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Transition to Adulthood: Dynamics of Disability, Food Security, Health, and SNAP Participation

Final Report

by

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Transition to Adulthood: Dynamics of Disability, Food Security, Health, and SNAP Participation

Project Summary

Young adults face enormous economic, social and psychological challenges when they transition into adulthood. This transition can be especially overwhelming and daunting for young adults with disabilities. Among the challenges young adults with disabilities are faced with are greater risk of low food security and barriers to healthcare. This study examines how the transition to adulthood may affect food security, health, and access to healthcare for youth with disabilities, and estimates the effects that SNAP has on this group in those turbulent years.

The study used five years of data (2011-2015) from the National Health Interview Survey (NHIS). We combined the public and restricted NHIS data with the state SNAP policy variables. The sample included low-income individuals ages 13-25 (and their families) to reflect the life stage from pre-transition, to transition, and then to post-transition. Analyses were conducted at the Census Research Data Center in Columbia, MO. A difference-in-difference (DID) approach in linear models was applied to compare individuals with and without disabilities regarding changes in food security status and their health-related outcomes in the transition to adulthood. State SNAP policy variables were used as exogenous instruments to estimate the effects of SNAP participation on food security and health/healthcare use for youth and young adults with disabilities in the models of instrumental variables. Below is a summary of the main findings in which youth are referred to as individuals under 18, and young adults are referred to as individuals ages 18 to 25.

- Compared to those without disabilities, individuals with disabilities have a greater risk of low food security in both childhood and young adulthood.

- Transition into adulthood results in greater food security for individuals without disabilities but an increased risk of low food security for individuals with disabilities. The increased risk for young adults with disabilities may well put them at very low food security, the most severe category on the food security scale.

- Food security status is associated with health and access to healthcare for all the four groups, youth and young adults, with or without disabilities. However, the associations between low food security and health-related outcomes do not seem to vary by disability status for young adults, indicating the additional risk of low food security that young adults with disabilities experience does not correlate with their health-related outcomes.

- Contrary to our expectation, SNAP participation does not seem to have statistically significant effects on food security and health-related outcomes for individuals with disabilities. These impacts, although insignificant, show expected directions (i.e., improving food security and health) that are different from those often found in the OLS estimation that does not address the selection bias.

- SNAP participation is a statistically significant predictor of youth's food security status measured by the food security raw score only, but not the other three food security measures. SNAP participation appears to have greater impacts for youth than for young adults. In other words, the protective effects of SNAP decrease for young adults perhaps because they encounter greater barriers accessing SNAP than when they were young.

The study's limitations are closely examined with a focus on the constraints that we had in the DID analysis and the IV analysis. We also suggested directions for future research. Since food security likely has a profound impact on the long-term development, economic independence, and self-sufficiency, we discussed a few policy strategies that may help individuals with disabilities in their transition to adulthood. These include special outreach services to improve SNAP accessibility, an embedded alert system that serves to bring awareness of a SNAP participant's upcoming transition to adulthood, incorporation of nutrition assistance in transition planning for youth, and better coordination of multiple public programs.

Introduction

Young adults face enormous economic, social and psychological challenges when they transition into adulthood (Osgood, 2007; Settersten, Furstenberg, & Rumbaut, 2005). Despite the many years that families and schools have taken to prepare children for this transition, when the time comes the path to adulthood is still full of stress and uncertainty. The pursuit of independence requires substantial resources and support to help youth achieve their goals in education, independent residence, employment, transportation, health, relationships, marriage and family. This transition can be especially overwhelming and daunting for young adults with disabilities. Research has shown that young adults with disabilities are less likely than those without disabilities to complete the tasks needed to achieve successful transition (Blackorby & Wagner, 1996; Janus, 2009).

The disparities between individuals with and without disabilities are found to be greater during the transition years (Levine & Wagner, 2005). Transition for young adults without disabilities is mostly a private matter, solved mainly through decision making within the family. Transition for young adults with disabilities involves moving from child to adult social programs and systems, with decisions for some of these moves made by public authorities and others outside the family system. The age range defining transition varies widely. Transition in public K-12 education is defined as 18-21. Young adults without disabilities age out of that system with high school graduation, generally around age 18, while young adults with disabilities often complete post-high school vocational training, aging out on their 22nd birthday. The Affordable Care Act defines ages for transition in healthcare as 18-25.

Among the challenges young adults with disabilities are faced with are greater risk of low food security and barriers to healthcare. Young adults with disabilities are more likely than those without disabilities to live in households having low food security and to receive food assistance

through the Supplemental Nutrition Assistance Program (SNAP) (Brucker, 2016; Brucker & Coleman-Jensen, 2017). Despite the importance of public assistance in protecting their food security and health during this time of transition, young adults with disabilities may lose eligibility for Supplemental Security Income (SSI), SNAP, and Medicaid due to a more stringent disability definition used for eligibility redetermination at age 18 (Davies, Rupp, & Wittenburg, 2009; Hemmeter, Kauff, & Wittenburg, 2009; Hemmeter, Mann, & Wittenburg, 2017). It is not clear how the transition to adulthood may affect food security, health status, and access to healthcare for youth with disabilities, and what effects that SNAP has on this group in those turbulent years.

To address the gap in the literature, this study uses the 2011-2015 NHIS restricted data to compare food security status and health outcomes of two age groups, youth (ages 13-17) vs. young adults (ages 18-25). We apply difference-in-difference and instrumental variable approaches to a sample of low-income individuals with disabilities and their families. We also examine the role of SNAP in protecting youth in transition and if the role of SNAP varies for individuals with and without disabilities. Specifically, this study examines the following three questions:

(1) Are individuals with disabilities transitioning to adulthood more likely than children with disabilities to experience low food security?

(2) Is food security associated with health/healthcare use for young adults with disabilities?

(3) For young adults with disabilities, does SNAP participation have a greater impact on food security and health/healthcare use than it does for children with disabilities?

Answers to these questions will help us understand SNAP effects for young adults with disabilities and provide insights into the dynamics of SNAP participation, health, and other related public assistance programs.

Literature Review

In this section, we examine four streams of literature, beginning with a review of literature on disability and food security. This is followed by a close look at food security in transition to adulthood, with a focus on youth with disabilities. Finally, we review effects of SNAP on both food security and health/mental health.

Disability and Food Security

Disability is an important risk factor for low food security (Cho, Ishdorj, & Gregory, 2016; Coleman-Jensen & Nord, 2013a; Huang, Guo, & Kim, 2006; She & Livermore; 2007). Studies have shown that low food security is more common in households with a member that has a disability (Coleman-Jensen & Nord, 2013a; Gundersen & Ziliak, 2014; Heflin, 2016). It is estimated that one out of three households with a member not in the labor force due to disability experienced low food security in 2009-2010 (Coleman-Jensen & Nord, 2013b). Among these, more than half had very low food insecurity (Coleman-Jensen & Nord, 2013b). Sonik, Parish, Ghosh and Igdalsky (2016) specifically compared households with children with disabilities to other households with children, finding the former more likely to report low household food security and low child food security.

