EXPLORING ADOLESCENT SNACKING BEHAVIORS AND THE FEASIBILITY OF A YOUTH ADVOCACY PROGRAM IN NEW YORK CITY

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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May 2022

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Cornell University 2022

Proper nutrition during adolescence is critical in ensuring long-term health and longevity. However, in the United States (U.S.), adolescents, especially those from minority, low socioeconomic status (SES), and urban backgrounds, have a poor diet. Studies report that energy-dense, nutrient-poor snacking comprises a large part of the adolescent diet. However, little is known about adolescent snacking behaviors, and there have been few attempts to intervene upon it. As such, the objectives of this dissertation are to: 1) investigate differences in the snacking behaviors of adolescents by socioeconomic status through analysis of National Health and Nutrition Examination Survey data, 2) explore factors that influence the snacking behaviors of adolescents from urban communities through interviews, and 3) assess the feasibility of a youth advocacy program promoting healthy snacking among adolescents at a Boys & Girls Club in New York City through a mixed methods process evaluation.

Chapter 1 of this dissertation reviews what is currently known about snacking among adolescents and how youth advocacy can be used as a strategy to promote healthy snacking behaviors. Chapter 2 explores SES differences in foods/beverages and nutrients consumed by U.S. adolescents when snacking, utilizing National Health and Nutrition Examination Survey 2005-2018 data. Results reveal that adolescents from low SES backgrounds have poorer snacking behaviors than those from higher SES backgrounds. In Chapter 3, this dissertation aims to understand the aforementioned findings by qualitatively exploring the factors that influence

snacking among adolescents from urban communities through interviews. Interviews report that the availability and accessibility of corner stores, which primarily stock energy-dense, nutrient-poor snacks, combined with urban adolescents' high food autonomy and self-efficacy to purchase snacks, promotes unhealthy snacking behaviors. Next, based upon findings from the prior projects, a youth advocacy program promoting healthy snacking in corner stores is developed by adapting the Youth Engagement and Action for Health! (YEAH!) curriculum. Chapter 4 of this dissertation reports on the feasibility of this youth advocacy program through a mixed methods process evaluation. Findings report high rates of retention, attendance, participant engagement, and participant satisfaction. Lastly, the implications of these findings on future research, policy, and practice are discussed in Chapter 5.

Overall, findings from this dissertation can be used to inform future research promoting adolescent snacking, as well as practices for engaging adolescents as change agents for their own health and the wellness of their communities.

BIOGRAPHICAL SKETCH

Navika was raised in Delaware and completed her Bachelor of Science in Dietetics at the University of Delaware in 2017. She then started her doctoral studies in Nutritional Sciences at Cornell University. She was admitted into the PhD/RD Program and trained under the guidance of Dr. Tashara Leak. As part of the Leak Research Group, she worked on developing and implementing behavioral interventions aimed at improving nutrition among adolescents from minority, low-income, and urban backgrounds. Navika's own dissertation focuses on exploring adolescent snacking behaviors and empowering adolescents as change agents to improve their own dietary behaviors, as well as the environmental conditions in their communities that promote an unhealthy diet.

In addition, as part of the PhD/RD program, Navika completed several experiences that allowed her to bridge research, policy, and practice. Firstly, she became a Registered Dietitian in 2019, after completing the 2018-2019 Cornell University and University of Rochester Medical Center Dietetic Internship and Registration Examination for Dietitians. Then, from 2019-2021, Navika was a predoctoral trainee on the National Institutes of Health (NIH) National Institute of Child Health & Human Development (NICHD) T32 Training Grant in Maternal and Child Nutrition. Lastly, from January through May 2022, while completing her dissertation, Navika worked as a research assistant with the New York Academy of Sciences. Overall, Navika's work has focused on combining research, policy, and practice, in order to promote adolescent nutrition and remediate health disparities.

This dissertation is dedicated to all the adolescents that I had the opportunity to work alongside with and learn from during this experience. I am forever grateful to be let into your lives and will not forget the kindness you extended to me and all the laughter that we shared.

ACKNOWLEDGMENTS

I truly do not have the words to express my gratitude and love for those that have helped me through my PhD studies. In a way, I grew up at Cornell, arriving in Ithaca freshly out of college. As such, those that I have crossed paths with in the last 5 years have helped shape me into the person I have become.

To my advisor, Dr. Tashara Leak. Thank you for taking a chance on working with me, for endlessly supporting me, and for showing me what true perseverance in equity and justice looks like. I am a far better person for having been trained by you.

To my special committee, Dr. Anthony Burrow, Dr. Gary Evans, and Dr. Marie Caudill – thank you for pushing me to see beyond the obvious and giving me the freedom to explore. This dissertation is undoubtedly better because of your contributions.

To the adolescents and staff at the Boys & Girls Club, without you this work simply would not have been possible. To the adolescents, it was my only wish for you to contribute, advocate, learn, grow, feel safe, and have fun. This work was a success if it lent to any of that.

To members of the Leak Research Group, past and present, thank you for your support and commitment to our work.

To my friends, spanning the country, this dissertation would not have been possible without you all. Ithaca friends, Dorothy, Felicia, and Katherine – thank you. Dorothy, you're a sister to me. From our first Madeleine's chocolate creme brulee, I knew we'd be sitting in Wegmans parking lots talking for hours, being each other's bridesmaids, and best friends forever. Felicia, to have a best friend be your colleague is indescribable. From our L train commutes to hours long conversations that made this dissertation better, I appreciate you so much. Katherine – the best people in life are free and you're one of them. Madi, Katelyn, and

Hickey, I cannot explain how much light your phone calls, group chats, and reunions have added to my life. You are my forever friends, and I cannot believe I lucked out this much with you all. To my NYC family, Em and Sabrina, having you both in my life has made moving to a new city as an adult the most wonderful experience. Thank you for your friendships. To James, thank you for being by my side while I finished up this dissertation. You make my life better.

And last, but not least, to my family, Cynthia, Nutan, Shailja, and Siddharth. In my hardest times, you all were there for me. Shell and Sid, there's no better feeling than having your siblings be your best friends. You both inspire me, and I can't wait for the rest of our lives together. To Mom and Dad, this dissertation is also for you both and every sacrifice you made for me, Shailja, and Siddharth. I love you both so much.

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CHAPTER 1

INTRODUCTION

Adolescents in the United States (U.S.) have poorer diet quality than younger aged youth.[1,2] Poor diet among adolescents is of special concern, since nutrition during this period has a direct impact on adult health and disease risk.[3] In addition, many health behaviors related to nutrition are formed during adolescence, and research reveals that these behaviors transcend into adulthood.[3] As such, there has been research, policy, and practice efforts focused on improving the adolescent diet.[4] However, many of these efforts have overlooked a significant eating occasion: snacking.

1.1 Snacking Trends Among U.S. Adolescents

1.1.1 Calories from Snacks and Snacking Frequency

Snacking, which is commonly defined as an eating occasion outside of breakfast, lunch, and dinner,[5] comprises approximately 22% of adolescents' daily caloric intake.[6] In addition, adolescents consume 555 calories (kcal) a day from snacks, according to data from the 2011-2014 National Health and Nutrition Examination Survey (NHANES),[7] and 284.54 kcal per snack, according to the 2005-2016 NHANES.[8] Research also reveals that adolescents consume multiple snacks a day, with the study from the 2005-2016 NHANES reporting 1.77 snacks per day.[7,8] Furthermore, a study called Project Eating Among Teens (EAT) was conducted in 2010 with 2,793 adolescents in urban areas of Minnesota.[9] Adolescents self-reported consuming an average of 4.3 snacks per day,[9] suggesting that snacking frequency may differ between these adolescents and adolescents from nationally representative samples, potentially due to sociodemographic factors.

1.1.2 Nutrients and Types of Foods/Beverages Consumed as Snacks

In addition to calories from snacks and number of snacks consumed per day, it is also important to consider the nutrient contribution of snacks and the types of foods/beverages consumed as snacks. Based on 2017-2018 NHANES data, adolescents consume the following percentages of nutrients each day from snacks: 20% of total fat, 21% of saturated fat, 25% of carbohydrates, 21% of dietary fiber, 34% of total sugars, and 12% of protein.[6] Data from the 2005-2006 NHANES indicated that adolescents consume 34% of their daily added sugar from snacks.[10] The most recent nationally representative data on the foods/beverages consumed as snack is dated and from the NHANES 2005-2006 data brief.[10] This brief reported that adolescents consume 38% of fruits, 32% of oils, 19% of grains, 17% of milk, 12% of vegetables, and 11% of meat/beans as snacks.[10] Furthermore, Project EAT reports that adolescents consume 2.2 servings of energy-dense, nutrient-poor snack foods per day.[9] Energy-dense, nutrient-poor (ENDP) is a term to describe foods/beverages high in calories, fat, sugar, and/or sodium.[11]

1.1.3 Relationship between Snacking Behaviors and Diet/Health Outcomes

Snacking is also associated with other diet and health outcomes among adolescents, yet data is equivocal about whether snacking is supportive of health or not. Data from the 1999-2004 NHANES revealed a positive trend between the number of snacks consumed per day and total daily calorie intake.[12] A study utilizing NHANES data from 2001-2004 reported that the number of snacks consumed per day was positively associated with total daily calorie intake, carbohydrate, total sugar, vitamin C, fruit, and solid fat intake and negatively associated with protein and total fat intake.[13] From Project EAT, among adolescents from urban areas of

Minnesota, the number of snacks consumed per day was positively associated with total energy and sugar-sweetened beverage intake and negatively associated with fruit and vegetable intake.[9]

There is some evidence that snacking characteristics are associated with overweight and obesity, but findings are mixed. Analysis of 2005-2016 NHANES data found that adolescents with overweight and obesity consumed significantly more snacks per day, calories per snack, and added sugar, saturated fat, and sodium from snacks than adolescents with normal weight.[8] Additionally, a study that utilized NHANES 2003-2012 data, revealed that there was a positive association between snacks per day (by contribution to total caloric intake) and body mass index (BMI) percentile and odds of overweight and abdominal obesity.[14] Project EAT also reported a significant positive association between consumption of EDNP snacks and BMI z-score, such that each additional ENDP snack food serving consumed increased BMI z-score 0.059 points.[9] On the other hand, in a study of 1999-2004 NHANES data, snacking frequency and percent of daily calories from snacks was associated with decreased odds of overweight or obesity and abdominal obesity.[12] Furthermore, when the Project EAT cohort examined all snacks, not just EDNP snacks, there was a negative relationship between snacks per day and BMI z-score, suggesting that the nutritional quality of snacks may be important in determining the relationship between snacking and BMI.[9]

1.1.4 Relationship between Snacking Behaviors and Sociodemographic Factors

In the U.S., there is limited research on associations between sociodemographic factors and snacking behaviors, though research suggests that disparities exist by race/ethnicity, socioeconomic status (SES), and geography (i.e., urban versus rural). In the study of the 2005-2016 NHANES, researchers reported that Non-Hispanic Black (NHB) adolescents consume significantly more snacks per day than Hispanic adolescents and Non-Hispanic White (NHW)

adolescents.[8] NHB adolescents also consumed more calories, sodium, and saturated fat from snacks than NHW adolescents.[8] Lastly, NHB and NHW adolescents consumed significantly more added sugar from snacks than Hispanic adolescents.[8] In this study, there were no significant differences in snacking by SES, when adolescents were categorized into low and high poverty-to-income ratio (PIR) groups (i.e., PIR>1.25 and PIR<1.25). From the Project EAT cohort, those who were Black and Native American and from families with low SES consumed significantly more EDNP snacks and sugar-sweetened beverages than their White and higher SES counterparts.[15] In terms of geography, a study of nationally representative data from 1977-1996 currently provides the most detailed examination of snacking among urban and rural U.S. youth.[16] Data revealed that a greater proportion of urban youth than rural youth report consuming a snack in a given day.[16] In addition, the percentage of daily calories from snacks was higher among urban youth than rural youth.[16]

1.1.5 Summary

In conclusion, snacking is a significant contributor to the adolescent diet. Even though the contribution of snacking to overall diet and health is equivocal, the data indisputably reveals that there is an opportunity to improve adolescent snacking behaviors, especially among adolescents from minority, low-income, and urban backgrounds. However, to improve this eating occasion, there needs to be an exploration of the factors that influence it.

1.2 Social Cognitive Theory as a Framework to Understand Adolescent Snacking Behaviors

Social Cognitive Theory (SCT), which describes that behavior is determined through an interplay between personal, behavioral, and environmental factors,[17–19] is a useful health behavior theory for exploring adolescent snacking behaviors (Figure 1-1). Health behavior

theories are frameworks depicting tested relationships between factors and health behaviors.[19] Therefore, they can be used as a guide to predict, understand, and improve health behaviors.

