. We define the "pre-treatment" period as May and June, and two "treatment" periods, one is in July and August, the other in September and October. The exact specification is as follows:

$$
\begin{aligned}
(1) \qquad y_{irt} = {} & \beta_0 + \beta_1 \mathrm{SNAP/TANF}_i \times \mathrm{Summer1}_t + \beta_2 \mathrm{SNAP/TANF}_i \times \mathrm{Summer2}_t \\
& + \beta_3 \mathrm{SNAP/TANF}_i + \beta_4 \mathrm{Summer1}_t + \beta_5 \mathrm{Summer2}_t \\
& + \phi_1 Female_i + \phi_2 Black_i + \phi_3 Age_i + \phi_4 Age_i^2 + X_i'\Gamma + \theta_{rt} + \epsilon_{irt}
\end{aligned}
$$

where y_{irt} is the outcomes of child i in region r at time t, including height, weight, BMI, obesity, overweight, and ever skipped a meal because not enough money; SNAP/TANF$_i$ is the dummy for any family members receiving SNAP or TANF for child i; Summer1 is a dummy with 0 if surveyed in May, June, September and October, 1 if surveyed in July or August; Summer2 is a dummy with 0 if surveyed in May, June, July and August, 1 if surveyed in September or October; $Female_i$ is child's gender; $Black_i$ is a dummy for being African-American; Age_i is the age in years; X_i is additional controls, including if child's mom is high school graduate or not, size of the family, number of kids in the family, living with married parents; θ_{rt} is the region-year fixed effect, and the standard errors are clustered at region and interview month level. In equation (1), β_1 and β_2 are the DD estimates of our interest.

To identify the heterogeneous effects for different ages, we also specify an estimation with full interactions for each age, with age 12 as the reference group:

(2)

$$
\begin{aligned}
y_{irt} = & \beta_0 + \sum_{k=13}^{17} \beta_{1,k}\text{SNAP/TANF}_i \times \text{Summer1}_t \times Age_k + \sum_{k=13}^{17} \beta_{2,k}\text{SNAP/TANF}_i \times \text{Summer2}_t \times Age_k \\
& + \beta_3\text{SNAP/TANF}_i + \beta_4\text{Summer1}_t + \beta_5\text{Summer2}_t + \sum_{k=13}^{17} \beta_{6,k} Age_k + \beta_7\text{SNAP/TANF}_i \times \text{Summer1}_t \\
& + \beta_8\text{SNAP/TANF}_i \times \text{Summer2}_t \sum_{k=13}^{17} \beta_{9,k}\text{SNAP/TANF}_i \times Age_k + \sum_{k=13}^{17} \beta_{10,k}\text{Summer1}_t \times Age_k \\
& + \sum_{k=13}^{17} \beta_{11,k}\text{Summer2}_t \times Age_k + \phi_1 Female_i + \phi_2 Black_i + X_i'\Gamma + \theta_{rt} + \epsilon_{irt}
\end{aligned}
$$

where $\beta_{1,k}$'s and $\beta_{2,k}$'s are the estimates that identify the difference of DD effects between children aged 12 and aged k for Summer1 and Summer2, respectively.

To show further evidence for parallel trend assumption, we perform a placebo test where we only use the observations from pre-treatment period, May and June, and assign June to be the fake treatment period. Specifically, we estimate the DD effect between May and June:

$$
\begin{aligned}
(3) \qquad y_{irt} = & \beta_0 + \beta_1 \text{SNAP/TANF}_i \times \text{Fake Summer}_t + \beta_2 \text{SNAP/TANF}_i + \beta_3 \text{Fake Summer}_t \\
& + \phi_1 Female_i + \phi_2 Black_i + \phi_3 Age_i + \phi_4 Age_i^2 + X_i' \Gamma + \theta_{rt} + \epsilon_{irt}
\end{aligned}
$$

where Fake Summer is a dummy with 0 if surveyed in May, 1 if surveyed in June. If the parallel trend assumption holds, β_1 should be insignificant.