The association between disability and food security is far from understood. While low food security is mostly caused by financial strain, disability is still found to have a strong association with food security status when factors such as income and assets are controlled for (Huang, Guo, & Kim, 2006). Such association is thought attributable to a number of reasons,

including limitations in accessing food, reduced time for food preparation because of having to care for self or others with disabilities, and financial challenges caused by higher costs of healthcare for people with disabilities (Gundersen & Ziliak, 2014).

Food Security in Transition to Adulthood

Chances of low food security vary across the life span. Young adults with disabilities (18-25 years) have greater rates of low food security than working-age or older adults with disabilities in several disability categories (Brucker, 2016; Brucker & Coleman-Jensen, 2017). Brucker and Nord (2016) find individuals with intellectual and developmental disabilities have significantly higher rates of low food security than those without disabilities and also higher SNAP participation rates than low-income individuals without disabilities, as they transition into adulthood.

For transitioning young adults with disabilities, the loss of SSI and SNAP benefits and lack of employment income all contribute to their increasing odds of low food security. It is estimated that nearly one in every three child SSI recipients lose eligibility when turning 18 years old (Hemmeter & Gilby, 2009; Hemmeter, Mann, & Wittenburg, 2017) due to a more stringent definition of disability used for re-determination, and 40 percent of new applications made by young adults with disabilities who were not child SSI recipients are denied (SSA, 2017). The loss of this income source is likely accompanied by the loss of SNAP eligibility because in most states SSI recipients are automatically granted SNAP eligibility, meaning losing SSI eligibility may well require one to reapply for SNAP.

What adds stress to this transition is the harsh reality that young adults with disabilities are less likely than those without disabilities to participate in the labor force (Blackorby & Wagner, 1996; Janus, 2009), and even if they are employed they receive lower pay, on average,

than their non-disabled peers (Erickson, Lee, & von Schrader, 2016). The lack of income not only increases risk of low food security and hinders them from seeking healthcare, but also creates a competition between food needs and healthcare needs for individuals with disabilities.

Effects of SNAP

Effects on Food Security. SNAP provides assistance to nearly half of food insecure households in the US (Coleman-Jensen, Gregory & Singh, 2013). About half of low-income households with a member not in the labor force due to disability and nearly two-thirds of working-age (18-64) adults who are SSI recipients receive SNAP benefits (Bailey & Hemmeter, 2015; Gundersen & Ziliak, 2014); therefore, it is important to examine the effects of SNAP on these households. As is recognized, the relationship between SNAP participation and food security is rather complex. Although there are reasons to expect positive effects of SNAP on food security among low-income households (Gregory, Rabbitt, & Ribar, 2016), comparisons of SNAP participants and non-participants often show less food security among SNAP participants (Coleman-Jensen, Gregory, & Singh, 2013; Gregory, Rabbitt, & Ribar, 2016). This selection bias or endogeneity problem has several sources, including that households with lower food security are more likely to apply for SNAP benefits, and that SNAP benefits have not always kept up with the inflation of food prices since 2009 (Nord & Golla, 2009; Nord, 2013).

To address the endogeneity of SNAP participation, more recent studies use matching techniques (e.g., Gibson-Davis & Foster, 2006), multivariate fixed effects methods (e.g., Greenhalgh-Stanley & Fitzpatrick, 2013; Wilde & Nord, 2005), and instrumental variables methods (e.g., Ratcliffe, McKernan, & Zhang, 2011; Yen, Andrews, Chen, & Eastwood, 2008). Results of these studies suggest that SNAP participation can improve food security although there are inconsistencies (Gregory, Rabbitt, & Ribar, 2016). It is found that the prevalence rate of

very low food security increased to around 20% few months prior to program entry and declined to 12% a few months after program entry (Nord & Golla, 2009). SNAP shows a moderate effect by reducing the prevalence of very low food security by nearly one-third (Nord & Golla, 2009).

Due to higher prevalence of low food security among individuals with disabilities, not surprisingly, their SNAP participation rates are also higher (Coleman-Jensen & Nord, 2013a), with variation in different sub-groups of disability (Brucker, 2016). SNAP has special provisions for individuals with disabilities to increase the program accessibility for them (Coleman-Jensen & Nord, 2013a). With aforementioned self-selection bias, higher prevalence of low food security is found among SNAP recipients with disabilities than those without disabilities (Brucker, 2016; Coleman-Jensen & Nord, 2013a). Yet it remains unclear what effects SNAP has on food security of individuals with disabilities.

Effects on Health and Mental Health. SNAP is expected to have a positive impact on health as well by providing access to food and nutrition. However, evaluation of the effects of SNAP on health has encountered the same challenges caused by selection bias. In addition, in contrast to relatively fast amelioration of food security after program entry, health shows slow changes in response to SNAP participation (Bitler, 2014, Gundersen & Ziliak, 2015). This is mostly reflected in the literature showing SNAP recipients have poorer health than those non-SNAP recipients (Bitler, 2014; Kreider, Pepper, Gundersen, & Jolliffe. 2012). For example, in Bitler's (2014) descriptive analysis, SNAP participants, both children and adults, are less healthy compared to their non-participating counterparts on a number of health indicators, which is likely a result of negative selection into SNAP. Focusing on causal estimates of SNAP effects, Kreider, Pepper, Gundersen, and Jolliffe (2012) note that commonly cited relationships between SNAP

and poor health outcomes are misleading and favorable impacts of SNAP on child health have been identified when the selection problem is addressed.

Despite a paucity of literature on the causal link between SNAP and health, the association between food security and health seems well documented (Brucker, 2017; Casey, 2005; Gundersen & Seligman, 2017; Gundersen & Ziliak, 2015; Gundersen & Kreiderb, 2009; Hampton, 2007; Heflin, Hodges, & Mueser, 2016; Huang, Mueser, 2016; Potochnick, & Heflin; 2017). In particular, as is noted in several studies (e.g., Casey, 2005; Gundersen & Kreiderb, 2009; Gundersen & Seligman, 2017; Kreider, Pepper, Gundersen, & Jolliffe, 2012), the effects of food security on health can be especially profound among children. For example, in a study by Cook et. al (2004), young children who are food-insecure had odds of "fair or poor" health nearly twice of that among food-secure children, and even marginal food security predicts adverse health outcomes in young children.

What is more, low food security can lead to poor mental health outcomes (Brucker, 2016; Brucker, 2017; Gundersen & Seligman, 2017; Melchior et al, 2012). For example, Melchior et al (2012) find that low food security in early childhood is longitudinally associated with poorer mental health (e.g., depression and anxiety) when children are older. Brucker (2017) finds that adults with disabilities reporting low food security in one year are twice as likely to report fair or poor health and 1.8 times as likely to report fair or poor mental health the next year as those with disabilities who are food secure.