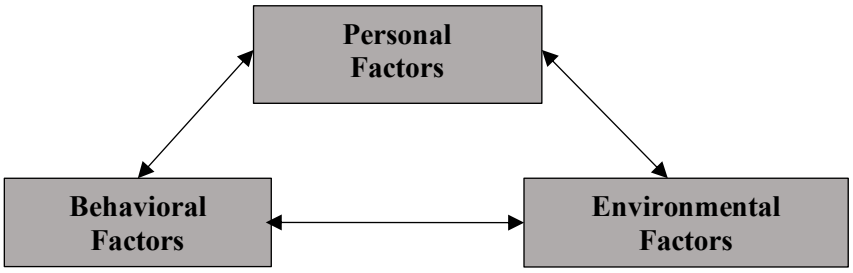

Figure 1-1. Social Cognitive Theory (SCT) Framework

Personal factors are defined as "personal abilities for processing information, applying knowledge, and changing preferences," and they include ability to comprehend outcomes of behavior and knowledge about the behavior.[19] Behavioral factors include the behavior and the individual's experience with the behavior, such as the skills they possess to perform it, their intentions to perform it, and internal and external reinforcements they have received for performing it.[19] Environmental factors are "aspects of the perceived social and/or physical environmental that promote, permit, or discourage engagement in a particular behavior."[19] Each of the factors has a bidirectional arrow to the others, such that they continuously exert influence on each other and behavior. This relationship is called reciprocal determinism and is a foil to linear and unidirectional health behavior theories that rest on an input-output model (i.e., various factors make up the input and that leads to the behavior output).

1.2.1 Personal, Behavioral, and Environmental Factors that May Influence Adolescent Snacking Behaviors

SCT can be used as a framework for exploring factors that influence adolescent snacking behaviors. Currently, there is little research on factors influencing snacking behaviors among

adolescents in the U.S. However, research on adolescent dietary behaviors (not specific to snacking) and on snacking behaviors among adolescents from outside the U.S. provide some preliminary understanding of this phenomenon.

In terms of personal factors, salient influences that may impact adolescent snacking are food preferences and knowledge. In a review of influences on adolescent dietary behaviors, authors state that food preferences are "one of the strongest predictors of food choices."[20] In addition, knowledge about the health concerns and benefits of snacking may also influence adolescent snacking behaviors. In studies with adolescents outside of the U.S., adolescents displayed a lack of health and nutrition knowledge related to snacking, and this seemed to contribute to unhealthy snacking.[21,22] They were also motivated to consume healthy snacks for their benefits (i.e., physical, emotional, academic).[23]

Adolescents also possess behavioral skills that influence snacking. Adolescents are in a life stage where they have increased autonomy and purchasing power.[24] This results in adolescents forming dietary behaviors and making decisions about what foods they consume independent of their families.[24] An example of this is purchasing snacks for themselves. A study in the Netherlands found that higher reports of autonomy was positively associated with the number of unhealthy snacks purchased each day.[25] Therefore, high autonomy and purchasing power are behavioral factors promoting adolescent snacking.

Aspects of the social and physical environment may also influence adolescent snacking behaviors. Social environmental influences include family, peers, and other individuals that adolescents interact with. The physical environment includes the home, school, after school, and food retail environment, as well as other settings that adolescents find themselves in. In terms of general food behaviors, research reports that families and peers are significant influences.[20]

Studies of adolescent snacking outside of the U.S. also reveal that peers influence snacking norms, oftentimes by determining which foods are acceptable as snacks.[21–23] In the physical environment, factors that may influence adolescent snacking are schools. Schools have guidelines for snacks, called Smart Snacks, which delineate nutrition requirements for snacks served in schools and may promote healthier snacking.[26] Lastly, the food retail environment, which includes all places that one can purchase food from, may influence adolescent snacking by providing availability and accessibility to snacks. When considering snacking, of special concern in the food retail environment are corner stores, which primarily stock EDNP snacks.[27–30] The influence of corner stores on adolescent snacking behaviors is further discussed in the next section.

1.2.2 Summary

SCT provides a framework for understanding snacking behaviors among adolescents in the U.S. Prior research has only addressed overall adolescent dietary behaviors and snacking behaviors among adolescents from outside the U.S. It is not clear if the factors that influence these behaviors are the same for snacking among U.S. adolescents. As, such there is a need for an in-depth exploration of factors that influence snacking among U.S. adolescents.

1.3 Snacking Among Adolescents from Urban Communities: The Role of Corner Stores

When considering the factors that influence snacking behaviors, adolescents from urban areas are especially at risk for unhealthy snacking behaviors. These disparities may be due to a unique environmental factor, which is the presence of corner stores.

1.3.1 Corner Stores as a Hallmark of the Urban Food Retail Environment

Corner stores, also referred to as convenience stores or bodegas, are described as small, independently-owned stores that sell both food items (snacks, beverages, candy, etc.) and non-

food items (household supplies, tobacco products, alcohol, lottery tickets, etc.).[31,32] Urban neighborhoods, especially those with a large proportion of residents from minority and low-income backgrounds, have a high availability of corner stores and low availability of supermarkets that stock healthier foods.[33–35] For example, in New York City (NYC), New York, there are more corner stores than supermarkets.[36] Moreover, in some urban communities, corner stores are closer to family homes than supermarkets.[37,38] One study of 514 residents in Philadelphia, Pennsylvania, revealed that corner stores were the closest food retail location for 89.3% of surveyed residents, with medium-sized grocery stores closest for 10.1% of residents, and large chain supermarkets closest for 0.6% of residents.[37] This proximity allows corner stores to be primary sources of food for some families.[36,39] Research from various urban centers also reveals the high frequency of corner store visits. Residents in Baltimore, Maryland visit corner stores about 3 times per week, and, in NYC, residents visit corner stores at least 5 times a week.[39,40] Furthermore, one study that conduced intercept surveys outside a specific corner store in NYC found that 46.6% of residents visited that corner store more than once a day.[41]

1.3.2 Availability of Energy-Dense, Nutrient-Poor Snacks in Corner Stores

Not only are corner stores highly available and accessible, but they also primarily stock EDNP snack foods/beverages, further contributing to poor snacking behaviors.[27–30] A study in Philadelphia revealed the high availability of EDNP foods/beverages and low availability of healthy foods/beverages in corner stores.[29] Chips and baked goods were sold in 94.8% and 92.1% of stores, respectively, while fruit was only available in 60.5% of stores.[29] One study specifically examined snack food/beverage availability at 3 corner stores in Philadelphia.[27] This study revealed that, in total, the 3 corner stores had 452 unique types of snack foods/beverages.[27] Of these, 96.4% were processed snacks, 0% were fruit/vegetable snacks (i.e., “whole (e.g.,

bananas) or cut-up fresh fruit (e.g., fruit salad) or vegetables (e.g., celery sticks), as well as some pre-packaged items with fruit or vegetables as the first ingredient"), and 3.6% were whole grain snacks (i.e., "any products having whole grain as the first ingredient").[27]

1.3.3 Adolescent Corner Store Usage

Corner stores are also frequently accessed by urban adolescents. Intercept surveys with 833 youth (4th to 6th graders) exiting corner stores in Philadelphia found that over 50% of surveyed youth visited corner stores at least once a day.[42] In a study based in Baltimore, youth visited corner stores an average of 2 times per week.[43] One reason for this frequency may be that, in urban areas, corner stores and schools are located within proximity to each other. A study in urban areas of Minnesota found an average of 2.5 corner stores within walking distance (800 meters) of high schools.[30] Moreover, from another survey based in Philadelphia, approximately 2/3 of students stated that they visited corner stores before or after school.[44] Another reason is that corner stores are more than just a food retail venue for adolescents. Focus groups conducted with 4th to 6th graders in Philadelphia revealed that corner stores are a place to socialize since "friends go there and you want to see your friends" and that youth are often unaccompanied by caregivers when at corner stores.[45] Another study reported that adolescents in NYC have an affinity for corner stores, as they stock foods "related to ethnic origins."[46]

1.3.4 Adolescent Corner Store Purchases

Data reveals that adolescents' top corner store purchases are EDNP snack foods/beverages.[32,43,47,48] Intercept surveys of adolescent corner store purchases in Philadelphia found that adolescents purchased an average of 2.3 food/beverage items at each corner store visit.[47] Of all items purchased in by adolescents, the top 5 categories of items were beverages, chips, pastry, candy, and prepared food items (from the deli counter, such as sandwiches &

bagels).[47] Within the beverage category, the top 2 most purchased beverages were regular soda and fruit-flavored drinks (<100% fruit juice).[47] Another study of adolescents from Baltimore reported that chips, candy, and soda were the most commonly purchased items from corner stores.[43] Adolescents purchased these items 2.5, 1.8, and 1.4 times per week, respectively.[43] Researchers also conducted a nutrient analysis of foods purchased (using collected receipts) and found that foods/beverages during each adolescent's purchasing occasion contained, on average, the following: 650.2 kcal, 61.9 g added sugar, 2.3 g fiber and 786.3 mg sodium.[32]

1.3.5 Relationship between Corner Stores and Diet/Health Outcomes

There is also data on how proximity to corner stores impacts adolescents' diet and health outcomes. A study based in Baltimore reported that adolescents living in food swamps (≥4 corner stores within ¼ mile of residence) consumed more EDNP snacks than those who lived in food deserts (distance to supermarket is >¼ mile from residence) or lived in neither (with no confounding effect of neighborhood SES).[49] Additionally, a study based in urban areas of Minnesota reported that adolescents who lived within 800 or 1600 meters of a corner store were more likely to consume sugar-sweetened beverages.[50] This study also revealed that adolescents who lived within 1600 meters of a corner store had significantly higher BMI z-score and body fat percentage than those that lived further away,[50] which is consistent with another study examining corner stores and adolescent weight status.[51]

1.3.6 Summary

Urban adolescents seem to be at additional risk for poor snacking behaviors, due to the high availability and accessibility of corner stores in their food retail environments. Despite this, there is yet to be an in-depth study of factors that influence snacking among adolescents from urban communities in the U.S. This is important to confirm prior research related to corner stores

and adolescent snacking and to design interventions to improve snacking among adolescents in urban corner store settings.

1.4 Youth Advocacy as a Strategy to Promote Healthy Snacking Behaviors Among Adolescents in Urban Corner Stores

1.4.1 What is Youth Advocacy?

Youth advocacy is a relatively novel method to promote healthy snacking in corner stores among adolescents in urban communities. Advocacy for health is individuals or groups attempting to "bring about social and/or organizational change on behalf of a particular health goal, program, interest, or population"[52] and involves "the presentation of information to public and private decisionmakers to encourage and persuade them to adopt policies and/or procedures."[53] Advocacy is separate from efforts to bring awareness, which do not necessarily have the goal of influencing a decision-maker,[52] and distinct from activism, which does not necessarily speak on behalf of a community or group[54] (though advocacy efforts may include bringing awareness and being an activist). In the literature, youth advocacy for health tends to happen in 3 steps: 1) identifying problems in the community, 2) developing a plan for improvement, and 3) meeting with decision-makers.[55–57]

Adolescents are at a developmental stage that is optimal for youth advocacy, as they are developing their identities and discovering their purpose.[58,59] One important facet of this purpose development is forming beyond-the-self intentions.[58,60] Beyond-the-self intentions are those that take into consideration not only the individual, but also the larger environment and society.[60] These goals may manifest in prosocial and social justice inclinations among adolescents.[60,61] Examples of these include participation in community service, civic engagement, and organized youth activities.[60] Prosocial behaviors may also be evident in youth's participation in social

movements, such as vegetarianism/veganism.[4] Furthermore, the period of adolescence is characterized by adolescents gaining increased autonomy and independence from caregivers and striving to exercise agency.[24,59] As such, these aforementioned values can all be harnessed to involve youth in advocacy efforts.

1.4.2 Youth Advocacy's Origin in Adolescent Substance Use Control

Youth advocacy for health first emerged as a method for adolescent substance use control.[57,62–65] In the 1970s and 1980s, anti-smoking advocacy groups flourished, which redirected much of the efforts to reduce smoking from the individual to environmental and policy factors.[66] By the 1990s, these citizen-led groups had incited environmental and policy changes, which regulated tobacco companies and changed public opinion about smoking.[66] As such, in the early 2000s, this redirection away from the individual was also applied to youth substance use prevention.[66] Before then, school-based prevention programs had educated youth about environmental issues related to substance use but did not engage adolescents in efforts to address these influences, blunting behavior change.[62] Therefore, the idea behind youth advocacy for substance use was that "advocacy would help students acquire the necessary skills to promote environmental and policy changes and to resist both personal and social pressures to smoke and drink."[62]

Substance control youth advocacy programs primarily include 3 steps: 1) identifying problems in the community, 2) developing a plan for improvement, and 3) meeting with decision-makers.[55–57] For example, in one of the first studies of youth advocacy to control substance use, adolescents initially took part in lessons where they learned about environmental factors leading to substance use problems and what advocacy is.[56] They then assessed their communities and identified multiple issues (e.g., stores displaying too many alcohol/tobacco

advertisements, stores selling tobacco to minors, and drug use in local parks).[56] To address these issues, adolescents decided to ask store owners to remove advertisements, conduct an education campaign for store owners, and post "Drug-free Zone" signs at parks.[56] They advocated for these changes with several decision-makers, such as store owners, the mayor, school board, and city council, and were able to implement all of them.[56] Other substance control youth advocacy initiatives have followed similar protocols, and studies evaluating these programs reveal that they have contributed to changes in personal, behavioral, and environmental factors that promote decreased substance use among adolescents.[57,62,63,65] Since these factors are also important for health behavior change, according to SCT, some programs have utilized youth advocacy as a method to promote other health behaviors.