5 Conceptual Framework

Grouping the summer months together and using this grouping as a treatment variable, this paper intends to investigate if summer breaks worsen height and weight measures for low-SES students. Summer breaks may have a differential impact on the two groups based on two main channels: the school food program and parental factors. First, low-SES students receive subsidised meals during the school session, but may not have access to the summer food program since its coverage is limited as compared to the school meal programs. Hence, this channel may lead to a *decrease* in the weight of low SES students. Second, parental behaviors also contribute to the effect of summer break on children's body size. Parents from low-SES and high-SES may prefer different dietary patterns and activities, which may be due to monetary constraints or general habits. For example, parents from low-SES may encourage consumption of fast food since it is cheaper, but these foods tend to have a high calorific content and are low on nutrients. In this case, one would expect to see a *increase* in body weight. Furthermore, in case of low SES households with many family members, there may be rationing of portion sizes or skipping of meals in the summer, which may lead to a *decrease* in the weight of the child. Hence, the parental channel may have two opposing effects on body weight.

As far as height is concerned, we do not expect to see an overall significant difference before and after the summer in both low and high SES students. However, this difference may be significant for certain age groups, which are near the puberty age and expected to experience the growth spurt. Specifically, for boys, we would expect to see this spurt in height around the age of 15-16. For girls, we expect to see this spurt earlier, around the age of 13-14. Lack of nutrition would only delay this spurt for children in this age range in low SES households, so the summer should affect low SES children who are around the growth spurt ages more adversely.

6 Results

The first two rows in Table 4 are the DD estimates from equation 1. Inc column (5), we can see an significant effect of Summer1 on the probability of being overweight for children receiving SNAP/TANF. Summer1 increase the probability by about 5 percentage points, about 26 percent within the treatment group (0.05/0.193), which is economically significant. No significant effects can be found either from Summer1 or Summer2 on the z-score for height, weight, BMI, and the probability of obesity and skipping meals.

Table 5 are the result of DD estimates from equation 2. It seems that Summer1 has a non-negligible effect on the weight and obesity for children aged 14. To be specific, for children aged 14, Summer1 increases the z-score for weight by 0.274, about 49 percent for the treatment group, and increases the probability of obesity by 0.106, about 55 percent for the treatment group. For children aged 15, Summer1 increases the probability of being overweight by 0.114, about 59 percent for the treatment group. On the other hand, Summer1 reduces the probability of skipping meals for children aged 13, 14, 16, and 17. This suggests that the difference may be driven more by *differences in the meal content*, with children from low SES households eating unhealthier food in the summer. High-SES parents may send their children to summer camps and enhance their physical activity levels, while low SES parents may let their children sit at home being inactive. However, in the case of children from low SES households, activity levels may dip in the summer, leading to an increase in the levels of lethargy after the summer break. The influence of this channel has been previously cited in the literature. AL et al. (2007) have speculated that nutritional gains during the school year are nullified due to a decrease in physical activity levels in the summer. Waehrer (2008) explain that a potential factor in contributing to weight gain in low SES students over the summer could be the increase in sedentary behavior. Thus the parental effect may be stronger in this case.

Last, Table 6 shows the placebo test described as equation (3), where the fake treatment period is defined as a dummy with 1 if surveyed in June. As we can see from the results, none of the DD estimates are significant. Therefore, we are more confident in the validity of parallel trend assumption.

7 Limitations and Future Work

There are certain limitations to our study. Our dataset only has information on the number of individuals receiving SNAP or TANF. This does not necessarily imply that the takeup rate for school programs is the same, as there is a separate application procedure which has to be completed to avail of these programs. Hence, the takeup rate for these programs may not correspond to the eligibility for SNAP and TANF. A second limitation of our dataset is that height and weight measures are self reported, which may have caused measurement errors in our estimates of height for age and weight for age. Future work would involve working with an alternative dataset where height and weight are measured.

Our results suggest that the presence of school meal programs may not be the only mechanism at work during the summer break. Further work on this subject would involve closely investigating the parental and environmental factors which affect nutritional intake as well as physical activity levels.