Methods

Data and Sample

The study used five years of data (2011-2015) from the National Health Interview Survey (NHIS) to examine the relationships of SNAP participation, food security, and health among

young adults and children with disabilities. The NHIS is a cross-sectional and nationally representative household survey collected by the CDC National Center for Health Statistics annually since 1957. It offers publically-available information on demographic background and health variables for the US civilian non-institutionalized population, such as health insurance coverage, health status, health limitations and injuries, and healthcare access and utilization. Since 2011, the NHIS has added the Family Food Security section sponsored by the US Department of Agriculture to assess whether families have sufficient food for healthy lives (USDA-ERS, n.d.). In addition, the restricted NHIS data provide information on geography, and household's state and county residence. Following a multi-stage area probability design, each annual NHIS has a sample size of approximately 35,000 households containing about 87,000 individuals. The survey oversamples ethnic minority groups of black, Asian, and Hispanic individuals.

Provided with access to the public and restricted NHIS data at the Census Research Data Center in Columbia, MO, we created a sample of low-income individuals ages 13-25 and their families. This age range broadly represents the life stage from pre-transition, to transition, and then to post-transition. Families in the sample have an income at or below 150 percent of the federal income poverty line, slightly higher than the SNAP's global income test rule (130 percent). The final analytical sample includes 31,483 low-income individuals ages 13-25.

Measures

Dependent Variables. One dependent variable is monthly household food security status generated from the USDA's 30-day Food Security Supplement (10 items; Connell, Nord, Lofton, & Yadrick, 2004). These questions ask respondents whether they worried that food would not last, did not eat balanced meals, ate less than they should, lost weight due to insufficient food,

and so on. Each question has three categories of responses, including "often true," "sometimes true," and "never true." The first two categories are considered affirmative responses and coded as "1," while the category of "never true" is coded as "0." Based on the responses to these questions, we created four measures of monthly household food security status. The first is a raw score counting the number of positive responses to the ten questions (0-10). The second measure is a dichotomous indicator of food security: those with a raw score higher than 2 are defined as having "low food security" and the others are having "food security." The other two measures are binary indicators of "marginal food security" and "very low food security," with a cut-off value of 1 and 6 on the raw scale, respectively.

Another set of dependent variables include three health and healthcare related indicators. Sample respondents self-reported their health status on a Likert scale from "Poor (0)" to "Excellent (4)." In addition, two dichotomous variables were created to measure unmet healthcare needs (1=some difficulty accessing healthcare, and 0=no difficulty accessing healthcare), indicating whether the respondent had delayed medical care and whether the respondent did not get needed medical care in the last twelve months due to the cost. Those having a positive response on any of these questions are considered having difficulties accessing healthcare.

Independent Variables. The study has three major independent variables. Transition into adulthood is indicated by age. Those ages 13 through 17 are assigned a value of "0," and those ages 18 through 25 are assigned a value of "1." The second independent variable of interest is disability status. The NHIS survey has a series of questions regarding self-reported limitations of activity, such as work limitations, difficulty in walking, climbing, standing, or carrying a ten-pound object, and the needs for personal assistance with eating, bathing, dressing, and other

activities of daily living. Individuals with disabilities are those who reported a positive response on any of these functional limitations. The third independent variable of interest, family SNAP participation status, is a dummy variable with "1" for participants and "0" for non-participants.

Control Variables. Multiple demographic and socioeconomic characteristics were controlled for in each model, including gender (1=male and 0=female), race/ethnicity (1=Hispanic, 2=Non-Hispanic White, 3=Non-Hispanic Black, 4= Asian, and 5= others), education (1=less than high school, 2=high school, 3=more than high school, and 4=missing), marital status (1=married and 0=otherwise), employment status (1=employed and 0=otherwise), household income, household size, state of residence, and urban/rural residence (1=urban and 0=rural).

Analyses

Research Question 1. To examine whether individuals with disabilities have a greater risk of low food security after entering adulthood, we used a difference-in-difference (DID) approach in linear models to compare individuals with and without disabilities regarding changes in food security status in the transition to adulthood. We used individuals without disabilities as the comparison group, and evaluated additional changes in food security status across childhood and young adulthood for individuals with disabilities:

$$F = \alpha + \beta_1 D + \beta_2 T + \beta_3 (D \times T) + X\lambda + \varepsilon \qquad (1)$$

Where *F* is food security status, *D* refers to disability status, *T* indicates transition into adulthood, and *X* is a vector of control variables. The regression coefficient of β_3 shows additional changes in food security among individuals with disabilities from childhood to adulthood, relative to the comparison group.

Research Question 2. If both disability status and transition to adulthood are related to food security status in the above analysis, then it is important to understand how, in general, food security is associated with health-related outcomes for children and young adults, with or without disabilities. We created a nominal variable that combines disability and age information for categorization: children without disabilities (0), young adults without disabilities (1), children with disabilities (2), and young adults with disabilities (3). Then we examined the association between food security status and health-related outcomes for the four groups:

$$H = \gamma + \delta_1 G + \delta_2 F + \delta_3 (G \times F) + X\zeta + \varepsilon \qquad (2)$$

Where *H* indicates one of the three health-related outcomes, *G* is the four-category grouping variable of children and young adults with or without disabilities, and *F* refers to food security status. The regression coefficient of δ_3 shows the association between food security status and health-related outcomes for the four groups.

While transition to adulthood may be associated with additional risk of low food security for young adults with disabilities, equation (2) cannot assess to what extent this *additional* change in food security status is correlated with health-related outcomes. This question is complicated because the additional risk of low food security for young adults with disabilities is estimated in equation (1) but not directly observed in the data. To see if this additional change in food security status for young adults with disabilities is associated with their health and healthcare, we applied the DID approach in the following two linear regression models:

$$H = \eta + \theta_1 D + \theta_2 T + \theta_3 (D \times T) + X\xi + \varepsilon \qquad (3)$$

$$H = \eta' + \theta'_1 D + \theta'_2 T + \theta'_3 (D \times T) + \theta'_4 F + X\xi' + \varepsilon' \qquad (4)$$

Equation (4) is slightly different from Equation (3) in that it adds in food security status, *F*, as an independent variable. That is, θ_3 in Equation (3) is the "total" additional difference in health-

related outcomes for individuals with disabilities across childhood to young adulthood, relative to the difference for those without disabilities. The "total" additional difference reflected by θ_3 also contains the effects of the additional change in food security status on health outcomes for young adults with disabilities. When food security status is controlled for in Equation (4), the coefficient, θ'_3, no longer contains the association between food security status and health-related outcomes. Thus, the difference between θ_3 and θ'_3 reflects the unique association between the additional change in food security status for young adults with disabilities and their health outcomes (VanderWeele, 2016).

Research Question 3. We limited the sample to low-income individuals with disabilities to assess the potential impacts of SNAP participation on children and young adults, respectively. Following previous literature (Borjas, 2004; Miller & Morrissey, 2011; Ratcliffe, McKernan, & Zhang, 2011), we used the variation in state SNAP policy rules (recorded in 1996-2014 SNAP State Rules Database; Miller & Morrissey, 2011; Ratcliffe, McKernan, & Zhang, 2011; Yen, Andrews, Chen, & Eastwood, 2008) as exogenous instruments to estimate the effects of SNAP participation on food security status and health/healthcare use for children and young adults with disabilities in the models of instrumental variables (Miller & Morrissey, 2015).