1.4.3 Youth Advocacy to Address Healthy Eating in Corner Stores

Some programs have focused on youth being involved in the advocacy process to promote healthy eating in corner stores. These four programs include: 1) Bayview Hunters Point project,[67] 2) East Oakland project,[68] 3) Proyecto Mercado Fresco,[31] and 4) Tenderloin project.[69] All 4 of these programs involved youth in advocacy to promote healthy eating in corner stores. The Bayview Hunters Point project and the East Oakland project engaged youth in the entire process that has been utilized in substance use youth advocacy initiatives (i.e., identifying problems in the community, developing a plan for improvement, and meeting with decision-makers.). The other 2 programs (Proyecto Mercado Fresco and Tenderloin project) involved youth in specific parts of the advocacy process. Table 1-1 describes key elements of each of these projects. They are also further discussed in this section.

Table 1-1. Four Corner Store Youth Advocacy Initiatives

	Bayview Hunters Point Project	East Oakland Project	Proyecto Mercado Fresco	Tenderloin Project
Length of advocacy initiative	2.5 years	3 years	1 semester	Not reported
Participants	6-8 high schoolers from minority backgrounds each year	30 high schoolers from minority backgrounds each year	~55 high schoolers (exact number not reported) in a predominantly Latino neighborhood	Youth from the Vietnamese Youth Development Center
Location	San Francisco, California	Oakland, California	Los Angeles, California	San Francisco, California
Aim of advocacy initiative	Reduce tobacco products/advertisements and unhealthy foods at corner stores and replace them with healthier food alternatives	Increase food access and reduce food insecurity	Redesign corner stores to promote healthier foods (through engagement and advocacy with city organizations)	Reduce tobacco advertising and increase availability/access to healthy foods in corner stores
Youth advocacy involvement	-Assessed 11 corner stores (inventory audits, digital mapping) -Developed a plan for incentives to corner stores for decreased tobacco and increased produce -Met with decision-makers about plan	-Assessed 30 corner stores (digital mapping) -Developed recommendations to decrease tobacco and increase produce and healthy foods -Prepared a presentation for decision-makers	-Youth were brought onto a corner store conversion project -Participated in advocacy activities (designing the new corner store layout and promoting the store through advertisements and public speaking)	-Assessed 35 food retail stores in the neighborhood (digital mapping), which revealed high amounts of tobacco ads and low amounts of produce

The first program in Bayview Hunters Point (San Francisco, California) was 2.5 years and involved high school students (6-8 each year) from minority backgrounds (i.e., African American, Asian American, Pacific Islander) in efforts to "reduce tobacco subsidiary food products and tobacco advertisements and replace them with healthier food alternatives" at corner

stores.[67] This program was initiated by the Literacy for Environmental Justice organization and was 1 of 10 initiatives aimed at improving overall community health. Adolescents learned about the relationship between tobacco and food companies and assessed 11 corner stores. For the assessment, they documented how much shelf space was devoted to different types of products (i.e., produce, processed foods, alcohol/cigarettes) and which food brands were tobacco company subsidiaries (i.e., food brands whose parent company is a tobacco producer). Next, adolescents conducted Geographic Information System (GIS) mapping, where they documented locations of corner stores and grocery stores, transportation routes, and demographic characteristics of the neighborhood, to highlight food access issues. Then, adolescents came up with a campaign that involved several city agencies (e.g., San Francisco Power Co-op, San Francisco Produce Market, etc.) providing incentives (e.g., new equipment, access to low interest loans, etc.) to corner stores if they made health-promoting changes. Examples of these changes included offering additional produce, stocking foods brands that are not tobacco subsidiaries, and limiting tobacco and alcohol advertisements. A pilot version of the campaign was implemented one corner store in Bayview Hunters Point. Adolescents assisted in implementation by conducting taste tests of healthy foods and press events to promote the store. Overall, there was an increase in fresh produce sales (5% of sales to 15%) and a decrease in alcohol sales (25% of sales to 15%). Outcomes among youth were not measured. In addition, this study did not have a process evaluation, which is the collection of data for the purpose of evaluating program implementation (e.g., participant satisfaction, engagement, etc.),[70,71] leaving questions about the initiatives' practicality and acceptability among youth.

The project in East Oakland, California spanned 3 years and, each year, involved 30 high school students from minority backgrounds (i.e., African American, Latino/a, Middle Eastern)

with an aim to address food security/access issues in the neighborhood.[68] It was initiated by the Institute for Sustainable Economic Educational and Environmental Design, who partnered with Youth Uprising (a youth-based organization), Castlemont High School, San Francisco State University, and the University of California Berkeley. Youth first engaged in lessons about disparities in food security, as well as about youth empowerment and resistance. They then visited 30 food retail stores to document the store type (e.g., grocery store, corner store, liquor store, etc.) and the types of products available at the stores using photography, written field notes, and audio notes. They also used the digital mapping tools, Local Ground and Streetwyze, to visualize their collected information. Next, youth created health-promoting recommendations for corner stores based on their assessments. Recommendations included stocking more fresh produce, stocking healthier staples (e.g., whole wheat bread, skim milk, etc.), increasing participation in food assistance programs, and limiting tobacco and alcohol advertisements. Adolescents also provided recommendations to further promote food security in East Oakland, including creating a new farmer's market and reimagining empty lots to be used for food-related entities (e.g., grocery stores, urban farms, etc.). These recommendations were added to a presentation for dissemination to decision-makers. From this project resulted a new weekly farmer's market. This study conducted exit interview and focus groups with youth where they reported increased awareness of inequities in their communities and that they felt empowered to make changes to address food insecurity. Other process evaluation measures were not collected.

Proyecto Mercado Fresco was a project in Los Angeles, California where approximately 55 Latino adolescents across 2 high schools were involved in a corner store conversion project through a semester-long elective course.[31] The project to convert a corner store into a healthier format (i.e., adding more fresh produce to inventory and redesigning layout of store so unhealthy

products are in the back and produce in the front) was initiated by University of California, Los Angeles Center for Population Health and Health Disparities and involved gathering support from various stakeholders (e.g., department of public health, community-based organizations, etc.). As part of the high school course, adolescents learned about nutrition, community food issues, health disparities, and using media for social change. They then participated in advocacy activities, such as designing new corner store layouts and developing a marketing campaign for the store, which resulted in the creation of videos promoting the store and healthy eating (shown at schools, community centers, and on buses), as well as print bus advertisements. Adolescents also spoke at community events and with the media about the project. Focus groups were conducted with 54% of youth participants after the initiatives, and they stated that they gained public speaking and leadership skills and built self-esteem.[72] Other process evaluation measures were not collected.

The Tenderloin project took place in the Tenderloin neighborhood of San Francisco, and it involved youth at the Vietnamese Youth Development Center, who were on the "Let's Stop Tobacco" team, in advocating for healthier corner store environments. The project engaged youth at the assessment phase. Youth audited 35 stores in the community. They marked whether stores had tobacco advertising, no smoking signs, trashcans, and fresh produce and assigned stores points based on the audit. They visualized these results on a map. This information was then passed onto other stakeholders, such as Food Justice Leaders (5 adults trained on food justice research and advocacy), who advocated to city representatives about the need for healthier corner store environments. Ultimately, a corner store was redesigned to reduce space devoted to tobacco and alcohol, remove tobacco and alcohol advertising, and increase fresh produce. However, this study did not have a process evaluation.

Initiatives that address healthy eating in corner stores exist, but they do not have a curriculum that allows for adaptations and scalability and have not been replicated and evaluated in multiple settings. Additionally, some span multiple years with different cohorts of students and do not involve youth in the entire youth advocacy for health process, which research suggests is important for health behavior change.[31,55,69] Lastly, many do not have robust process evaluations, which leaves questions about the initiatives' acceptability among youth, as well as best practices for replication and future implementations.

1.4.4 Youth Engagement and Action for Health! (YEAH!) Program

A prominent youth advocacy program that is well established with a curriculum, has been evaluated in a variety of settings and populations, and involves a single cohort of youth in the entire youth advocacy for health process is called Youth Engagement and Action for Health! (YEAH!).[73–75] This program primarily focuses on physical activity, and its framework was based off of substance control youth advocacy programs. As part of the YEAH! curriculum, youth identify problems in the community through assessments, develop plans for improvement, and present plans to decision-makers. There is a curriculum for YEAH!, and it is available online.[76] YEAH! is designed to be 14 sessions, and studies of the program report that it has typically spanned from 10-12 weeks.[73–75] The program is held at schools and youth-based organizations, which include the Boys & Girls Clubs and the YMCA. One evaluation of the YEAH! program was conducted with youth in San Diego, California.[73,74] After participation in the program, personal factors, such as assertiveness and knowledge of resources was significantly higher among youth. There were also resulting environmental changes, including installing lights at a community center so youth can walk at night and adding a female-only swim time to a local YMCA to increase participation from female Muslim youth. Lastly, in terms of

behavioral factors, youth increased in self-efficacy for advocacy behaviors. They also improved health behaviors themselves, such that youth increased the number of days they were physically active for at least 60 minutes from 3.62 days/week to 4 days/week following the program.

In another study of YEAH!, the program was implemented at 18 youth-based organizations nationwide.[75] They found significant pre-post differences in personal, environmental, and behavioral factors by place (urban vs. rural), race/ethnicity, and sex. There were also improvements to health behaviors. Participants significantly increased the number of days they were physically active for at least 60 minutes from 3.89 days/week to 4.29 days/week. An additional analysis was conducted with a subset of youth from this project, and results revealed that there are also significant pre-post differences in personal and behavioral factors by club type (school-based versus non-school-based) and community partnership (partnership with city department and non-government organizations vs. no partnership).[77] In addition, there has been an evaluation of the YEAH! program from the perspective of adult leaders, which outlines lessons learned and best practices for the YEAH! program.[78]

1.4.5 Summary

Overall, youth advocacy programs related to healthy eating in corner stores exist, but none have focused on healthy snacking behaviors. Moreover, they do not have a curriculum and have not been replicated and evaluated in a variety of settings. As such, it is difficult to design a youth advocacy program to address healthy snacking based on the models available. YEAH! is a program that can be used with a variety of populations and settings, but it has not focused on healthy snacking. As such, there is an opportunity to amend the YEAH! curriculum to focus on healthy snacking and implement it among an urban adolescent population.

1.5 Dissertation Overview

The overall aims of this dissertation are to: 1) investigate differences in the snacking behaviors of adolescents by socioeconomic status through analysis of National Health and Nutrition Examination Survey data, 2) explore factors that influence the snacking behaviors of adolescents from urban communities through interviews, and 3) assess the feasibility of a youth advocacy program promoting healthy snacking among adolescents at a Boys & Girls Club in New York City through a mixed methods process evaluation.

This dissertation begins by addressing gaps in the understanding of adolescent snacking behaviors. **Chapter 2** explores SES differences in foods/beverages and nutrients consumed by U.S. adolescents when snacking, utilizing NHANES 2005-2018 data. **Chapter 3** explores the many factors that influence snacking among adolescents from urban communities through qualitative interviews. The interview guide was informed by Social Cognitive Theory, and interviews were conducted with adolescents at a Boys & Girls Club (BGC) in New York City (NYC). Then, based upon findings from Chapter 2 and Chapter 3, a youth advocacy program promoting healthy snacking in corner stores was developed by adapting the Youth Engagement and Action for Health! curriculum. This adapted program was 12 sessions and was implemented at a BGC in NYC. **Chapter 4** is a mixed methods process evaluation of the youth advocacy program. Lastly, **Chapter 5** discusses the implication of these findings on future research, policy, and practice.

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CHAPTER 2

SOCIOECONOMIC DISPARITIES IN FOODS/BEVERAGES AND NUTRIENTS CONSUMED BY U.S. ADOLESCENTS WHEN SNACKING: NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY 2005–2018*

2.1 Introduction

Adolescents from low socioeconomic status (SES) households are at greater risk of obesity than their higher-SES counterparts.[1,2] One way to reduce obesity risk is to improve snacking behaviors. Snacks, often consumed between meals (e.g., breakfast, lunch, and dinner),[3] account for 22% of adolescents' daily energy intake.[4] In addition, adolescents consume an average of 284.54 calories (kcal) per snacking occasion.[5] Moreover, there is evidence that poor snacking behaviors, such as greater kcal consumed from snacks and more frequent consumption of energy-dense, nutrient-poor snacks, are positively associated with obesity among adolescents.[5–7] What remains less clear is if there are SES differences in snacking behaviors, such as snacking frequency, foods/beverages consumed as snacks, and nutrients consumed from snacks.