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Table 1: Sample Observations

Survey Month	Year 2008	2009	2010	2011	2012	2013	2014	Total
1	82	16	72	258	304	301	136	1,169
2	153	109	236	242	244	250	127	1,361
3	186	75	219	282	234	257	223	1,476
4	176	149	147	261	273	230	226	1,462
5	191	203	182	264	296	253	246	1,635
6	173	160	178	325	283	245	241	1,605
7	180	181	159	252	311	269	209	1,561
8	170	215	194	266	267	274	211	1,597
9	176	154	150	254	285	241	213	1,473
10	95	287	216	280	300	166	201	1,545
11	80	259	236	268	273	161	188	1,465
12	84	269	102	251	260	70	167	1,203
Total	1,746	2,077	2,091	3,203	3,330	2,717	2,388	17,552

Table 2: Summary statistics

	Receiving SNAP or TANF			Receiving SNAP or TANF	
	NO	Yes		NO	Yes
Age	15.252	15.166	z_Height	0.069	-0.103
	(1.669)	(1.649)***		(1.059)	(1.109)***
Female (%)	0.486	0.502	z_Weight	0.419	0.559
	(0.5)	(0.5)		(0.998)	(1.027)***
Mom high school graduate (%)	0.861	0.657	z_BMI	0.38	0.619
	(0.346)	(0.475)***		(1.056)	(1.07)***
Black (%)	0.143	0.274	Obesity (%)	0.122	0.192
	(0.35)	(0.446)***		(0.328)	(0.394)***
Size of family	3.995	4.18	Overweight (%)	0.16	0.193
	(1.214)	(1.595)***		(0.366)	(0.394)***
Number of kids	1.74	2.16	Skip any meal (%)	0.307	0.405
	(0.918)	(1.223)***		(0.461)	(0.491)***
Married parents (%)	0.357	0.378	Observations for Skip	2451	1912
	(0.479)	(0.485)**			
Height in cm	165.323	163.819			
	(10.551)	(10.611)***			
Weight in kg	61.126	62.767			
	(14.9)	(15.592)***			
BMI	22.22	23.268			
	(4.319)	(4.796)***			
Observations	14909	2618	Observations	14909	2618