More specifically, we merged the NHIS data of each year with the SNAP state rules in the previous year (e.g., the 2015 NHIS data with the 2014 SNAP state rules) because changes in state rules may have delayed effects on program participation. The study selected multiple potential policy instrumental variables which may affect SNAP participation rates at the state level. These variables include states' broad-based categorical eligibility, elimination of the asset test, operation of a combined application for both SNAP and SSI, requirement of fingerprinting of SNAP applicants, eligibility of legal noncitizen adults for SNAP assistance, online program

application, outreach spending per capita, and the simplified reporting option for program certification.

Supplemental Analyses. Supplemental analyses were conducted to test the robustness of the findings generated from the analyses addressing the above three research questions. We tried different age ranges for the groups of children and young adults with disabilities (e.g., 15-17 vs. 19-22; 16-17 vs. 18-19). We also used different cut-offs to define low-income families (i.e., 130%, 180%, and 200% of the federal poverty line). For dichotomous dependent variables, we applied logit regression models instead of linear probability models to a set of supplemental analyses. All the main and supplemental analyses were adjusted for the NHIS survey features.

Results

Descriptive Statistics

Table 1 presents descriptive statistics of the dependent, independent, and control variables for the full sample (N= 31,483, column 1) and by disability and age status (column 2-4). Among low-income individuals ages 13-25, nearly 10% had at least one disability condition, and two-thirds were age 18 and above. Nearly 30% of the sample respondents were Hispanic and another 20% were black. About one third of youth (children under 18, and thereafter), and young adults were employed, and less than one-tenth were married at the time of the interview. Only 3% of respondents received SSI assistance; over 30% were covered by Medicaid. The mean self-reported general health score was about three ("Very Good"). Slightly more than 10% of respondents reported delayed healthcare, and 8% did not receive needed healthcare in the last 12 months.

Regarding family characteristics, one quarter of families in which these respondents lived had at least one member with some college experience or a college degree. Mean family income was about $17,000, and, on average, these families had fewer than four members. About 45% of the families were SNAP recipients and, as expected, these families had a high risk of low food security. The mean food security raw score was 1.7, close to the cut-off of 2 ("low food security"). Nearly half of these families had marginal food security, meaning they had one or more positive responses on the 10-item food security scale. In addition, more than one quarter of families had low food security (i.e., two or more positive items), and more than 10% of the sample respondents reported very low food security (i.e., six or more positive items). The rates of low food security and very low food security are more than doubled compared to those of all American households in 2015 (12.7% with low food security and 5% with very low food security; Coleman-Jensen, Rabbitt, Gregory & Singh, 2016).

About one fifth of youth and young adults with disabilities received support from SSI, whereas less than 2% of those without disabilities did. Young adults with disabilities (25%) had a higher SSI participation rate than youth (20%) in the sample. Medicaid coverage dropped from 62% to 42% for individuals with disabilities from childhood to adulthood, and from 50% to 20% for those without disabilities. Overall, individuals with disabilities had poorer health and higher levels of unmet healthcare needs, relative to those without disabilities. Regardless of disability status, youth had better self-reported health and better access to healthcare than young adults. Consistent with previous literature (Young-Southward, Philo & Cooper, 2017), unmet healthcare needs grew substantially in the transition to adulthood. For individuals without disabilities, food security decreases in their transition to adulthood, as indicated by all the four measures; by contrast, food security status of individuals with disabilities did not show much change.

Food Security and Healthcare across Childhood and Young Adulthood

Figures 1-5 further illustrate changes in food security status and health-related outcomes across childhood and young adulthood. Figure 1 shows the mean food security raw score by age, disability, and SNAP participation. First, the food security raw score, indicated by the blue line, shows a downward trend for individuals without disabilities across ages, and it is relatively stable after the age of 19. For individuals with disabilities (i.e., the red line), however, the score is much higher after age 16 except for ages 19 and 25. Second, probably due to the small sample size of individuals with disabilities at each age, the red line exhibits greater fluctuation than the blue line. Third, SNAP recipients without disabilities (i.e., the purple line) and with disabilities (i.e., the green line) share patterns across ages similar to their counterparts in the general population, respectively, but have higher mean food security scores. This is because those with greater risk of low food security are more likely to self-select into the SNAP program.

We identified similar trajectories using the measures of low food security, very low food security, marginal food security, and each individual item in the 10-item food security module. A plot of low food security is presented in Figure 2.

Figure 3 presents self-reported health by disability status and SNAP participation across ages 13-25. All the lines show a downward trend. Individuals with disabilities have a lower health score than those without, and such group difference grows larger in adulthood. Figures 4 and 5 show that, the four groups have similar rates of delayed medical care and not receiving medical care in childhood, but unmet healthcare needs become more severe for those with disabilities in adulthood. It is not clear in these figures if SNAP has any effect in relation to health and healthcare.

Regression Results on Disability, Transition to Adulthood, and Food Security

Table 2 reports results from Equation (1) for the DID estimation of food security. When demographic and socioeconomic characteristics are adjusted, the mean food security raw score of youth without disabilities is .98 ($p<.001$), lower than that of youth with disabilities, and their mean score further decreased by .20 ($p<.001$) in transition. In contrast, individuals with disabilities gained additional .53 points ($p<.001$) in adulthood. In other words, the food security raw score increased by .33 (.53-.20; $p<.001$) for individuals with disabilities as a result of transition.

Regarding the low food security variable, a measure used to determine whether a household is food secure or not in the national report (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2016), the rate of low food security for youth without disabilities is 16 percentage points ($p<.001$) lower than that for youth with disabilities, and four percentage points ($p<.001$) higher than that of young adults without disabilities. In other words, those without disabilities become more food secure when entering young adulthood. This, however, does not seem to be the case for individuals with disabilities, as shown by the regression coefficient of the interaction term between disability status and transition ($\beta_3=.05$, $p<.05$). Instead, the rate of low food security shows an increment of one percentage point (.05-.04, $p<.05$) for individuals with disabilities when entering adulthood. We found similar results using the measures of very low food security and marginal food security.

Regression Results on Food Security and Health-Related Outcomes

Table 3 lists the results from Equation (2) examining the associations of low food security and health-related outcomes for the four groups — youth and young adults, with or without disabilities. Similar results are found on all the three health-related outcomes. We mainly

focus on the regression coefficient of low food security (δ_2) and its interactions with these groups (δ_3). For example, among youth without disabilities, those with low food security have a delayed medical care rate 5 percentage points ($p<.001$) higher than that for those who are food secure. Results of the interaction terms show that low food security has a similar association with a higher risk of delayed medical care for youth with disabilities. Low food security is correlated with an increased rate of delayed medical care for young adults without (11 percentage points, $p<.001$) and with disabilities (6 percentage points, $p<.05$) relative to youth without disabilities. The association of low food security and each health-related outcome does not significantly differ between the two groups of individuals by disability status.