On average, adolescents have 1.77 snacking occasions per day,[5] and it remains unclear if there are differences in snacking frequency by SES. A study by Tripicchio et al. analyzed data from the National Health and Nutrition Examination Survey (NHANES) 2005–2016 and found no SES differences in snacking frequency among adolescents (12–19 years).[5] However, the analysis only examined SES differences between adolescents from households with a poverty-to-income ratio (PIR) of greater than and less than 1.25. Additionally, analysis of data from Project

*Published as Gangrade, N., Figueroa, J., & Leak, T. M. (2021). Socioeconomic disparities in foods/beverages and nutrients consumed by u.S. adolescents when snacking: National health and nutrition examination survey 2005–2018. *Nutrients*, *13*(8), 2530. https://doi.org/10.3390/nu13082530

EAT (Eating Among Teens), a longitudinal study in urban areas of Minnesota, USA, also found no significant differences in snacking frequency by SES.[8] However, Project EAT does not include a nationally representative sample, and snacking frequency was captured through adolescents' self-report of the number of snacking occasions per day. Thus, conclusions from this study may have limited generalizability.

In addition to snacking frequency, there may be SES differences in the types of foods/beverages consumed as snacks and the nutrient composition of snacks. An analysis of NHANES 2005–2006 revealed that the top five foods/beverages consumed as snacks by adolescents are grains, vegetables, fruits, milk, and meat/beans.[9] The authors did not examine differences in foods/beverages consumed as snacks by SES. Regarding the nutrient composition of snacks, the analysis of NHANES 2005–2016 by Tripicchio et al. reported that adolescents from low-SES households consume significantly more added sugar calories from snacks than adolescents from higher-SES households.[5] This analysis also found no differences in sodium and saturated fat consumed from snacks by SES.[5] Findings from Project EAT reveal that adolescents from low-SES households consume significantly more sugary drinks and energy-dense, nutrient-poor snacks (captured by a food frequency questionnaire) than adolescents from higher-SES households.[8] Overall, data on the types of foods/beverages consumed as snacks by adolescents are dated, with limited examination of differences by SES. In addition, only select nutrients have been examined when exploring SES differences in the nutrient composition of snacks.

The overall aim of this paper is to analyze data from a nationally representative sample of U.S. adolescents (12–19 years) participating in NHANES 2005–2018 to examine what foods/beverages and nutrients are consumed when snacking and what differences exist by SES.

Findings can help guide future interventions that aim to improve snacking behaviors among adolescents from low-SES households.

2.2 Methods

2.2.1 Study Design and Population

Data from adolescents (12–19 years) who participated in NHANES 2005–2018 were included in this analysis. NHANES is an ongoing, cross-sectional study conducted by the Centers for Disease Control and Prevention (CDC) that collects nutrition and health data from a nationally representative sample of U.S. civilian, noninstitutionalized populations.[10] NHANES is conducted in two-year cycles, using a complex, multistage probability sampling method to recruit participants. Seven NHANES cycles from 2005–2018 (i.e., 2005–2006, 2007–2008, etc.) were included in this analysis. Data collection for NHANES starts with an at-home interview where sociodemographic and basic health information are collected by a trained interviewer. Adolescents 12–15 years answer questions with the assistance of an adult, and adolescents 16–19 years answer questions independently.

Next, adolescents visit the NHANES Mobile Examination Center (MEC), where health measures (e.g., anthropometrics) and a 24-h dietary recall are collected. Adolescents (≥12 years) independently self-report dietary intake. A second 24 h dietary recall is collected via telephone within 3 to 10 days of the MEC visit but was not used in this present study. In this present study, only 1 day of dietary data was able to be used, since the most common types of foods/beverages consumed as snacks were described by the proportion of adolescents consuming the food/beverage category as a snack on a given day. Thus, the interviewer-administered 24 h dietary recall in the MEC was utilized, as it is more standardized and valid than the second 24 h dietary recall collected via telephone.[11]

Given the research question, inclusion criteria were adolescents (12–19 years), reliable interviewer-administered 24 h dietary recall in the MEC, consumption of at least one snack item other than plain/tap water, and complete household poverty-to-income ratio (PIR) data (2948 excluded). The final analytic sample included 7132 adolescents.

Adolescents 12–17 years provided assent with parental consent, and adolescents 18–19 years provided consent. NHANES was approved by the National Center for Health Statistics Research Ethics Review Board (protocol #2005-6 for years 2007–2010, #2011-17 for years 2011–2016, and #2011-17 and #2018-01 for years 2017–2018).[12] NHANES data are publicly available and de-identified, and university Institutional Review Board approval was not necessary.

2.2.2 Measures

2.2.2.1 Sociodemographic Characteristics

Sex (male or female) and race/ethnicity (non-Hispanic White, non-Hispanic Black, Mexican American, Other non-Hispanic, and Other Hispanic) were self-reported. Household PIR was utilized to operationalize SES, and it is calculated by dividing family income by the poverty threshold specific to the survey year and accounting for family size. PIR was characterized into three categories: low-income (PIR ≤ 1.3), middle-income (PIR > 1.3–3.5), and high-income (PIR > 3.5).[13] As an estimation, a PIR of 1.3 equates to an annual income of $34,444 for a family of four, and a PIR of 3.5 equates to $92,733 for a family of four.[14]

2.2.2.2 Dietary Intake

Dietary intake was obtained through the first interviewer-administered 24 h dietary recall in the MEC. The United States Department of Agriculture (USDA) Automated Multiple-Pass Method was used to collect the dietary recalls, and the following information about all

foods/beverages consumed was collected: name of eating occasion, time eaten, where obtained, eaten at home or not, description of the food/beverage, additions to the food/beverage, and amount of food/beverage consumed.[15] The selected "name of eating occasion" was used to identify snack items (i.e., snack, drink, extended consumption, merienda, entre comida, botana, bocadillo, tentempie, or bebida). The term "snack item" will be used hereafter to refer to each separate snack food/beverage reported by the participant.

In the dataset, each snack item was given a Food and Nutrient Database for Dietary Studies (FNDDS) code, and the Food Patterns Equivalent Database (FPED) was used to convert FNDDS codes into USDA What We Eat in America (WWEIA) Food/Beverage Categories. In this study, we will report on the top five WWEIA Food/Beverage Categories by the proportion of adolescents consuming it as a snack item. In addition, we will report the average number of snack items consumed, average amount of energy per snack item, proportion of total energy intake from snack items, and mean nutrient densities of snack items (grams, milligrams, or micrograms of the nutrient per 100 kcal of the snack item). The nutrients examined in this study were the three macronutrients and dietary components of public health interest according to the USDA Dietary Guidelines for Americans (i.e., saturated fat, added sugar, fiber, sodium).[16]

2.2.3 Analyses

Survey weights, strata, and clustering variables were used to account for the complex, multistage probability sampling design used in NHANES.[17,18] A combined (seven-survey cycle) weight was calculated using the dietary day 1 sample weights in accordance with NHANES methods.[19] Categorical variables were summarized with weighted proportions, and continuous variables were described using weighted means ± standard error (SE). Rao–Scott Chi-Square tests were used for examining associations between categorical data. Survey-weighted logistic

regression models were used to estimate adjusted odds ratios (aOR) with 95% confidence intervals. Survey-weighted multiple linear regression models were run to estimate adjusted least squares (LS) means for comparisons of continuous data. The normality of the fitted residuals from the linear models was assessed using histograms and Q–Q plots. If distributions were highly skewed, *p*-values were reported using square-root transformed nutrient values. All models controlled for sex, age (years), and race/ethnicity to produce adjusted estimates. The significance level was set at $p < 0.05$, and *p*-values were also adjusted for multiple pairwise comparisons using the Tukey–Kramer adjustment. All analyses were conducted using SAS Version 9.4 (Cary, NC, USA).

2.3 Results

Weighted proportions for individual and household characteristics of the study sample ($n = 7132$) are presented in Table 2-1. Approximately half (51.8%) of the participants were 12–15 years, and half (48.2%) were 16–19 years. Most participants were non-Hispanic White (29.7%), and 26.3% were non-Hispanic Black, 23.9% were Mexican American, 11.3% were Other non-Hispanic, and 8.8% were Other Hispanic. About 32.5% of the adolescents resided in a low-income household (PIR ≤ 1.3), 36.0% in a middle-income household (PIR > 1.3–3.5), and 31.5% in a high-income household (PIR > 3.5).

On average, adolescents consumed 2.94 snack items per day. There were no significant differences in the number of snack items consumed by PIR, with those from low-, middle-, and high-income households consuming 2.90, 2.92, and 2.99 snack items per day, respectively. Per snack item, adolescents consumed an average of 210.89 kcal and 10.27% of their total energy intake. Those from low-income households consumed significantly more calories per snack item than those from high-income households (220.25 kcal vs. 194.94 kcal; $p = 0.023$). Additionally,

adolescents from low- and middle-income households had a higher percentage of calories from snacks than those from high-income households (10.85% and 10.54% vs. 9.44%; $p < 0.001$ and $p = 0.006$).

Table 2-1. Demographic Characteristics of U.S. Adolescents (12–19 years), $n = 7132$ (NHANES 2005–2018).

			Poverty-to-Income Ratio Groups			
Characteristic	**Overall**		**PIR ≤ 1.3 Low-Income (*n* = 2975)**	**PIR > 1.3–3.5 Middle-Income (*n* = 2580)**	**PIR > 3.5 High-Income (*n* = 1577)**	***p*-Value [b]**
	n	**%**	**% (SE)**	**% (SE)**	**% (SE)**	
Total [a]	7132	100	32.5 (1.52)	36.0 (1.24)	31.5 (1.43)	
Sex						0.11
Male	3620	50.8	48.1 (1.28)	52.8 (1.57)	51.2 (1.86)	
Female	3512	49.2	51.9 (1.28)	47.2 (1.57)	48.8 (1.86)	
Age						**0.031**
12–15	3693	51.8	47.2 (1.74)	53.2 (1.54)	52.7 (1.78)	
16–19	3439	48.2	52.8 (1.74)	46.8 (1.54)	47.3 (1.78)	
Race/ethnicity						**<0.001**
Non-Hispanic White	2121	29.7	41.3 (2.57)	58.1 (2.47)	77.4 (1.52)	
Non-Hispanic Black	1878	26.3	20.7 (1.93)	13.5 (1.22)	7.0 (0.78)	
Mexican American	1701	23.9	21.3 (1.96)	12.9 (1.17)	5.1 (0.72)	
Other Non-Hispanic	807	11.3	7.5 (0.96)	8.7 (1.00)	7.9 (0.95)	
Other Hispanic	625	8.8	9.2 (1.17)	6.8 (0.91)	2.6 (0.42)	

[a] Row % displayed for "Total". All other percentages are column %. [b] Comparisons of demographic variables across PIR groups were conducted using Rao–Scott Chi-Square tests. $p < 0.05$ are shown in bold.

2.3.1 Types of Foods and Beverages Consumed as Snack Items and Differences by SES

Table 2-2 describes the five most common WWEIA Food/Beverage Categories consumed as a snack item. The "Snacks and Sweets" category (e.g., savory snacks, crackers, candy) was consumed as a snack item by 73.3% of adolescents. "Beverages" (e.g., sweetened

beverages, 100% juice, diet beverages, and coffee and tea) were consumed by 51.9% of adolescents. "Milk and Dairy" was the third most consumed food/beverage category, with a quarter (25.0%) of adolescents consuming it as a snack item. "Fruits" were consumed as a snack item by 21.0% of adolescents. Lastly, "Grains", which include quick breads and bakery products and ready-to-eat cereals, were consumed by 15.4% of adolescents. In terms of overall diet, snacking contributed to approximately 68.7% of adolescents' daily "Snacks and Sweets" intake, 40.2% of their "Beverages" intake, 22.2% of their "Milk and Dairy" intake, 49.4% of their "Fruits" intake, and 11.1% of their "Grains" intake.

Table 2-2. Proportion of Adolescents Consuming What We Eat in America Food/Beverage Categories as a Snack Item on a Given Day by Poverty-to-Income Ratio (PIR) from NHANES 2005–2018 (n = 7132).