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Balanced Check

	(1) Jan	(2) Feb	(3) Mar	(4) April	(5) May	(6) Jun	(7) Jul
SNAP/TANF	0.146***	-0.0103	0.0694*	0.00440	0.00222	-0.0161	-0.0523
	(0.0387)	(0.0395)	(0.0377)	(0.0379)	(0.0369)	(0.0375)	(0.0379)
Age	0.0122	0.223	-0.0758	0.303**	-0.146	-0.0142	-0.00634
	(0.162)	(0.156)	(0.151)	(0.153)	(0.146)	(0.149)	(0.150)
Age squared	-0.000568	-0.00781	0.00255	-0.00986*	0.00490	0.000669	0.000490
	(0.00537)	(0.00516)	(0.00499)	(0.00506)	(0.00484)	(0.00492)	(0.00496)
Female	-0.0360	0.00178	0.0228	0.0278	0.0150	0.00313	-0.0192
	(0.0280)	(0.0267)	(0.0260)	(0.0261)	(0.0252)	(0.0255)	(0.0256)
Mom HS graduate	-0.0302	-0.0355	0.0921**	0.0184	-0.0218	0.0570	-0.0435
	(0.0375)	(0.0364)	(0.0373)	(0.0359)	(0.0346)	(0.0361)	(0.0351)
Black	-0.0477	0.0622*	-0.0703*	0.000914	0.0208	0.0180	0.160***
	(0.0394)	(0.0359)	(0.0367)	(0.0362)	(0.0346)	(0.0348)	(0.0335)
Size of family	0.0294	-0.0125	0.0256	0.0376*	0.0166	-0.0129	-0.0230
	(0.0223)	(0.0226)	(0.0213)	(0.0218)	(0.0200)	(0.0204)	(0.0212)
Number of kids	-0.0322	0.0160	-0.0348	-0.0377	-0.0130	0.0185	0.0403
	(0.0278)	(0.0279)	(0.0262)	(0.0271)	(0.0247)	(0.0254)	(0.0261)
Married parents	-0.0387	-0.0708*	-0.0640	-0.0338	-0.0321	0.0861**	0.0810**
	(0.0429)	(0.0411)	(0.0406)	(0.0406)	(0.0381)	(0.0386)	(0.0389)
Observations	19096	19096	19096	19096	19096	19096	19096
	(8) Aug	(9) Sep	(10) Oct	(11) Nov	(12) Dec	(13) Summer1	(14) Summer2
SNAP/TANF	-0.0178	-0.0215	-0.00345	-0.00235	-0.100**	-0.0274	0.00751
	(0.0375)	(0.0387)	(0.0377)	(0.0390)	(0.0426)	(0.0378)	(0.0380)
Age	0.0317	-0.0554	0.00407	0.0788	-0.358**	0.0745	0.00990
	(0.147)	(0.152)	(0.151)	(0.154)	(0.161)	(0.149)	(0.151)
Age squared	-0.00115	0.00188	-0.0000648	-0.00279	0.0118**	-0.00248	-0.000363
	(0.00486)	(0.00503)	(0.00499)	(0.00509)	(0.00533)	(0.00492)	(0.00498)
Female	0.00892	-0.0329	-0.0378	0.0319	0.0112	0.00775	-0.0417
	(0.0255)	(0.0260)	(0.0257)	(0.0261)	(0.0278)	(0.0257)	(0.0258)
Mom HS graduate	-0.0112	-0.0397	-0.0467	0.0435	0.0303	-0.0169	-0.0411
	(0.0349)	(0.0357)	(0.0349)	(0.0369)	(0.0389)	(0.0349)	(0.0351)
Black	-0.0310	-0.0140	-0.00398	-0.0695*	-0.0765*	0.0667*	-0.0561
	(0.0355)	(0.0359)	(0.0353)	(0.0369)	(0.0396)	(0.0347)	(0.0353)
Size of family	-0.0277	-0.00666	-0.00202	-0.0205	0.00292	-0.0268	0.00801
	(0.0217)	(0.0224)	(0.0204)	(0.0217)	(0.0219)	(0.0215)	(0.0214)
Number of kids	0.0223	0.00333	0.00232	-0.0000645	0.00680	0.0317	-0.0155
	(0.0268)	(0.0276)	(0.0256)	(0.0272)	(0.0272)	(0.0264)	(0.0265)
Married parents	0.108***	-0.0995**	0.0153	-0.0211	0.0437	0.111***	-0.110***
	(0.0393)	(0.0413)	(0.0389)	(0.0407)	(0.0425)	(0.0395)	(0.0400)
Observations	19096	19096	19096	19096	19096	10246	10246

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Baseline Estimation From Eq. (1)