Similar associations between low food security and health-related outcomes for young adults may imply that the estimated additional risk of low food security young adults with disabilities have (in Table 2) does not correlate with their health-related outcomes. We conducted two DID analyses for each health-related outcome to see its association with the additional risk of low food security in adulthood (see Table 4). The first analysis has the same specification as those reported in Table 2, and the second analysis adds in low food security status as a control variable. In Model 1, individuals without disabilities have worse health (θ_2= -.18, $p<.001$) and higher unmet healthcare needs (θ_2= .04 for both measures of delayed care and not receiving care, $p<.001$) when transitioning into adulthood. Furthermore, the health score for individuals with disabilities decreased by .33 points ($p<.001$) and unmet healthcare needs increased by 12-13 percentage points ($p<.001$) in adulthood, in addition to the changes in the dependent variables for those without disabilities.

While low food security status is negatively associated with the health score (θ'_4=-.25, $p<.001$) and positively associated with unmet healthcare needs (θ'_4=.12 for delayed care and .11

for not receiving care), there is barely any change in the results for the other variables when the variable of low food security is included in Model 2. We are particularly interested in the difference in regression coefficients of the interaction terms in the two models (θ_3- θ'_3) because it indicates the associations between health-related outcomes and the additional risk of low food security as a result of transition for those with disabilities. However, the difference turned out to be insignificant, as indicated by the results of the Chi-square tests.

Results of Instrumental Variable Analyses

The instrumental variable approach is used to correct the potential selection bias in the association between SNAP participation and food security/health. To identify valid instrumental variables, we used each of the policy variables discussed above as a regressor in simple regression models to predict SNAP participation. Three of them - eligibility of legal noncitizen adults (F=23.28), outreach spending (F=20.63), and simplified reporting option (F=48.01) — turn out to have a statistical association with SNAP participation, with a model F value greater than the cut-off (F>10) suggested by Staiger and Stock (1997). Despite this, poor results yield from the model with the instrumental variable, (specifically for individuals with disabilities), with the model F values of 5, indicating a problem of weak instruments.

We further tested various combinations of these three policy measures as instrumental variables for the endogenous regressor of SNAP participation in predicting food security status and health-related outcomes. We compared these combinations regarding their performance on overidentifying restrictions (Sargan-Hansen test) and weak instruments problem (the Cragg-Donald F statistic and the Kleibergen-Paap F statistic; Stock & Yogo, 2005). Of all the combinations examined, outreach spending turned out to be the strongest, and therefore was used as the instrumental variable in the analyses. It should be noted that this variable is still

considered a weak instrument, according to the Kleibergen-Paap F statistic, because it fails to reject the null hypothesis that the maximum relative bias compared to the OLS caused by the weak instrument is 25%.

Table 5 reports the results of the instrumental variable approach on the seven outcomes for youth and young adults with disabilities. Adjusted by the instrumental variable, SNAP participation now shows an expected direction in all the analyses. It is positively associated with health, and negatively correlated with unmet healthcare needs and food security. However, what is unexpected is that SNAP participation is statistically significant only in predicting food security raw scores for children with disabilities.

Discussion

Low-income youth with disabilities encounter a number of challenges in their transition to adulthood: striving to achieve independence, moving out of special education programs and pediatric healthcare, and going through changes of public support and assistance. Insufficient access to nutrition and food (Brucker, 2016; Brucker & Coleman-Jensen, 2017) is one of them. This study examines the risk of low food security for individuals with disabilities during the transition, and its association with health and participation, respectively. Overall, we find that, compared to individuals without disabilities, those with disabilities have a greater risk of low food security when transitioning to adulthood. In addition, their food security status is associated with health and access to healthcare. However, contrary to our expectation, SNAP participation does not seem to have statistically significant impacts on food security and health-related outcomes for this group. This is likely due to the estimation bias not adequately addressed by the weak instrumental variable used in the analysis. Nonetheless, these impacts, although insignificant, yield expected directions (i.e., improving food security and health), which is

different from the results often found in the OLS estimation that does not address the selection bias.

Second, there seems a clear pattern that transition into adulthood is associated with an increased rate of low food security for individuals with disabilities, regardless of how different the four food security measures are from the technical perspective. Specifically, the increase is eight percentage points counted by marginal food security and five percentage points by low food security or very low food security (Table 2). As three of these measures are on the same continuum indicating the level of food security, the estimates indicate that nearly three percentage points fall in the range between marginal food security and low food security, and the other five percentage points fall in the category of very low food security. In other words, for young adults with disabilities, the increased risk of low food security may well put them at very low food security, the most severe category on the food security scale. The effect size of this increased risk – a 12%-17% increase in the low food security rate and very low food security - is beyond modest for individuals with disabilities. By contrast, individuals without disabilities become more food secure as a result of the transition. A similar pattern is also observed in the health-related outcomes, as shown in Figures 3 and 4. These findings suggest that in the transition to adulthood individuals with disabilities fall further behind their counterparts without disabilities. Apparently, the transition is a stage that amplifies the developmental disparity accumulated in childhood. While this study is not able to answer why the two groups show an increasing divergence on these indicators, it is suspected that employment opportunity and consumption priority may play a large part in it.

Our analyses of food security indicate that risk of low food security varies for youth and young adults, with or without disabilities. This variation is reflected in health-related outcomes

as well. As reported in Table 3, food security is related to health and unmet healthcare needs for all four groups, but the correlation is statistically stronger for young adults. It is perhaps because children or youth (under 18 years) receive stronger protection from both families and public programs on nutrition and health care, which mitigates the association between food security and health. Although the group differences indicated by the three health measures lack statistical significance, it seems public health programs should be applauded for improving access to healthcare for individuals with disabilities. These group differences also present an example of complexity of co-occurrence of food and health hardship, and perhaps other material hardships as well. Therefore, it is important to have a comprehensive and coordinated public assistance system in place in order to effectively address low food security and its potential impacts on other aspects of well-being, such as health.

Although the conceptual reasoning is that food security status affects health, it is perhaps equally plausible that food security and health may share some common causes or confounders, such as lack of economic resources. Hence, in addition to examining the correlation between food security and health (Table 3), we evaluated whether additional risk of low food security is reflected in health outcomes and how it is for young adults with disabilities relative to youth with disabilities and young adults without disabilities (Table 4). Using a framework that combines the DID approach and mediation analysis to address the common confounder issue, a test was conducted to look into the potential causality between food security and health. However, this part of the analyses did not yield significant results.

We also tested the potential impacts of SNAP participation on food security and health-related outcomes for youth and young adults with disabilities, respectively. Constrained by the weak instrumental variables, our analyses show SNAP participation a statistically significant

predictor of youth's food security status measured by the food security raw score only. While it is still unclear and needs further investigation, the current IV results seem to imply that SNAP participation has greater impacts for youth than for young adults, which is somewhat different from our hypothesis.

As is mentioned earlier, policies applied to children with disabilities and adults with disabilities are different. Although SNAP rules make it easier for SSI/Medicaid recipients with disabilities to access SNAP (for example, some state agencies use the same application form for SNAP and Medicaid to streamline the application; SNAP allows medical expense deduction and higher asset limits; SNAP grants individuals with disabilities longer certification periods and uses change reporting for recertification, Center on Budget and Policy Priorities, 2014, 2015a, 2015b; Gundersen & Ziliak, 2015), they no longer apply when young adults lose SSI and/or Medicaid. Given these policy differences, our initial hypothesis is that SNAP participation has greater marginal effects for young adults than for children or youth. The IV results, however, seem to suggest the opposite – the protective effects of SNAP declined for young adults, perhaps because they have greater barriers than when they were young in accessing SNAP.