		Poverty-to-Income Ratio Groups			
Top 5 Food and Beverage Categories	**All Adolescents (n = 7132)**	**PIR ≤ 1.3 Low-Income (n = 2975)**	**PIR > 1.3–3.5 Middle-Income (n = 2580)**	**PIR > 3.5 High-Income (n = 1577)**	***p*-Value [a]**
	% (SE)	**% (SE)**	**% (SE)**	**% (SE)**	
Snacks and Sweets	73.3 (0.90)	71.2 (1.20)	72.4 (1.53)	76.4 (1.75)	**0.038**
Beverages	51.9 (0.93)	55.1 (1.55)	52.8 (1.33)	47.7 (1.82)	**0.004**
Milk and Dairy	25.0 (0.88)	21.4 (1.05)	25.9 (1.53)	27.8 (1.95)	**0.017**
Fruits	21.0 (0.87)	18.7 (1.10)	19.8 (1.30)	24.8 (1.73)	**0.004**
Grains	15.4 (0.82)	15.7 (1.01)	15.9 (1.25)	14.6 (1.31)	0.65

Weighted column % displayed. [a] Comparisons of reported food/beverage category consumption across PIR categories were conducted using Rao–Scott Chi-Square tests. $p < 0.05$ are shown in bold.

There were also differences in the odds of consuming a particular food/beverage category as a snack item by income (Table 2-3). Adolescents from low-income households had approximately 45% higher odds of consuming "Beverages" as a snack item than those from high-income households (aOR: 1.45; 95% CI: 1.19–1.76; p = 0.001). However, odds of

consuming “Snacks and Sweets” (aOR: 0.75; 95% CI: 0.59–0.95; $p = 0.035$), “Milk and Dairy” (aOR: 0.74; 95% CI: 0.58–0.95; $p = 0.007$), and “Fruits” (aOR: 0.62, 95% CI: 0.50–0.78; $p = 0.001$) were lower than adolescents from high-income households. There were no significant differences in odds of consuming “Grains” by SES.

Table 2-3. Odds of Adolescents Consuming a What We Eat in America Food/Beverage Category as a Snack Item on a Given Day by Poverty-to-Income Ratio (PIR) from NHANES 2005–2018 ($n = 7132$).

Top 5 Food and Beverage Categories	Poverty-to Income Ratio	Odds Ratio	95% Confidence Interval	*p*-Value
Snacks and Sweets	PIR ≤ 1.3 low-income	0.75	0.59–0.95	**0.035**
	PIR > 1.3–3.5 middle-income	0.79	0.61–1.03	0.35
Beverages	PIR ≤ 1.3 low-income	1.45	1.19–1.76	**0.001**
	PIR > 1.3–3.5 middle-income	1.28	1.05–1.57	0.44
Milk and Dairy	PIR ≤ 1.3 low-income	0.74	0.58–0.95	**0.007**
	PIR > 1.3–3.5 middle-income	0.92	0.71–1.19	0.56
Fruits	PIR ≤ 1.3 low-income	0.62	0.50–0.78	**0.001**
	PIR > 1.3–3.5 middle-income	0.69	0.54–0.89	0.20
Grains	PIR ≤ 1.3 low-income	1.03	0.81–1.31	0.98
	PIR > 1.3–3.5 middle-income	1.06	0.83–1.36	0.66

Survey-weighted logistic regression models were adjusted for sex, age (years), and race/ethnicity; adjusted odds ratios with 95% CI are shown. Referent group PIR > 3.5. $p < 0.05$ is shown in bold.

2.3.2 Nutrient Composition of Snack Items and Differences by SES

Per 100 kcal of the snack item, adolescents consumed an average of 2.85 g total fat, 1.00 g saturated fat, 17.55 g carbohydrates, 0.80 g fiber, 10.68 g total sugar, 7.46 g added sugar, 103.80 mg sodium, and 1.96 g protein. In terms of overall diet, snacking contributed to

approximately 25.0% of adolescents' daily total fat intake, 25.4% of saturated fat intake, 31.6% of carbohydrate intake, 25.5% of fiber intake, 39.5% of total sugar intake, 41.9% of added sugar intake, 17.8% of sodium intake, and 16.9% of protein intake.

There were differences in nutrient intake by income (Table 2-4). Adolescents from low- and middle-income households consumed 2.79 and 2.81 g of total fat per 100 kcal of the snack item, respectively, while adolescents from high-income households consumed 2.96 g of total fat ($p = 0.007$ and $p = 0.041$). Similarly, those from low- and middle-income households consumed less saturated fat than those from high-income households (0.95 and 0.98 g vs. 1.07 g; $p = 0.001$ and $p = 0.039$).

Table 2-4. Energy and Nutrient Consumption from Snack Items by Poverty-to-Income Ratio (PIR) among Adolescents from NHANES 2005–2018 (*n* = 7132)

		Poverty-to-Income Ratio		
Nutrients	**All Adolescents (*n* = 7132)**	**PIR ≤ 1.3 Low-Income (*n* = 2975)**	**PIR > 1.3–3.5 Middle-Income (*n* = 2580)**	**PIR > 3.5 High-Income (*n* = 1577)**
	LS Mean ± SE	LS Mean ± SE	LS Mean ± SE	LS Mean ± SE
Energy, kcal	210.89 ± 4.02	220.25 ± 5.90 [a]	218.27 ± 8.66	194.94 ± 5.33
Energy, %	10.27 ± 0.15	10.85 ± 0.28 [c]	10.54 ± 0.23 [b]	9.44 ± 0.24
Total Fat, g	2.85 ± 0.04	2.79 ± 0.05 [b]	2.81 ± 0.06 [a]	2.96 ± 0.06
Saturated Fat, g	1.00 ± 0.02	0.95 ± 0.02 [c]	0.98 ± 0.03 [a]	1.07 ± 0.03
Carbohydrate, g	17.55 ± 0.11	17.78 ± 0.14 [a]	17.68 ± 0.19	17.20 ± 0.19
Fiber, g	0.80 ± 0.02	0.78 ± 0.03 [a]	0.77 ± 0.03 [a]	0.84 ± 0.03
Total Sugar, g	10.68 ± 0.11	10.88 ± 0.19 [a]	10.94 ± 0.18 [a]	10.21 ± 0.19
Added Sugar, g	7.46 ± 0.14	7.98 ± 0.23 [a]	7.78 ± 0.18 [a]	6.66 ± 0.21
Sodium, mg	103.80 ± 3.26	99.02 ± 3.05	101.39 ± 4.37	111.02 ± 7.34
Protein, g	1.96 ± 0.04	1.85 ± 0.06 [c]	1.94 ± 0.07 [b]	2.08 ± 0.05

[a] $p < 0.05$ when compared with PIR > 3.5. [b] $p < 0.01$ when compared with PIR > 3.5. [c] $p < 0.001$ when compared with PIR > 3.5. "Energy, kcal" is the average calorie amount of a snack item. "Energy, %" is the average % energy of a snack item out of a person's total energy intake. All other nutrients are presented per 100 kcal of a snack item. Survey-weighted linear regression models were adjusted for sex, age (years), and race/ethnicity; adjusted least squares (LS)-means with standard error (SE) are shown. *p*-values for all pairwise differences across all three PIR categories were adjusted using Tukey–Kramer method.

For carbohydrates, adolescents from low-income households consumed 17.78 g of the nutrient per 100 kcal of the snack item, while adolescents from high-income households consumed significantly less at 17.20 g ($p = 0.030$). Adolescents from low- and middle-income households had significantly less fiber from snack items than those from high-income households (0.78 and 0.77 g vs. 0.84 g; $p = 0.044$ and $p = 0.019$). In terms of total sugar, those from low- and middle-income households consumed 10.88 and 10.94 g per 100 kcal of the snack

item, respectively, which was significantly higher than adolescents from high-income households (10.21 g; $p = 0.037$ and $p = 0.022$). For added sugar, those from low- and middle-income households also consumed significantly more (7.98 and 7.78 g) than those from high-income households (6.66 g; $p = 0.012$ and $p = 0.026$). There were no significant differences in sodium from snack items by SES. Lastly, adolescents from low- and middle-income households consumed less protein at 1.85 and 1.94 g per 100 kcal of the snack item, respectively, compared to those from high-income households, who consumed 2.08 g protein ($p < 0.001$ and $p = 0.01$).

2.4 Discussion

This study fills a critical gap in understanding SES differences in foods/beverages and nutrients consumed during snacking among a nationally representative sample of U.S. adolescents. Findings from the current study revealed that adolescents from lower-income households consume significantly more calories, "Beverages", carbohydrates, total sugar, added sugar and less "Snacks and Sweets", "Milk and Dairy", "Fruits", total fat, saturated fat, fiber, and protein from snacks than adolescents from high-income households. Of particular concern are "Beverages", "Fruits", and "Milk and Dairy", as well as added sugar, fiber, and saturated fat, which are dietary components of public health interest, according to the Dietary Guidelines for Americans.[16]

In this study, adolescents from lower-income backgrounds had higher added sugar intake from snacks than those from high-income backgrounds. This is similar to a study that utilized NHANES 2005–2016 data and found that adolescents from low-income households consumed significantly more added sugar calories from snacks than those from higher-income households.[5] However, a study that examined SES differences in added sugar intake in adolescents' overall diet did not find differences by PIR.[20] As such, this information collectively suggests that

adolescents from low-SES households consume snacks high in added sugar, such as sugar-sweetened beverages (SSBs).[8] Disparities in SSB consumption may explain some of the difference in added sugar intake from snacks. In fact, data from this current study reveal that the odds of those from low-income households consuming "Beverages" (which includes SSBs) are higher than those from high-income households. Other studies describe similar income disparities in SSB consumption.[21] Thus, focusing on reducing SSBs consumed as snacks among adolescents from low-income households may decrease disparities in added sugar intake from snacks.

Findings also revealed that adolescents from low-SES backgrounds consumed less fiber from snacks than their peers from high-SES backgrounds, which aligns with other studies that have found SES disparities in intake of fiber-rich foods, such as whole grains and fruits.[22,23] An analysis of NHANES 2005–2012 found that whole grain intake was higher among adolescents from high-income households compared to those from low-income households.[22] In addition, fruits are one of the main sources of dietary fiber intake among U.S. children,[24] and this study reveals that those from low-income households have lower odds of consuming "Fruits" as a snack, compared to those from higher-income households. Thus, increasing intake of whole grains and fruits as snacks may improve fiber intake among adolescents from lower-income households.

Lastly, we found that saturated fat intake from snacks was lower among adolescents from lower-income households than the high-income group. This finding may be related to the significantly lower odds of consuming "Milk and Dairy" also reported in this present study. Evidence from NHANES suggests that milk is one of the top sources of solid fat (which includes saturated fat) among U.S. children (2–18 years).[25] As such, the lower consumption of "Milk and

Dairy" among adolescents from lower-income households in this study could contribute to findings related to saturated fat. Other studies corroborate these findings, revealing that milk and dairy intake among adolescents is positively correlated with SES[26] and that milk and dairy intake is low among adolescents from low-SES backgrounds due to factors like preferences, lactose intolerance, and health beliefs among this demographic.[27,28]

In response to the contrary findings surrounding "Snacks and Sweets", which suggest that those from low-income households have lower odds of consuming "Snacks and Sweets" compared to those from high-income households, we explored several explanations. One explanation is that adolescents from lower-income households may be eligible for USDA food assistance programs like the Child and Adult Care Food Program (CACFP), which provides free snacks to youth that attend centers that serve a large number of children from low-income households.[29] There are food group/nutrient requirements for the snacks provided by CACFP such that they cannot include many of the foods in the "Snacks and Sweets" category,[30] possibly leading to lower odds of consuming them among adolescents from lower-income backgrounds. Another explanation may be that adolescents from high-income households have greater discretionary funds,[31] which they may use to purchase foods in the "Snacks and Sweets" category. Nevertheless, nutrients that are consumed from "Snacks and Sweets," such as kcal, added sugar, and sodium, were significantly higher in lower-income groups. As such, more research may be needed to understand the findings surrounding "Snacks and Sweets."

Ultimately, this study highlights improvements that can be made to adolescent snacking behaviors, and one area to initiate improvements is in corner stores, where adolescents from lower-income households frequently purchase snacks.[32] A study based in low-income areas of Philadelphia found that adolescents purchased an average of 2.3 food/beverage items during each

corner store visit.[33] Data also reveal that adolescents' corner store purchases are energy-dense, nutrient-poor foods/beverages.[33,34] In the aforementioned study in Philadelphia, the top five categories of items purchased from the corner store were beverages (the top two beverages were regular soda and fruit-flavored drinks [<100% fruit juice]), chips, pastry, candy, and prepared food items (e.g., sandwiches and bagels).[33] In addition, researchers found each adolescent's purchasing occasion contained, on average, 650.2 kcal, 25.0 g fat, 13.9 g protein, 95.5 g carbohydrates, 61.9 g sugars, 2.3 g fiber, and 786.3 mg sodium.[33] As such, this information alongside results from this study highlight an opportunity to improve adolescent corner store snacking.