	(1) z_hgt	(2) z_wgt	(3) z_bmi	(4) obese	(5) overweight	(6) skip
Receiving SNAP or TANF × summer1	0.00296	0.0993	0.100	0.00643	0.0519**	-0.0206
	(0.0742)	(0.0776)	(0.0837)	(0.0344)	(0.0249)	(0.0502)
Receiving SNAP or TANF × summer2	0.00683	0.0372	0.0409	-0.0143	0.0222	0.0629
	(0.0633)	(0.0666)	(0.0640)	(0.0289)	(0.0266)	(0.0594)
SNAP/TANF	-0.102*	0.124**	0.190***	0.0720***	0.00854	0.0997**
	(0.0564)	(0.0546)	(0.0520)	(0.0229)	(0.0187)	(0.0440)
summer=1	0.00811	0.0110	0.00188	0.00605	0.000945	0.0460
	(0.0246)	(0.0308)	(0.0257)	(0.00838)	(0.0110)	(0.0298)
summer=2	-0.0307	-0.0318	-0.0271	0.00487	-0.00441	-0.0101
	(0.0228)	(0.0329)	(0.0337)	(0.00734)	(0.0109)	(0.0293)
Female	-0.225***	-0.244***	-0.135***	-0.0641***	-0.0181*	-0.0349
	(0.0207)	(0.0193)	(0.0212)	(0.00782)	(0.00963)	(0.0208)
Age	-0.403***	0.0732	0.0188	-0.120***	-0.0604	0.0994
	(0.106)	(0.117)	(0.122)	(0.0377)	(0.0459)	(0.119)
Age squared	0.0136***	-0.00293	-0.00190	0.00352***	0.00176	-0.00309
	(0.00353)	(0.00382)	(0.00399)	(0.00121)	(0.00151)	(0.00396)
Black	-0.00846	0.135***	0.169***	0.0266*	0.0129	0.0305
	(0.0218)	(0.0345)	(0.0373)	(0.0141)	(0.0104)	(0.0309)
Mom HS graduate	0.287***	-0.0980***	-0.256***	-0.0614***	-0.0355***	0.0272
	(0.0283)	(0.0303)	(0.0308)	(0.0116)	(0.0122)	(0.0311)
Size of family	-0.0141	-0.0121	-0.0000214	-0.00395	0.00301	-0.0434***
	(0.0153)	(0.0184)	(0.0175)	(0.00727)	(0.00645)	(0.0150)
Number of kids	-0.0333*	-0.0384*	-0.0366*	-0.0120*	-0.00102	0.00654
	(0.0182)	(0.0192)	(0.0206)	(0.00690)	(0.00765)	(0.0193)
Married parents	-0.0418	0.0456	0.0635*	0.0158	0.0111	0.0440
	(0.0336)	(0.0343)	(0.0321)	(0.0102)	(0.0129)	(0.0345)
Survey Year × Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10424	10424	10424	9398	9398	9398

[1] Each column represents a regression, the dependent variables are z-score of height (z_hgt), weight (z_wgt), BMI (z_bmi), probability of begin obese, overweight, skipping meals, respectively. Sample period is restricted on May to October, Summer1 is a dummy with 1 if surveyed in July and August; Summer2 is a dummy with 1 if surveyed in September and October. Row 1 and 2 are the DD estimates of our interest.
[2] Standard errors in parentheses, clustered at survey month and region level. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5: Estimation for Age From Eq. (2)

	(1) z_hgt	(2) z_wgt	(3) z_bmi	(4) Obese	(5) Overweight	(6) Skip
SNAP/TANF × summer1 × Age 13	0.101	-0.135	-0.160	-0.00878	-0.0436	-0.357**
	(0.314)	(0.271)	(0.225)	(0.0761)	(0.0822)	(0.152)
SNAP/TANF × summer1 × Age 14	0.301	0.274*	0.121	0.106*	0.0891	-0.283**
	(0.324)	(0.150)	(0.197)	(0.0565)	(0.0966)	(0.104)
SNAP/TANF × summer1 × Age 15	0.264	0.314	0.269	-0.00523	0.114*	-0.143
	(0.280)	(0.225)	(0.254)	(0.0640)	(0.0552)	(0.100)
SNAP/TANF × summer1 × Age 16	0.00636	0.0616	0.131	0.0600	-0.00124	-0.548***
	(0.297)	(0.246)	(0.227)	(0.0547)	(0.0804)	(0.130)
SNAP/TANF × summer1 × Age 17	0.0919	0.151	0.180	0.0706	0.0765	-0.480***
	(0.293)	(0.238)	(0.229)	(0.0707)	(0.0850)	(0.119)
SNAP/TANF × summer2 × Age 13	0.145	-0.143	-0.276	0.0193	-0.0600	-0.182
	(0.321)	(0.298)	(0.306)	(0.0762)	(0.0953)	(0.219)
SNAP/TANF × summer2 × Age 14	0.200	0.107	0.0315	0.0746	0.0268	-0.145
	(0.317)	(0.213)	(0.197)	(0.0727)	(0.0863)	(0.144)
SNAP/TANF × summer2 × Age 15	0.424	0.297	0.161	0.0234	-0.00793	0.0378
	(0.338)	(0.283)	(0.279)	(0.0672)	(0.0535)	(0.149)
SNAP/TANF × summer2 × Age 16	0.170	-0.144	-0.203	0.00284	-0.0982	-0.0580
	(0.326)	(0.206)	(0.164)	(0.0688)	(0.0729)	(0.159)
SNAP/TANF × summer2 × Age 17	0.0170	0.0169	0.0861	0.0253	0.0610	-0.187
	(0.307)	(0.218)	(0.236)	(0.0868)	(0.0880)	(0.136)
Controls for female, black, mom is HS graduate, size of family, number of kids, married parents	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year × Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10424	10424	10424	11863	11863	2351