The study has several limitations. First, our repeated cross-sectional design used in this study is not able to fully capture the complex phenomenon of disability, which is defined variantly by different public programs. For example, those identified in the repeated cross-sectional design as young adults with disabilities could be different from those who have had disabilities since childhood (the theoretical population of this study). Longitudinal analyses based on panel data could resolve this problem and better capture the changes in the transition process. Second, to evaluate the impacts of SNAP participation, we tried a number of variables but were not very successful in identifying effective instrumental variables. Also, the DID

analysis has an overly strong assumption that the dynamics of food security is similar for children with and without disabilities. Third, our evaluation of the effects of food security on health-related outcomes is limited by the current data structure. The NHIS measures household food security status 30 days prior to the interview and unmet healthcare needs 12 months prior to the interview. Therefore, the data may not accurately reflect the hypothesized temporal effects of food security on health even though they are considered concurrent measures in the current study. In addition, the disability sample is relatively small in this study and therefore estimation regarding this group may be less reliable.

For future research, additional control variables (e.g., homeownership, education, and employment status of household head) can be considered for the first and second research questions. In addition, the definition of disability used in the American Community Survey may be considered for a comparison with the findings of this study. For the third research question, probit models may be used for the instrumental variables approach (Yen, Andrews, Chen, & Eastwood, 2008) and the conditional likelihood ratio test for weak instruments (Moreira & Poi, 2003) may be considered.

The findings of this study have several important implications for policy. Young adults with disabilities face a greater risk of low food security, which may affect other aspects of their well-being (e.g., health). What they experience in the transition will likely impact their long-term development, economic independence, and self-sufficiency. Therefore, it is important to improve accessibility of food assistance programs. Better access to public food assistance will improve not only food security but also health and other aspects of individual well-being. A few strategies may be considered. For example, special outreach services could be created to target both young adults and youth with disabilities and encourage participation in food assistance programs. For

youth with disabilities receiving nutrition assistance, an alert system embedded in the state administrative processes and case management services may serve to bring awareness of the upcoming transition to adulthood and potential risk of low food security. Then, additional resources (e.g., information regarding reapplication and/or private nutrition assistance) may be provided accordingly to prevent low food security. Moreover, nutrition assistance could be included in transition planning for youth with disabilities and become an integrated part along with other transition activities. Since individuals with disabilities often participate in multiple public programs, they would benefit from a coordinated and streamlined system that optimizes accessibility and benefits. Finally, although focusing on the transition to adulthood - a specific life stage, this study has broader implications for future research that aims to understand the dynamics of food security over the life span/in different populations and how that may affect the use of public assistance.

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Table 1. Descriptive Statistics of Youth (Ages 13-17) and Young Adults (Ages 18-25) in the Sample (N=31,483)

	Full sample (N=31,483)	Youth w/ disabilities (n=1,432)	Adults w/ disabilities (n=1,325)	Youth w/o disabilities (n=10,280)	Adults w/o disabilities (n=18,446)
Individual Characteristics					
Disability (%)	8.89				
Young adults (%)	66.65				
Male (%)	48.71	63.26	47.37	49.59	46.99
Race and Ethnicity					
Hispanic	28.84	25.09	17.49	38.53	25.41
Non-Hispanic White	44.59	47.44	56.35	33.82	48.55
Non-Hispanic Black	20.35	24.13	22.69	22.23	19.03
Non-Hispanic Asian	4.75	0.90	1.90	3.60	5.60
Non-Hispanic Others	1.48	2.45	1.58	1.47	1.41
Married	8.60	0.19	7.97	0.44	13.08
Employed	32.02	0.00	21.01	0.00	49.99
SSI participation	3.03	20.01	24.63	1.65	0.91
Medicaid participation	30.94	61.88	41.60	50.06	19.07
Self-reported general health status (mean)	3.01	2.48	1.97	3.18	3.04
Delayed medical care (%)	10.11	5.50	23.63	4.33	12.16
Not getting medical care (%)	8.31	4.19	22.86	3.31	9.88
Family Characteristics					
Family members' highest education					
High school and below	76.79	79.02	81.26	77.70	75.89
Some college	10.58	11.85	10.54	11.92	9.87
Four-year college/above	12.63	9.13	8.19	10.38	14.24
Family income (mean)	16937.14	19518.49	14263.36	21477.67	14832.65
Family size (mean)	3.55	4.45	3.00	4.72	2.98
Family SNAP participation	44.71	68.16	56.95	56.91	36.48
Family food security					
Raw score (mean)	1.68	2.89	3.07	1.84	1.42
Low food security (%)	27.92	47.82	47.01	31.17	23.61
Very low food security (%)	11.52	23.69	26.81	12.06	9.31
Marginal food security (%)	43.43	62.67	61.64	48.98	38.16

Table 2. Food Security, Disability, and Transition to Adulthood: DID Estimation (N=31,483)

	Food Security Raw Score	Low Food Security	Very Low Food Security	Marginal Food Security
Disability (Yes; β_1)	.98***	.16***	.11***	.13***
	(.75, 1.22)	(.12, .19)	(.08, .14)	(.09, .16)
Adulthood (Yes; β_2)	-.20***	-.04***	-.01*	-.06***
	(-.31, -.09)	(-.06, -.02)	(-.03, -.00)	(-.08, -.04)
Disability×Adulthood (β_3)	.53***	.05*	.05**	.08***
	(.22, .83)	(.00, .10)	(.01, .09)	(.03, .13)
Intercept (α)	1.66***	.28***	.12***	.43***
	(1.42, 1.91)	(.24, .32)	(.09, .15)	(.37, .48)

Analyses of Equation (1). Regression coefficients and 95% CI are reported in Table.
*p<.05, **p<.01, ***p<.001.

Table 3. Health-Related Outcomes and Low Food Security
for Youth and Young Adults, With and Without Disabilities (N=31,483)

	Global Health	Delayed Medical Care	Not Receiving Medical Care
Populations (δ_1)			
Youth w/o disabilities (ref. group)			
Adults w/o disabilities	-.15***	.01*	.01
	(-.19, -.11)	(.00, .02)	(-.00, .02)
Youth w disabilities	-.61***	.02**	.02**
	(-.71, -.50)	(.01,.04)	(.01, .04)
Adults w disabilities	-1.02***	.15***	.14***
	(-1.13, -.90)	(.11, .19)	(.10, .17)
Low food security (Yes, δ_2)	-.16***	.05***	.04***
	(-.21, -.11)	(.04, .06)	(.03, .05)
Populations × Low food security (δ_3)			
Adults w/o disabilities	-.12***	.11***	.12***
	(-.19, -.06)	(.09, .13)	(.10, .14)
Youth w disabilities	-.01	-.01	-.00
	(-.16, .13)	(-.04, .03)	(-.04, .02)
Adults w disabilities	-.22***	.06*	.10**
	(-.37, -.06)	(.00, .12)	(.05, .16)
Intercept (γ)	3.30***	.07***	05***
	(3.24, 3.37)	(.05, .09)	(.03, .07)

