

# The Supplemental Nutrition Assistance Program and Academic Performance in SC Children

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## INTRODUCTION

Food insecurity is the limited or uncertain ability to obtain quality food. Individuals from food insecure households have reported overall poorer physical and mental health.<sup>1-3</sup> In children, food insecurity (FI) is negatively associated with school engagement and lower reading and mathematics skills.<sup>4-5</sup> Further, children with better nutritional habits have been shown to perform better in school. The purpose of the supplemental nutrition assistance program (SNAP) is to reduce hunger in families in need. While (SNAP) has shown to reduce household FI, its downstream effect on academic performance has not previously measured.

### Research Question

**Is receiving SNAP associated with improved child educational outcomes? Further, is there an exasperated effect by income level?**

## METHODS

### Study Population

This study used a cross-sectional design to evaluate the association of SNAP and educational outcomes. The data came from the 2012 – 2014 South Carolina Behavioral Risk Factor Surveillance System (BRFSS) and the follow-up childhood survey, Children's Health Assessment Survey (CHAS). This study focuses on children older than 5 years and younger than 18 years old. The low-income children in this study are assumed to be the population of eligible children for SNAP.

### Variables

The exposure of interest for this study is household participation in SNAP.

The educational outcomes of interest are:

- A child has repeated a grade (Model 1)
  - "Since starting kindergarten, has (s/he) repeated any grades?". (Yes or No)
- Academic performance (Model 2)
  - "How would you describe (CHILD)'s grades in school over the past 12 months? Would you say they were MOSTLY A's, B's, C's, D's, or F's?". (Mostly A's or B's or not)
- School attendance (Model 3)
  - "During the past 12 months, about how many days did (CHILD) miss school?" (continuous)
  - The reason for missing school was because of an illness, injury, or other

The confounders that were included in the full model were selected using a directed acyclic graph (DAG). The selected confounders were household composition, highest household education, and household income.

### Analysis

A log-binomial regression model was used to estimate prevalence ratios (PR) of binary outcomes for Model 1 and 2, and a Poisson model was used in Model 3. The adjusted models contain the confounders and the multiplicative interaction between of SNAP participation and income. For the descriptive analysis, means and standard deviations were computed for continuous variables, with t-tests for comparison. Frequency distributions were assessed for categorical variables, using a chi-square test for comparison. Missing observations were imputed using multiple imputations by chained equations for the modeling only using R version 3.3. All other analyses were performed in SAS 9.4.

## RESULTS

There were 2,528 total children in from the 2012 – 2014 CHAS surveys included in the analysis, where approximately 25% of the children live in household that receive SNAP benefits. The adjusted model estimates the prevalence ratio (PR) of repeating a grade for those with SNAP benefits to be 1.34 [95% CI (1.02, 1.77)]. In Model 2, the PR of having above average grades was 0.92 [95% CI (0.84, 1.00)]. Model 3, estimated the PR of missing a school day to be 1.26 [95% CI (0.92, 1.76)] for children with SNAP.

**Table 1. Characteristics of South Carolina children aged 6+ population, 2012 – 2014 CHAS, n = 2528**

Variable	Household Receives SNAP		p <sup>a</sup>
	Yes	No	
<i>n</i> (%)	495 (24.5)	2021 (75.5)	
<b>Academic performance</b>			
Repeated a grade, <i>n</i> (%)	106 (21.2)	181 (8.5)	< 0.0001
Above Average grades, <i>n</i> (%)	328 (74.9)	1604 (85.4)	< 0.0001
Number of missed school days <sup>b</sup>	5.66 (12.74)	4.73 (7.33)	0.123
<b>Child demographics, <i>n</i> (%)</b>			
Age, years <sup>b</sup>	11.4 (4.8)	11.8 (5.2)	0.136
Sex (males)	249 (52.7)	1038 (50.2)	0.502
School Grade			
Elementary (1 <sup>st</sup> – 5 <sup>th</sup> )	189 (45.8)	644 (41.3)	0.118
Middle school (6 – 8 <sup>th</sup> )	115 (25.4)	485 (24.1)	
High School (9 – 12 <sup>th</sup> )	144 (28.5)	805 (34.6)	
School Type			
Public/charter school	473 (95.3)	1699 (87.3)	0.0001
Private	6 (0.8)	223 (8.1)	
Home schooled	12 (3.0)	84 (4.3)	
Race			
Black	163 (38.4)	261 (15.4)	< 0.0001
White	298 (51.3)	1654 (75.2)	
Other	34 (10.3)	106 (9.40)	
Free/reduced lunch	307 (92.4)	344 (28.0)	< 0.0001
<b>Household demographics, <i>n</i> (%)</b>			
Low-income	309 (73.8)	192 (10.5)	< 0.0001
Highest household education			
Some high school or less	52 (10.9)	26 (1.3)	< 0.0001
HS diploma/GED	190 (38.5)	292 (12.8)	
Some college	172 (34.9)	516 (26.0)	
College graduate	78 (15.8)	1184 (59.9)	
Single Parent Household	125 (14.0)	242 (7.2)	0.0001

**Footnotes:** Only children older than 5 are included. Missing data may cause fluctuations in frequencies. Low-income classification was based on 130% below the federal poverty level by household size.