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Placebo Test From Eq.(3)

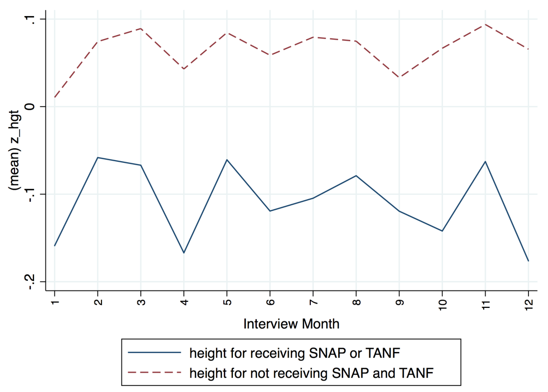
	(1) z_hgt	(2) z_wgt	(3) z_bmi	(4) Obese	(5) Overweight	(6) Skip any meal
SNAP/TANF × Fake Summer	-0.0374	0.0137	0.0158	0.0128	-0.0124	-0.0927
	(0.123)	(0.108)	(0.0959)	(0.0452)	(0.0322)	(0.0860)
SNAP/TANF	-0.0861	0.0760	0.137**	0.0577	0.00988	0.148*
	(0.109)	(0.0729)	(0.0551)	(0.0313)	(0.0284)	(0.0629)
Fake Summer	-0.0319	-0.112***	-0.112***	-0.0151	-0.0132	0.0244
	(0.0364)	(0.0250)	(0.0165)	(0.00821)	(0.0168)	(0.0443)
Female	-0.189***	-0.198***	-0.100**	-0.0591***	-0.00683	-0.0474
	(0.0247)	(0.0360)	(0.0379)	(0.00775)	(0.0178)	(0.0290)
Age	-0.375	0.0310	-0.0880	-0.0626	-0.123	0.0755
	(0.203)	(0.251)	(0.260)	(0.0669)	(0.0786)	(0.192)
Age squared	0.0130	-0.00158	0.00139	0.00172	0.00372	-0.00259
	(0.00685)	(0.00826)	(0.00850)	(0.00213)	(0.00262)	(0.00616)
Black	0.0210	0.124**	0.139**	0.0176	0.00681	0.00513
	(0.0337)	(0.0491)	(0.0568)	(0.0247)	(0.0225)	(0.0374)
Mom HS graduate	0.250**	-0.146**	-0.295***	-0.0689***	-0.0280	0.0512
	(0.0796)	(0.0584)	(0.0477)	(0.0178)	(0.0194)	(0.0554)
Size of family	-0.0257	-0.0531	-0.0392*	-0.00807	-0.0102	-0.0785*
	(0.0330)	(0.0309)	(0.0180)	(0.00880)	(0.0122)	(0.0343)
Number of kids	-0.0259	-0.00188	-0.00333	-0.00426	0.0115	0.0404
	(0.0325)	(0.0405)	(0.0350)	(0.0115)	(0.0172)	(0.0443)
Married parents	0.0227	0.126*	0.116*	0.0295**	0.0243	0.0847
	(0.0513)	(0.0555)	(0.0562)	(0.00869)	(0.0214)	(0.0716)
Survey Year × Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3234	3234	3234	3234	3234	618