There are several ways to improve adolescent corner store snacking. One method is to increase the availability and accessibility of healthier snack options. A study that surveyed 403 adolescents found that they would be receptive to buying a fiber-rich product called a whole-grain snack pack, which is a whole-grain snack (e.g., granola bar, crackers) paired with a fruit or vegetable and a condiment (e.g., yogurt, dressing), if they were available at corner stores.[35] A related study found that corner store owners would also be receptive to stocking a whole-grain snack pack.[36] Making a product like a whole-grain snack pack available and accessible to adolescents may improve fiber and fruit intake from snacks. Another intervention based in Philadelphia centered on providing resources (e.g., corner store owner trainings, signage, refrigeration) to increase the availability and access of healthy foods and beverages at 192 corner stores.[34] However, one year after the intervention, they found no differences in the energy or nutrient content of corner stores purchases.[34] As such, other options to improve adolescent corner store snacking include nutrition education. An example of this is the Taster's Choice (TC) curriculum, which is a 6th-grade health class curriculum focused on empowerment and

encouraging peer promotion of healthy snack and SSB consumption from corner stores.[37] Focus group findings revealed that adolescents reduced SSB consumption after participation. Overall, strategies to address availability, accessibility, and education surrounding healthy snacks at corner stores are imperative in remediating SES snack disparities highlighted in this study.

Though this study provides critical, translational information, it is not without limitations. For example, we only used a single 24-h recall, and there is a possibility it may not reflect usual intake, though guidelines report that a single 24-h recall is valid for estimating the average intake of a large group.[11,38] Additionally, the dietary data were self-reported, so there may be missing and/or inaccurate data due to recall and/or social desirability bias. An example of this includes misreporting of portion sizes of foods and beverages, which may result in under- or overestimations of energy intake. However, in NHANES, the computer-assisted Automated Multiple-Pass Method for obtaining dietary data is used, and research reports that this method reduces bias in the collection of energy intakes compared to other 24 h recall methods.[39] In addition, we did not include physical activity as a covariate as the questions capturing physical activity were redefined in 2011 and not comparable across multiple survey years. Lastly, NHANES is a cross-sectional study, and thus casual inferences cannot be made. Therefore, there is a need for further research on factors that influence snacking among adolescents.

Despite these limitations, this study is the most detailed and updated description of snacking behaviors among a nationally representative sample of U.S. adolescents. Examining the types of foods/beverages and nutrients consumed while snacking by SES may help explain disparities in overall diet and obesity among adolescents, since most studies of adolescent snacking behaviors only examine snacking frequency and energy from snacks. This previously

missing information is imperative in creating effective interventions and policies to improve snacking behaviors among adolescents, especially those from low-SES households.

2.5 Conclusion

In summary, intervening on the types of foods/beverages consumed as snacks may be one way to address the childhood obesity epidemic and reduce SES disparities. Our findings provide insight into specific foods/beverages and nutrients that adolescents consume while snacking, which can be used to develop targeted intervention efforts.

This study also provides a base for future research on snacking, including exploring snacking in relation to overall diet and examining differences between those who snack and those who do not. Furthermore, implications from this study include the need for strategies that address factors that influence snack choices at the individual, environmental, and policy levels. As such, research is also needed to understand factors that influence snacking behaviors and develop ways to improve the availability, accessibility, and affordability of healthy snacks in low-income communities.

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CHAPTER 3

FACTORS THAT INFLUENCE SNACKING BEHAVIORS OF ADOLESCENTS FROM URBAN COMMUNITIES: A QUALITATIVE STUDY*

3.1 Introduction

Intervening on snacking (i.e., foods/beverages consumed between meals)[1] may be one way to improve diet quality and reduce chronic disease risk among U.S. adolescents. Research suggests that consumption of energy-dense, nutrient-poor (EDNP) snacks is associated with poor overall diet quality and obesity among adolescents.[2,3] Moreover, snacking accounts for approximately 22% of adolescents' daily energy intake.[4] Regarding types of snacks consumed, the majority (54%) are EDNP foods/beverages (e.g., grain-based desserts, salty snacks from grain or starchy vegetables, sweet snacks and other sweets, and sugar-sweetened beverages).[5]

There is also evidence that adolescents from urban communities have particularly poor snacking behaviors and consume multiple EDNP snacks a day.[6] In urban areas, corner stores, where EDNP snacks are highly available,[7,8] serve as primary locations for food/beverage purchases.[9] Research reveals that adolescents frequent corner stores by themselves to purchase EDNP snacks.[10–12] A study in Philadelphia found that the most purchased items from corner stores by adolescents were beverages and chips.[12] This same study revealed that each purchasing occasion contained, on average, over 600 kcal, 50 g added sugar, and 500 mg sodium.[12]

Despite the significant role that snacking plays in the diet quality of all adolescents, few behavioral interventions target this eating occasion. Most snacking interventions that do exist are designed for younger children and take place in after school settings, [13–16] as research reveals it is

*Published as Gangrade, N., St Fleur, K., & Leak, T. M. (2022). Factors That Influence Snacking Behaviors of Adolescents From Urban Communities: A Qualitative Study. *Journal of Nutrition Education and Behavior*. https://doi.org/10.1016/J.JNEB.2021.12.008

an important venue for snacking.[17,18] One intervention that did address snacking among adolescents was the B'more Healthy Communities and Kids study.[19] As part of this intervention, the availability and marketing of low-sugar foods/beverages in small stores in Baltimore was increased, and nutrition education was offered to youth 9-15 years at recreation centers.[19] This led to an increase in the purchase of not only healthier foods/beverages, but also unhealthier foods/beverages, and there was a modest decrease in calories consumed from sweets.[19] Another snacking intervention assigned youth 8-15 years in New York City (NYC) to either read a comic called "Fight for Your Right to Fruit" or an unrelated newsletter during after school programming, and those that received the comic were significantly more likely to choose a healthy snack.[18] Ultimately, there is a need for effective interventions aimed at creating sustainable changes to adolescents' snacking behaviors, especially in after school settings where snacking is prevalent, and among urban adolescents who have poor snacking behaviors.

Prior to designing an intervention that focuses on adolescent snacking, it is important to understand factors that influence the target behavior.[20] There are several frameworks that can guide the exploration of adolescent snacking, such as a food systems approach,[21] which describes direct/indirect influences across the food supply chain, food environments, and the individual, the Food Choice Process Model,[22] which takes into account an individual's life course, influences, and personal systems, and Social Cognitive Theory (SCT),[23] which focuses on personal, environmental (social and physical), and behavioral factors that influence behavior. In understanding adolescent food behaviors, SCT is a particular useful theory. Personal factors include biological and affective factors. Environmental factors include aspects of the social or physical environmental that encourage or discourage a behavior. Behavioral factors include an individual's experience with the behavior, such as the levels of self-efficacy and autonomy one

feels they have regarding the behavior. These factors are especially relevant during adolescence.[24] Furthermore, SCT has been widely used in nutrition interventions with adolescents,[25,26] making it an appropriate framework for an exploration of adolescent food behaviors that may inform an intervention.

In terms of general adolescent food behaviors, research reveals that personal factors, such as taste preference and body image, environmental factors, such as availability and parental influence, and behavioral factors, such as cooking ability, are significant influences.[27–30] For example, focus groups with adolescents suggest that they make decisions on what to eat based on what tastes best to them and what is available at home and school.[28] Body image is also a concern for some adolescents, who state that they eat certain foods to build muscle or gain/lose weight.[28] Parents also influence food choice, as they often decide and prepare the household's meals.[28,30] Lastly, cooking ability informs food choice in a variety of ways, with many adolescents having limited ability leading them to choose processed foods.[30]

However, it is unclear whether these factors are salient for snacking. Moreover, most of the research on factors that influence snacking are either with younger U.S. children or adolescents outside of the U.S. Qualitative research focused on younger U.S. children reveals that parents exhibit less control over snacks than meals,[31,32] and they offer snacks to their infants and preschool-aged children as behavior management.[33–35] Since adolescents are in a developmental stage where they have increased food autonomy,[28,29,36,37] it is unclear whether the factors that influence snacking among younger children are relevant for adolescents. Regarding adolescents outside of the U.S., Blum et al.[38] conducted in-depth interviews with Indonesian adolescents and found that snacks provide a distraction from boredom, and taste is the most important driver of choice. Furthermore, focus groups conducted with female adolescents from

Iran revealed that peer pressure, parental influence, and media advertisements contribute to the consumption of "unhealthy snacks."[39] However, given that culture is an important factor influencing food choice,[40] it is necessary to conduct similar research with U.S. adolescents, especially those residing in urban communities.

The overall aim of this study is to explore factors that influence snacking behaviors among adolescents from NYC. This study is guided by Social Cognitive Theory, due to its focus on constructs relevant to adolescents and use in adolescent nutrition intervention research.[25,26] Information from this study is critical for designing effective interventions to promote healthful snacking among U.S. adolescents in urban communities.

3.2 Methods

3.2.1 Participants and Recruitment

Study eligibility criteria included adolescents (12-18 years) who could speak and write in English and were members of a Boys and Girls Club (BGC) in NYC. The BGC is a national organization with local chapters that offer programming to promote personal and professional development for youth from predominantly low-income backgrounds.[41,42] There are 1.98 million BGC youth members, with approximately 577,000 being teens.[42] Additionally, over 57% of members are eligible for free- or reduced-price lunch.[42] As such, due to its membership and scope, several studies aimed at improving adolescent nutrition disparities have been centered at the BGC.[43–45] The present study was conducted at the BGC as part of formative work for an intervention to improve snacking among adolescents from urban communities. The BGC is an ideal setting for this type of intervention, and it is important to conduct formative work with an intervention's target audience,[20,46] thereby determining the setting for this present study.

For this study, a recruitment email was sent out by BGC staff to adolescents and their families. The recruitment email contained a Qualtrics survey that included eligibility screening. If participants met eligibility criteria, they were directed onto the rest of the survey, which contained the consent/assent forms, phone interview scheduling questions, and a demographic and snacking behavior survey. The recruitment email was sent out until the target sample size of 30 adolescents was recruited. A target sample size of 30 was decided based on best practices for qualitative research [47–50] and estimates of data saturation from another qualitative interview study on a similar topic.[51] In addition to these objective methods to estimate target sample size, researchers also assessed saturation on their own. By reviewing transcripts and individual memos written during the coding process, it was determined that data saturation was reached after the 23rd interview.[52] However, to provide the opportunity for the maximum number of BGC members to participate, recruitment continued until 30 adolescent participants were recruited. Participants received $50 gift cards as an incentive and an additional $10 gift card if they recommended the study to another adolescent who participated. The study protocol underwent full review and was approved by the Cornell University Institutional Review Board. Signed parental consent and assent was received from all participants.

3.2.2 Data Collection

Data collection took place between September 2020 and February 2021. After receiving parental consent and adolescent assent, adolescents completed a demographic and snacking behavior survey that included questions about demographics (age, sex [options: male, female], gender [options: male, female, trans male/trans man, trans female/trans woman, genderqueer/gender non-conforming, different identity], race/ethnicity [options: White; Hispanic, Latino, or Spanish; Black or African American; Asian; Native Hawaiian or Pacific

Islander; and Middle Eastern or North African] and snacking behaviors [e.g., frequency of snacking, frequency of independent snack purchasing, etc.]). After the survey was completed, researchers contacted each adolescent to schedule a phone interview.

Phone interviews were conducted using a semi-structured interview guide. The interview guide was developed by the researchers as part of formative research for the development of an SCT-based intervention to improve snacking among adolescents from urban communities. This present study focuses on data from a subset of the interview questions that explored factors that influence snack choice and consumption, with the first set of questions focusing on snacks in general and the second set on healthy snacks (Appendix A). The rest of the interview questions concentrated on participant perceptions about the definition of a snack, and those data will be published elsewhere.

The interview guide questions that this present study focuses on were informed by SCT, which focuses on personal, environmental, and behavioral factors that influence behavior.[23,24] These factors are especially salient during adolescence.[24] As such, the ways that they may influence snacking were explored in this interview. In addition, interview questions were guided by previous literature on factors that influence snacking among other age groups (i.e., preschool children, adults, etc.).[31–35,53–56] The two main questions from the interview guide that this study focused on are: 1) "When you want a snack, how do you decide what to snack on?" and 2) "What are some of the reasons you choose a healthy snack to snack on?" Probes followed these two main questions and were based on specific SCT constructs (e.g., knowledge, outcome expectations, physical environment, etc.). Examples of probes were: "How does where you are influence what you snack on?" and "How does health play a role in what you snack on?" The interview guide was pilot tested with 3 adolescents from NYC.

All interviews were conducted by the lead researcher who has experience conducting, analyzing, and publishing qualitative research. In addition, the lead researcher was previously trained by 2 senior qualitative researchers based on protocols by Goodell et al.[57] The lead researcher had no relationship to participants prior to the interview. Interviews were approximately 45 minutes long, conducted in English, audio-recorded, and transcribed verbatim.