<sup>a</sup> p-value is based on the Chi-Square test. <sup>b</sup> The mean (standard deviation) are presented for the continuous variable. Abbreviations: SNAP, Supplemental Nutrition Assistance Program

## CONCLUSIONS

Safety net programs, especially when established early, are beneficial to children into adolescence and adulthood. The topic and implications of this study are particularly important when there are threats to cut funding, as well as changes to school-level dietary restrictions. Future national, longitudinal studies can investigate the current and future effects of such modifications.

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**Table 2. Prevalence ratios/rates and 95% Confidence Intervals from the log-binomial model of SNAP use on child educational outcomes, n = 2528.**

Variable	Model 1	Model 2	Model 3
	Child has repeated a grade	Child has above average grades	Total school days missed
<b>Unadjusted</b>			
SNAP	2.44 (1.85, 3.21) <sup>†</sup>	0.87 (0.80, 0.94) <sup>**</sup>	1.25 (1.02, 1.55) <sup>*</sup>
<b>Adjusted</b>			
SNAP (ref = no)	2.06 (1.18, 3.59) <sup>**</sup>	0.85 (0.70, 1.03)	1.66 (0.85, 3.24)
Low-income (ref = no)	1.72 (1.01, 2.93) <sup>*</sup>	0.89 (0.75, 1.06)	1.10 (0.87, 1.39)
Education (ref = college degree)			
Some high school or less	3.49 (1.87, 6.50) <sup>**</sup>	0.93 (0.88, 0.98) <sup>*</sup>	1.09 (0.95, 1.24)
HS diploma/GED	2.40 (1.53, 3.75) <sup>**</sup>	1.00 (0.86, 1.18)	1.21 (0.73, 1.99)
Some college	1.24 (0.71, 2.15)	0.84 (0.76, 0.92) <sup>**</sup>	1.24 (0.93, 1.66)
Single Parent (ref = no)	1.07 (0.75, 1.53)	0.91 (0.93, 1.66) <sup>**</sup>	0.85 (0.70, 1.04)
SNAP×Low-income	NS	NS	NS

**Footnotes:** \* p < 0.05 \*\*p < 0.01 † p < 0.0001

The outcomes are for children older than 5 year. Multiple imputations using multiple chains were used to better estimate the point estimates. Each model contains the interaction term SNAP×Low-income.

## DISCUSSION

Children with SNAP are more likely to repeat a grade. When comparing children from income-eligible households, there was no difference in educational outcomes of those receiving and not receiving SNAP. Household income seems to play a larger role than SNAP participation. Although the effect of SNAP was not significant in the adjusted models, this study adds to the literature as the additional benefits of SNAP have not been consistently established, although the benefits of nutrition on education are well-documented. Future cohort studies are needed to insert the casual effect of SNAP on child academic performance.

**Limitations.** We were unable to include food insecurity, sex, and race, nor SNAP timing. The inclusion of sex and race did not change the PR of SNAP in the preliminary data. Food insecurity was not included in CHAS, but should be investigated in the future.

## REFERENCES

1. Pruit, S. L. *et al.* Who Is Food Insecure? Implications for Targeted Recruitment and Outreach, National Health and Nutrition Examination Survey, 2005–2010. *Prev. Chronic Dis.* **13**, 160103 (2016).
2. Seligman, H. K., Jacobs, E. A., Lopez, A., Tschann, J. & Fernandez, A. Food insecurity and glycemic control among low-income patients with type 2 diabetes. *Diabetes Care* **35**, 233–238 (2012).
3. Phipps, E. J., Singletary, S. B., Cooball, C. A., Hares, H. D. & Braitman, L. E. Food Insecurity in Patients with High Hospital Utilization. *Popul. Health Manag.* **0**, pop.2015.0127 (2016).
4. Ashiabi, G. Household food insecurity and children's school engagement. *J. Child. Poverty* **11**, 3–17 (2005).
5. Jyoti, D. F., Frongillo, E. A. & Jones, S. J. Food Insecurity Affects School Children's Academic Performance, Weight Gain, and Social Skills 1 – 3. *J. Nutr.* 2831–2839 (2010).
6. Mabli, J. & Worthington, J. Supplemental nutrition assistance program participation and child food security. *Pediatrics* **133**, 610–9 (2014).
7. Mabli, J. & Ohls, J. Supplemental Nutrition Assistance Program Participation Is Associated with an Increase in Household Food Security in a National. *J. Nutr.* **145**, 344–351 (2015).