Standard errors in parentheses

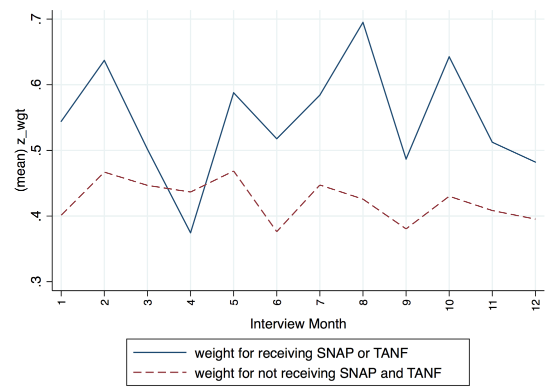
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

8 Appendix

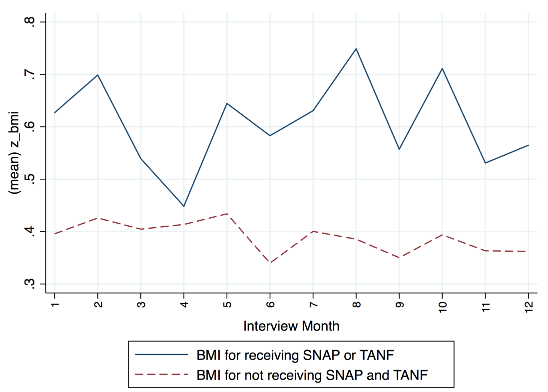
Figure 1: Graphs for Outcome Variables by Receiving SNAP/TANF or Not



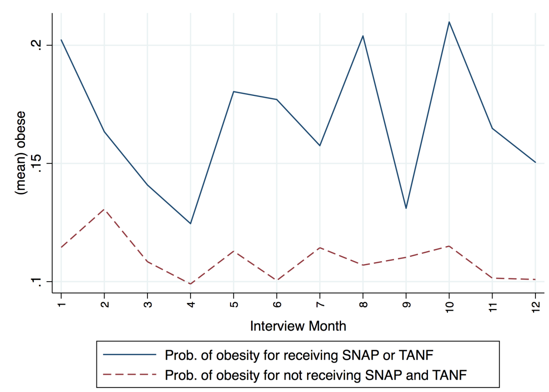
(a) Z-score for Height



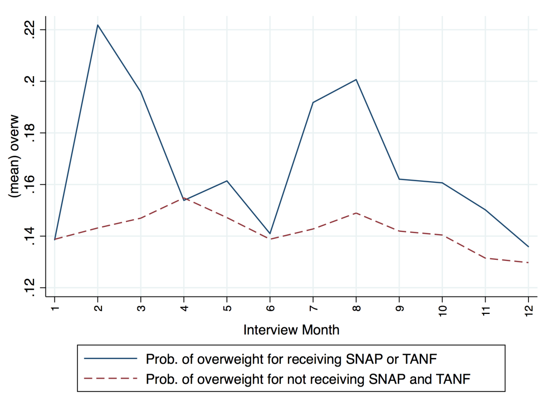
(b) Z-score for Weight



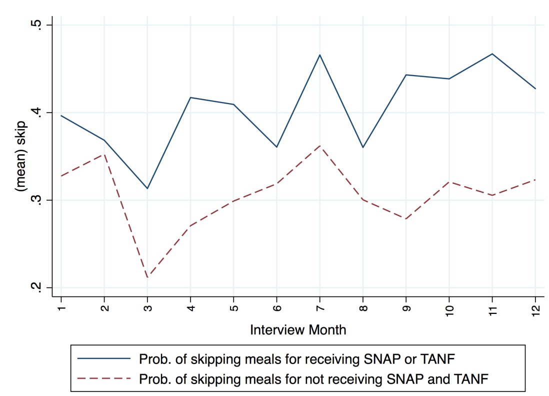
(c) Z-score for BMI



(d) Probability of Obesity



(e) Probability of Overweight



(f) Probability of Skipping Meals