3.2.3 Data Analysis

For the demographic and snacking behavior survey, descriptive statistics were calculated in Stata Statistical Software: Release 15. For the interview, transcripts were analyzed in NVivo (Version 12) using the thematic analysis approach.[58] The lead researcher and a research assistant who was also trained on qualitative research methodology[57] were the two coders. The 6 phase coding approach used in thematic analysis was employed by the two coders as follows, coders: 1) independently read through transcripts to familiarize themselves with data, 2) independently open coded 10% of transcripts using a priori codes guided by SCT constructs, 3) met and developed a preliminary codebook expanding on a priori codes, 4) independently coded all transcripts with preliminary codebook (coders met regularly to discuss coding progress), 5) met to discusses any new emergent ideas and revise codebook, and 6) met to draft a narrative of themes that included illustrative quotes decided through consensus by both coders. Throughout the analysis process, coders wrote individual memos where they documented emergent themes and reflected on reflexivity and bias. When coding discrepancies arose, the coders discussed until a consensus was reached.

3.3 Results

Participants (n=30) were on average 15.2 years, mostly female (57%), and Black or African American (83%). Survey results also described snacking behaviors (Table 3-1).

Qualitative interviews revealed various themes regarding factors that influence snacking behaviors, and they were categorized into SCT factors (i.e., personal, environmental, and behavioral). Additional supporting participant quotes can be found in Table 3-2.

Table 3-1. Demographic Characteristics and Snacking Behaviors Among Adolescent Participants from a Boys and Girls Club in New York City (n=30)

Characteristics	**N (%)**
Age, mean (SD)	15.17 (1.62)
Sex	
Male	13 (43%)
Female	17 (57%)
Race/ethnicity	
Hispanic, Latino, or Spanish origin	3 (10%)
Black or African American	25 (83%)
Asian	1 (3%)
Mixed race/ethnicity	1 (3%)
Average daily snack frequency, mean (SD)	3 (1.5)
Most popular time of day to snack	
Before breakfast	0 (%)
Between breakfast and lunch	12 (40%)
Between lunch and dinner	13 (43%)
After dinner	5 (17%)
Frequency of independent snack purchasing[a]	
More than once a day	1 (3%)
Once a day	2 (7%)
5-6 times/week	0 (0%)
3-4 times/week	5 (17%)
1-2 times/week	13 (43%)
2-3 times/month	4 (13%)
Once a month	4 (13%)
Less than once a month	1 (3%)
Never	0 (0%)

[a]Defined as purchasing a snack without the supervision of a caregiver.

3.3.1 Personal Factors

Personal factors that emerged as major influences on snacking behaviors were preference and health.

3.3.1.1 Preference

All participants stated they picked what they "preferred" to snack on, with some explicitly stating "...it's mainly preference" and "I just prefer those things." When the theme of preference was investigated further, preferences were largely related to taste. One participant stated: "Even if it's like very, really good for me, if I don't like the taste of it, I wouldn't eat it. So, the taste is what's making me eat it." Participants also continually mentioned preference for certain brands of snacks, oftentimes in lieu of the actual food and beverage itself. For example, a participant mentioned that his school had "healthier" versions of Doritos and that "they're still Doritos so imma eat them," thereby describing his affinity for the brand.

3.3.1.2 Health

Many participants mentioned a connection between snacks and health. However, many acknowledged that they did not consciously pay attention to health when making snacking decisions. Some stated this was because they ate healthy meals, so they did not feel the need to eat healthy snacks. For those that did indicate that health influenced them, certain health benefits and health concerns were repeatedly mentioned.

One of the health benefits mentioned was increased energy, with many participants stating that they would choose "healthy snacks" and "sugary snacks" when they needed energy. Other participants described longevity as a reason for choosing healthy snacks. One participant stated, "I don't even care if my friends clown me and other stuff to me. I'm like, 'This stuff might not taste the greatest but it's good for you.... You could laugh...but I'm gonna be alright when I turn 60, still be able to play ball.'" Another health benefit that was prevalent was snacks providing participants the ability to focus, influencing many to snack during schoolwork.

Participants mentioned specific health concerns related to snacking, such as the connections between sugar from snacks and diabetes, as well as calories from snacks and obesity. They explained how this knowledge influenced them to avoid large amounts of sugar and calories in snacks. Other participants cited having a family history of these conditions as part of their reasoning for healthy snacking. “On my mom and dad side there’s like a few cases of people having diabetes and like just people getting obese, so I like to try and watch what I eat a lot so that I don’t like end up in the same thing.”

3.3.2 Environmental Factors

Social environments that influenced participants included peers, family (including family culture), and other individuals, and physical environments included the home, school, after school, and food store environments (i.e., food store availability and food store access).

3.3.2.1 Peers

Participants stated that they ate “unhealthy” snacks when with peers. One participant said, “When you’re with your friends, you’re most likely not going to have something healthy, because your friends are not going to, like, look at you and say, ‘Let’s go get an apple for a snack.’ Like, no. The first thing they’re going to say is, ‘Let’s go to McDonalds, let’s go to Burger King,’ or something.” In addition, participants described that peers would verbally encourage them to try certain snacks and would even give adolescents a taste of what they were eating. There were also instances where peers helped them make healthy snacking decisions.

3.3.2.2 Family

For the most part, family that influenced adolescents’ snacking behaviors included parents and grandparents, and they generally influenced participants to snack less often and on “healthy” snacks. Parents influenced adolescents through verbal encouragement, role modeling,

or purchasing snacks for participants. For example, one participant mentioned that when she's with her mother and "she gets something, I'll probably just copy her. Sometimes she gets stuff that's healthy. Like, she will get like a water and like a peanut, or something like that, I will just get it with her." Parents and grandparents also influenced participants' snacking behaviors by providing adolescents with money that they would use to purchase snacks on their own.

Family culture was a large influence in determining what snacks adolescents ate, particularly at home. Examples of cultural snack foods that participants ate at home were Caribbean fruits, namkeen (a group of savory, usually fried snacks from South Asia), Jamaican coconut cake, and bofrot (a fried dough snack eaten in Sub-Saharan Africa). In addition, eating cultural snacks influenced participants to snack on non-cultural snacks when outside of the home. For example, one participant stated, "We eat traditional food.... and then when I get outside, I'm just like, 'Oh, okay, so, I get a break from this today, and I get to eat this.'"

3.3.2.3 Other Individuals

Sports coaches encouraged participants to snack healthier for their success in sports. One participant said that he ate healthier snacks because his coach "usually encouraged us to eat healthy things before games and after practice, so we wouldn't get out of shape or lose energy too fast by eating all the salty and sweet things." Another large influence was after school staff, who often verbally encouraged participants to snack on healthy foods.

3.3.2.4 Home Environment

Many participants mentioned that they would make decisions about what to snack on based on what snacks were available at home. Participants also stated that snacks at home were "healthier" than in other places, due to their parents. "When you're at home, it's based on what

your parents get for you, and parents are most likely to get like healthy stuff to you." Fruits were specifically mentioned as being available for snacks at home.

3.3.2.5 School Environment

Similarly, many participants mentioned that schools had availability of healthy snacks. They also mentioned that they ate them because they were available: "We don't pick what we want.... I eat whatever they give inside the school." On the other hand, some participants specifically mentioned not eating snacks even if they were available because they did not like school food. One participant stated, "They offer snacks, but it won't be snacks that you like. It'll just be healthy snacks." As such, participants found alternative ways to snack during school days. Many mentioned either bringing snacks from home, purchasing them from school vending machines, or purchasing them from corner stores before and after school.

3.3.2.6 After School Environment

The after school snack environment varied based on the program that students attended. Many participants mentioned that they were hungry after school, so they would want a snack. Some would go to the corner store to purchase snacks prior to their after school program starting. When snacks were made available by after school programs, participants mostly described consuming what was available. However, from the perspective of participants, there was not consensus about whether they thought the snacks were healthy or not: "Sometimes there's an apple, cheese stick, oranges, and stuff like that. But sometimes they're like junk, like pizza, chicken nuggets, fries."

3.3.2.7 Food Store Environment

Participants mentioned that corner stores had more EDNP snacks available than supermarkets, which seemed to stock healthier snack options. One participant summed up the

disparity in availability by saying, “At the deli the only thing you can possibly get is chips, sweets, and juice, and stuff. But if you go to, like, other grocery stores, and get more like fruits, and vegetables and things, and like whole wheat stuff.” In addition, when healthier snacks were available at corner stores, participants mentioned that they were not fresh, seemed expired, or even that “it would be molding.”

Participants also mentioned that corner stores were more accessible than supermarkets: “The amount of bodegas compared to the amount of supermarkets that are in my community...the ratio is completely unbalanced...for every six bodegas in my community, there’s one supermarket...There’s a lot of unhealthy choices in my community...my mom would actually have to travel some, quite some distance to get the healthy choices.” In addition, supermarkets with healthy food were also not accessible. In fact, corner stores were closer to home and school, and many participants mentioned going there on the way to school or on the way home from school. Lastly, participants mentioned that they would snack more healthfully if it were more accessible: “I feel like living closer to supermarkets that have like better fruit and vegetable options, like more fresh ones, I feel like if I did live near, like closer to that, I would be more inclined to buy them, instead of chips and candy.”

3.3.3 Behavioral Factors

Behavioral factors that influenced snacking were adolescents’ high self-efficacy to consume the snacks they wanted and high levels of autonomy to obtain snacks on their own.

3.3.3.1 Self-Efficacy

Overall, participants seemed to have high self-efficacy surrounding consuming snacks, especially relative to meals. Regarding meals, one participant said, “Meals have to be… prepared and cooked, so you would have, it would take time to get the stuff you need, and it will take time

to make it, whereas snacks, I can just purchase it, eat it as soon as I purchase it." Moreover, participants further explained that they had higher self-efficacy surrounding obtaining "regular snacks" versus "healthy snacks," due environmental factors, such as lack of healthy food availability and access, but also personal factors, such as not being motivated to prepare healthy snacks (i.e., cut up fruit).

3.3.3.2 Autonomy

Participants in this study had high levels of autonomy surrounding snacks, which centered on a few topics. One topic was food choice autonomy, where adolescents mentioned eating certain foods as snacks even when they were urged to eat something else by others. Another topic was assisting with grocery shopping for the household's food/beverages. Participants sometimes had sole input about snacks that were chosen for the family, oftentimes made the grocery list, and occasionally joined parents on grocery shopping trips. Lastly, participants would go to corner stores by themselves to purchase snacks: "I kind of just look for what I have in my house. And if I don't have it, sometimes I'll actually leave my house and go to the store and get it." Many of the times that participants went independently to corner stores, they would purchase snacks with their own money.

Table 3-2. Quotes from Adolescents from a Boys & Girls Club in New York City about Factors that Influence their Snacking Behaviors (Categorized by Social Cognitive Theory Factors)

Themes	Example Quotes
Personal Factors	
Preference	"I just go for the one thing I actually always get. It's an Arizona, that's the only drink I honestly get, yeah. I don't know, I just think that Arizona is my favorite option. I feel like my favorite combo to get is just Lay's chips, a Snickers, and a Gatorade."
Health	"I personally choose healthy snacks to snack on, it's because I don't really want to be behind. I want to be able, like I want to be able to do more things. Like I want to be able to run fast without having to take so many breaths. I want to be able to be strong. I want, like, I want to be able to be like more than what I am. So, if I want to do that, one step, or one solution is by eating healthy, because it can provide me like the goals I want to achieve." "Eating too much sugar and stuff, you know, every day could cause like, diabetes and stuff like that. So, I just try to, you know, be mindful about that and be mindful about what I do. Because I'm not trying to, you know, affect what I like to do in the long run."
Environmental Factors (Social and Physical)	
Peers	"Kids will, like, come to school with certain chips and they will let me try them, and I'd like them. I then to go to the store after school and buy my own bag." "Let's say one person picks up this, we're like, 'Hold on, let's read the back and see what is in it, you know, see if it's actually good.'.... So, we'll just like influence each other not to get it, and we will actually don't get it."
Family	"If I was in my grandparents' house, they would constantly talk to me about my weight, and since diabetes kind of does run in my family, I have to be careful, because I can get it. So, they would like make me eat healthy most of the time." "My family, they're most likely to have all these Caribbean fruits. They'll be like, 'Oh, [participant name], do you want to have a bite of this?' Stuff like that. Whereas when I'm with my friends, we're just going to like, pop into a store and get something to eat."
Other Individuals	"They [after school staff] mad healthy, so they be telling you like, 'Don't eat a lot of junk food,' to eat like food that you know that's good for you, like eating fruits."
Home	"I usually just have a fruit, because at home, you usually have to just go out and get something from the deli and bring it home for the next day. But if you don't, if you never did that, you just eat a fruit at home, or what is at home."
School	"They gave us healthy stuff, even though it didn't taste great, I knew it was good for my body. I didn't really get it 'cause it didn't taste great, I usually tried to stay away from it and just wait 'til lunchtime or something."