Analyses of Equation (2). Regression coefficients and 95% CI are reported in Table.
*p<.05, **p<.01, ***p<.001

Table 4. Health-Related Outcomes, Disability, and Additional Risk of Food Security in Young Adulthood: DID Estimation (N=31,483)

	Global Health		Delayed Care		Not Having Care	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Disability (Yes; θ_1/ θ'_1)	-.64***	-.60***	.03***	.01	.02***	.00
	(-.72, -.56)	(-.68, -.52)	(.01, .05)	(-.00, .02)	(.01, .04)	(-.01, .02)
Adulthood (Yes; θ_2/ θ'_2)	-.18***	-.19***	.04***	.04***	.04***	.04***
	(-.21, -.14)	(-.22, -.15)	(.03, .05)	(.03, .05)	(.03, .05)	(.03, .05)
Disability ×Adulthood	-.33***	-.32***	.12***	.12***	.13***	.13***
(θ_3/ θ'_3)	(-.45, .-.22)	(-.44, .-.21)	(.09, .15)	(.08, .15)	(.10, .17)	(.10, .16)
Low Food Security (Yes;		-.25***		.12***		.11***
θ'_4)		(-.28, -.21)		(.08, .15)		(.10, .13)
Intercept (η/ η')	3.27***	3.33***	.08***	.05***	.06***	.02***
	(3.20, 3.33)	(3.27, 3.40)	(.06, .10)	(.03, .07)	(.04, .08)	(.01, .04)

Analyses of Equations (3) and (4). Regression coefficients and 95% CI are reported in Table.
*p<.05,**p<.01,***p<.001

Table 5. SNAP Participation, Food Security, and
Healthcare for Individuals with Disabilities: IV Estimation

Models	Intercept	SNAP Participation
DV1: Food security score		
Youth with Disabilities	14.09***	-8.30*
	(4.67, 23.53)	(-13.68, -2.92)
Adults with Disabilities	4.52**	-4.38
	(1.21, 7.82)	(-12.92, 4.17)
DV2: Low food security		
Youth with Disabilities	1.28	-1.02
	(-1.29, 3.84)	(-2.54, .50)
Adults with Disabilities	0.62	-1.23
	(-.073 1.96)	(-3.83, 1.37)
DV3: Very low food security		
Youth with Disabilities	1.85	-1.03
	(-0.33, 4.02)	(-2.34, .28)
Adults with Disabilities	0.60	0.19
	(-0.42, 1.60)	(-1.85, 2.23)
DV4: Marginal food insecurity		
Youth with Disabilities	2.30	-1.08
	(-0.47, 5.06)	(-2.81, 0.64)
Adults with Disabilities	0.34	-1.97
	(-1.21, 1.88)	(-5.02, 1.08)
DV5: Health		
Youth with Disabilities	2.68	0.12
	(-0.57, 5.94)	(-2.81, 0.64)
Adults with Disabilities	0.34	-1.97
	(-1.21, 1.88)	(-1.58, 1.83)
DV6: Delayed Medical Care		
Youth with Disabilities	-0.22	-0.09
	(-1.80, 1.36)	(-1.19, 1.02)
Adults with Disabilities	-0.68	-1.51
	(-2.04, 0.68)	(-4.32, 1.30)
DV7: Not Receiving Medical Care		
Youth with Disabilities	-0.02	-0.11
	(-0.99, 0.95)	(-0.66, 0.44)
Adults with Disabilities	-0.70	-1.09
	(-1.90, 0.50)	(-3.48, 1.29)

Regression coefficients and 95% CI are reported in Table.
*p<.05, **p<.01, ***p<.001

Figure 1. Food Security Raw Score by Age, Disability, and SNAP Status

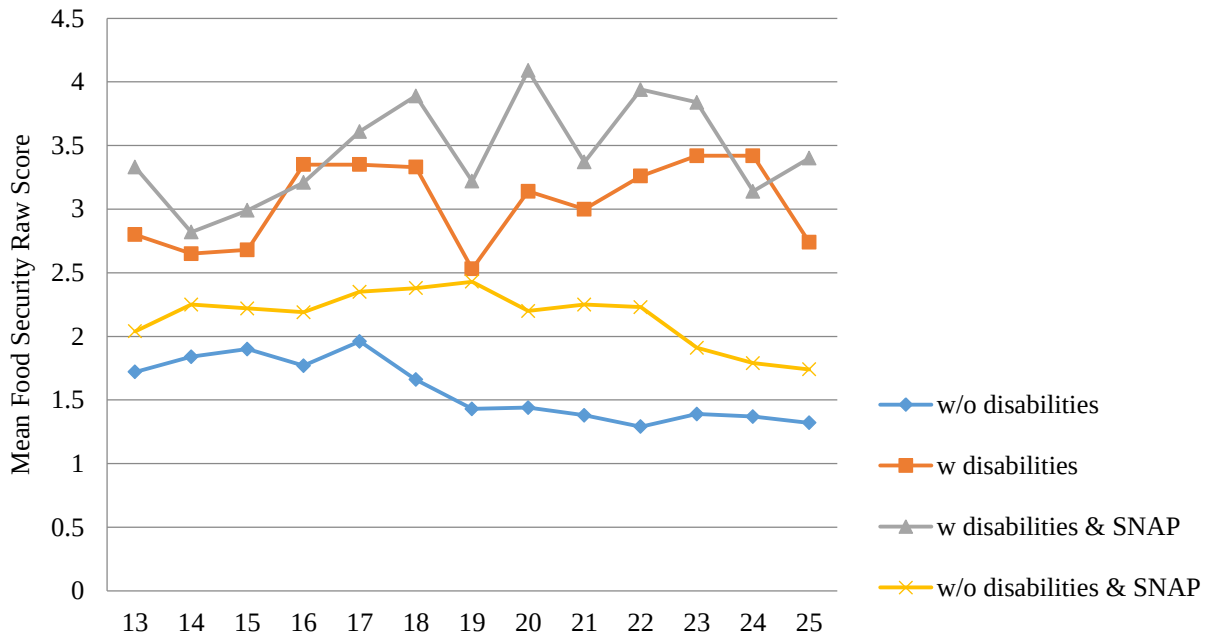

Figure 2. Low Food Security Status by Age, Disability and SNAP

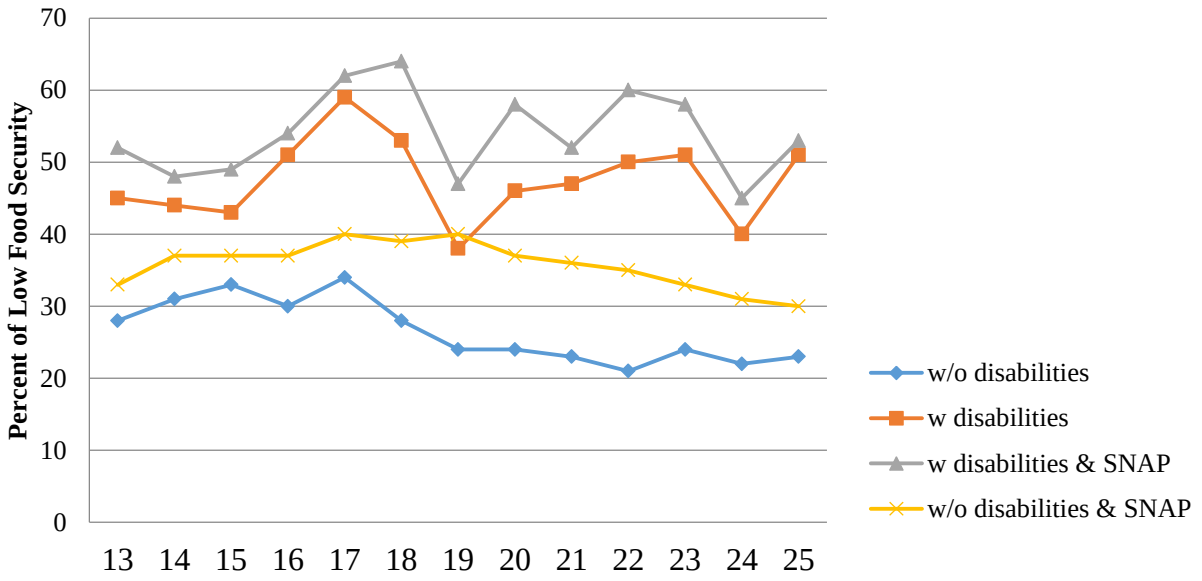

Figure 3. Self-reported General Health Status by Age, Disability, and SNAP

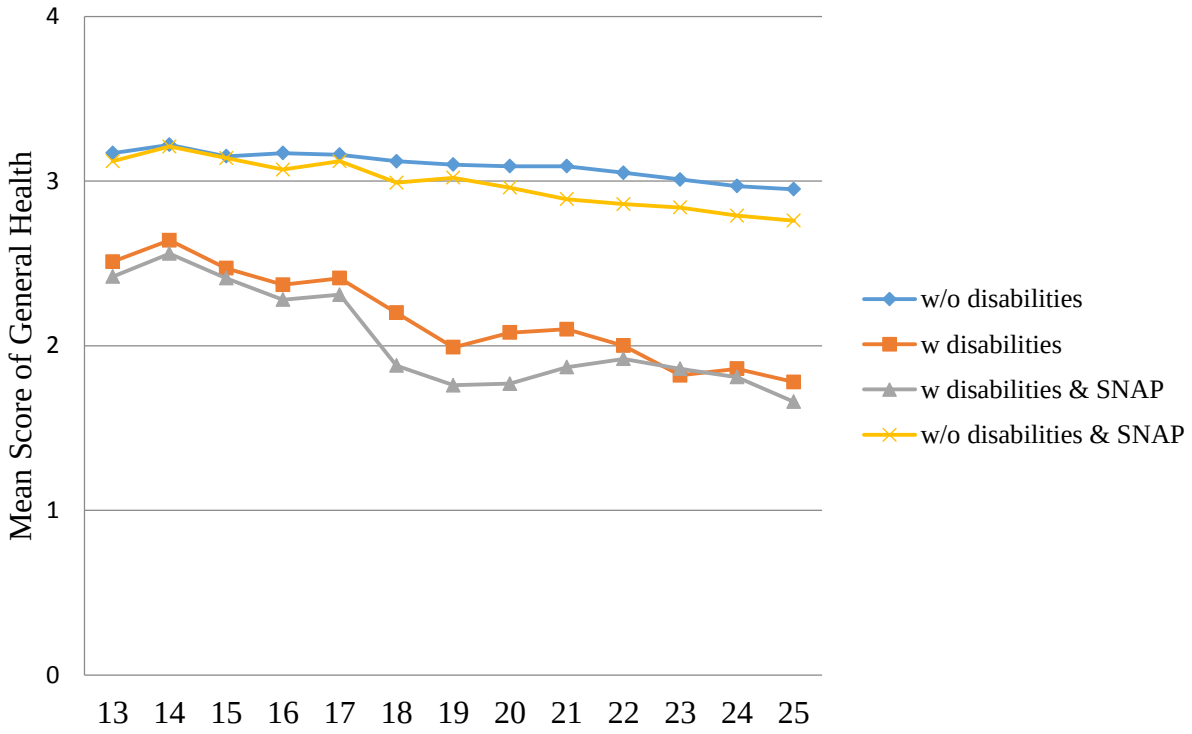

Figure 4. Delayed Medical Care by Age, Disability, and SNAP

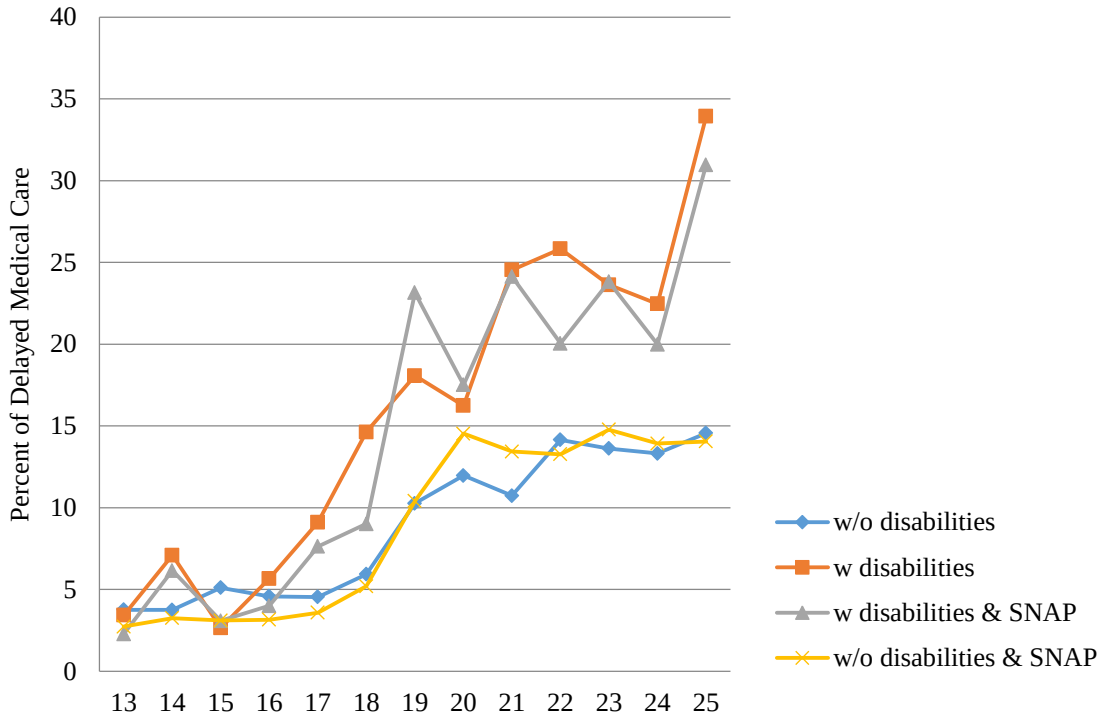

Figure 5. Not Having Medical Care by Age, Disability, and SNAP Status