After School	"In the Boys and Girls Club, they usually gave us snacks. Sometimes it will be like something like a bag of chips and sometimes it will be a fruit. So, I guess it was like, they just alternated between it, you didn't really get to choose, but I didn't really mind."
Food Store	"There is a lot of delis near my home and near my school, so I always have a variety. I would always pass like at least five delis on my way to school."
Behavioral Factors	
Self-Efficacy	"The cupboard in my house will have like a lot of snacks in it, but every once in a while, I'll go and I'll make my own snacks. Like, just the other day, I made like cookie dough to snack on."
Autonomy	"I remember one time I stopped eating the snacks for like days, like a couple days. I was like, 'Oh, I can't do this no more.' My mom had stopped buying snacks. She was like, 'You all need to stop eating all of this.' And then I would just be like, 'Mom, I can't.' Then I would go to the store and buy it." "When I go to the store, I can like get more stuff than what I get at home, because it's like when we buy the boxes, it's like only that in there. But then when I go to the store, I can just get whatever I feel like."

3.4 Discussion

This qualitative study examined factors that influence snacking among U.S. adolescents from urban communities. Results revealed that adolescents' snacking was influenced by personal factors (preference and health), environmental factors (peers, family, other individuals, as well as the home, school, after school, and food store environments), and behavioral factors (self-efficacy and autonomy).

Data from this study highlights the importance of preference in determining snack choice. Previous research has described that preference, specifically taste preference, is an important factor influencing food choice, perhaps due to adolescents' emphasis on pleasure and hedonic rewards of food.[27,28] For example, in a study where adolescents were interviewed after a food choice simulation task, researchers found that taste preference was the most important factor influencing their choice.[29] However, a unique facet of preference that emerged in this study is brand preference. Not only did participants use brand names to describe types of food (e.g., Lays

for chips, Arizona for iced tea, etc.), but also reported consuming a healthier version of a snack because it was of a certain brand (e.g., Cheetos "Puffs," Baked Lays, Reduced Fat Doritos, etc.). These aforementioned "healthier version" snacks are called "copycat snacks" in the literature because they are formulated by food companies to meet certain nutrition requirements so that they are able to be served in schools.[59] Another study that examined "copycat snacks" found that adolescents, for the most part, could not detect significant differences in the taste between "copycat" and regular snacks.[60] Adolescents were not able to distinguish between "copycat" and regular Doritos and Froot Loops but were able to detect differences in "copycat" and regular Rice Krispy treats.[60] This evidence, in conjunction with findings from this study, suggest that "copycat snacks" may be feasible solutions for healthier snacking and can be expanded to retail locations beyond school, though consideration should still be taken about the overall nutritional value of these snacks.

In terms of health, participants in this study mentioned both health benefits and concerns as influencing snacking behaviors. Specifically, adolescents were able to articulate the relationship between food and health, complex health ideas (i.e., diabetes, obesity, and energy), and how their nutrition knowledge influences their snacking. In other qualitative studies on factors that influence overall diet among adolescents, adolescents were less descriptive about nutrition and/or health, leading researchers to conclude that health has a minimal impact on eating behaviors.[28,46] Even in qualitative studies that explored snacking with adolescents outside the U.S., nutrition and health were only cursorily discussed, with themes of dieting and body image being the most salient health-related themes.[38,39] Findings from these other studies may reflect adolescents' low risk perception and future orientation, which leads them to consider their future health less in food decisions.[61] In this study, it is possible that adultification, partially due

to living in an urban area,[62–64] may contribute to adolescents having greater risk perception and future orientation, resulting in connecting health to snacking and changing behavior accordingly.

Another environmental factor that emerged was family culture. In this study, family culture influenced adolescent snack choice both inside and outside the home. Most studies that have explored family culture and food behaviors have focused on it through the lens of acculturation and the sociological meaning of food.[65,66] These studies have highlighted that adolescents view certain foods as way to connect with their family heritage.[65,66] Fewer studies have connected it to a large variety of adolescent daily food behaviors.[67] In contrast, findings from this study depict that family culture may be explanations for a wide range of daily snacking behaviors, such as corner store snack choices and acceptance of school snacks. However, despite this fact, culture (i.e., both cultural snack foods and the explicit acknowledgement of the diverse cultures of participants) has been largely absent in interventions to improve snacking.[18,19] It is especially important given the cultural diversity of many urban communities that are targeted in these interventions to improve snacking.

This study also reported that the after school activity environment was an influence on adolescent snacking. Adolescents stated that they oftentimes received foods at after school activities, but that there was no consensus about whether the foods were healthy or not. This may indicate a lack of policies surrounding after school activity snacks. Schools that participate in the USDA school food program must also follow the USDA Smart Snack guidelines, which limit the amounts of calories and certain nutrients (e.g., sodium, saturated fat, etc.) that may be in a snack.[68] However, nutrition requirements for snacks in non-school settings are less universal. In one study, researchers conducted an analysis of snacks available during after school programming across 9 national after school organizations (e.g., Boy Scouts of America, Boys

and Girls Clubs of America, YMCA of the USA, etc.).[17] They found that only 50.4% of the 562 programs surveyed met healthy snack criteria (i.e., fruits and vegetables served more frequently than salty and sweet snacks), signaling that the lack of universal recommendations may manifest in a lack of healthy snacks in after school activity environments.[17]

Another theme was neighborhood availability and access of snacks in corner stores. In this study, all adolescents visited corner stores to purchase snacks, highlighting a significant opportunity to intervene at corner stores. Leak et al.[69,70] conducted a study examining the willingness of corner store owners and adolescents who frequent corner stores in NYC to, respectively, offer and purchase healthy grab-and-go snack packs. Corner store owners reported that they would offer healthy grab-and-go snack packs as long as they made a profit, received additional display shelving and refrigerators, and had assistance marketing the product.[69,70] In addition, a large percentage of adolescents reported that they would purchase snack packs if they were available.[69,70] These profit and infrastructure concerns signal that improving adolescent snacking behaviors in corner stores may need to start from external support to corner stores.

Lastly, in this study, behavioral factors that emerged as influencing snacking were that adolescents had more self-efficacy to procure and consume snacks than meals and that adolescents were highly autonomous concerning snacking, leading them to purchase and consume unhealthy snacks. In general, adolescence is a period of increased autonomy and purchasing power, and this often results in adolescents forming dietary behaviors and making decisions about what foods they consume independent of families who may encourage healthier dietary behaviors.[29,37,71,72] One study that examined adolescent levels of autonomy and snacking behaviors found that higher levels of autonomy were significantly associated with greater weekly

purchase of "unhealthy snacks."[71] These findings surrounding autonomy are important for designing interventions addressing adolescent snacking.

This study has limitations and strengths that we would like to acknowledge. Adolescents were recruited from a BGC in NYC, and thus findings may not be generalizable to adolescents who do not participate in after school programming in NYC. The BGC also has a diverse membership with a focus on youth from low-income backgrounds. Although individual socioeconomic status was not measured in this present study, findings may also not be generalizable to adolescents in NYC that are from different socioeconomic backgrounds. In addition, NYC has a unique food environment with an abundance of corner stores,[73] so findings regarding the environment may not apply to other communities. This study was also conducted during the Covid-19 pandemic, and results may have been influenced by circumstances surrounding the pandemic. Also, there may be social desirability bias, which has been shown in other studies that inquire about dietary behaviors.[39,74] This may lead to greater remarks about the influence of certain factors (i.e., health, cost, etc.) on snack choice. Regarding strengths, 30 individual interviews were conducted, resulting in rich data about influences on snacking behaviors. In addition, the interview guide was theory-informed and employed rigorous qualitative methodology throughout. Finally, this study addresses a significant gap in literature by qualitatively exploring U.S. adolescent snacking behaviors, focusing particularly on adolescents from urban communities.

3.5 Implications for Research and Practice

Recommendations for research stemming from results of this study include a further exploration of how different dimensions of preference (e.g., taste, brand, etc.) and health influence snacking. In addition, future practice surrounding urban adolescent snacking should

incorporate family culture and the food store environment, both of which emerged as important elements in this study. Furthermore, given that this study suggests that adolescents are consuming snacks after school, future research and policy endeavors to create common after school activity snack recommendations may have a positive influence on snacking behaviors.

Lastly, adolescents in this study had high levels of self-efficacy and autonomy surrounding snacking behaviors. Both autonomy and self-efficacy are important constructs for health behavior change.[23] Therefore, snacking-focused nutrition interventions with adolescents may be more effective by addressing these constructs. By acknowledging that adolescents may be purchasing snacks on their own or preparing them (oftentimes unlike meals which are prepared by family members),[29,37,72] adolescents may be more inclined to make positive health changes. Thus, interventions are needed where the adolescent is the target participant (versus caregivers). Findings from this study will be used to develop an intervention to improve snacking at a Boys & Girls Clubs in NYC, which may improve overall diet quality and reduce chronic disease risk among U.S. adolescents, especially those from urban communities.

3.6 Acknowledgments

This research study received funding from the Cornell University College of Human Ecology Alumni Association and the Cornell University Qualitative and Interpretive Research Institute. The authors would like to thank the staff and youth members of the Boys and Girls Club for their support and continued collaboration, all of which made this research possible.

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CHAPTER 4

EXAMINING THE FEASIBILITY OF A YOUTH ADVOCACY PROGRAM PROMOTING HEALTHY SNACKING IN NEW YORK CITY: A MIXED METHODS PROCESS EVALUATION

4.1 Introduction

There is a critical need for innovative strategies that encourage healthy snacking behaviors among adolescents in urban communities. Snacking plays a significant role in the adolescent diet, with adolescents consuming 2.9 snack items per day and snacks comprising 22% of daily energy intake.[1,2] Moreover, adolescents primarily consume energy-dense, nutrient-poor (EDNP) snacks, such as chips, candy, and sugar-sweetened beverages.[2,3] Of special concern are adolescents in urban communities, as they are subject to unique factors that promote unhealthy snacking. Urban environments have a high availability of corner stores, which mainly stock EDNP snacks and lack healthy snack options, such as fruit/vegetable snacks.[4,5] Additionally, a study found that adolescents in urban areas prefer EDNP snacks and have high levels of food autonomy and purchasing power that contribute to the purchasing of them from corner stores.[6] As such, strategies aiming to improve adolescent snacking behaviors in urban communities should consider the corner store environment.

Current strategies to improve snacking in corner stores have mainly involved increasing the availability of healthy foods and training corner store staff to promote them.[7,8] However, these studies reveal limited effects on adolescent purchasing behaviors and diet. One reason for this may be a lack of investment from adolescents. Recent research on adolescent nutrition interventions asserts that adolescents' autonomy, agency, and desire to be involved in decision-

making is important to harness to achieve intervention buy-in.[9] Therefore, strategies that involve adolescents as change agents may promote healthy snacking behaviors in corner stores.

A novel and understudied strategy that may improve adolescent snacking behaviors is youth advocacy to promote a health-related goal (i.e., youth advocacy for health). Advocacy for health involves working towards "social and/or organizational change on behalf of a particular health goal, program, interest, or population"[10] and includes presenting information to decision-makers to "encourage and persuade them to adopt policies and/or procedures."[11] Advocacy is separate from efforts to bring awareness, which do not necessarily have the goal of influencing a decision-maker,[10] and distinct from activism, which does not necessarily speak on behalf of a community and instead vocalizes personal beliefs[12] (though advocacy efforts may include bringing awareness and being an activist).

In the literature, youth advocacy for health initiatives primarily include 3 steps: 1) identifying problems in the community, 2) developing a plan for improvement, and 3) meeting with decision-makers.[13–15] Youth advocacy for health first emerged as a method to reduce adolescent substance use. This strategy has been successful in improving perceptions about the importance of substance-free environments among adolescents involved in advocacy, creating environmental conditions that discourage substance use (i.e., "Drug-Free Zone" signs in parks), and reducing the underage tobacco purchasing rate in the community.[14,16–18] Since dietary behaviors have similar influencing factors to substance use (e.g., knowledge, peer influence, retail environmental influences, etc.), youth advocacy may be a novel method to improve adolescent snacking behaviors.

There are some studies of youth advocacy programs that aim to improve healthy food access in urban corner stores, but none have focused on snacks. One program in San Francisco,

California spanned 2.5 years and involved high school students (6-8 each year) from minority backgrounds in reducing "tobacco subsidiary food products and tobacco advertisements and replace them with healthier food alternatives" at corner stores.[19] Adolescents learned about the relationship between tobacco and food companies and conducted assessments at 11 corner stores documenting how much shelf space was devoted to different types of products (i.e., produce, processed foods, alcohol/cigarettes) and which food brands were tobacco company subsidiaries. Next, adolescents came up with a campaign that involved several city agencies providing incentives (e.g., new equipment, access to low interest loans, etc.) to corner stores if they stocked less tobacco products and more produce. During the campaign, adolescents provided taste tests of healthy foods at one corner store and participated in in press events. Overall, there was an increase in fresh produce sales (5% of sales to 15%) and a decrease in alcohol sales (25% of sales to 15%). Another project in East Oakland, California lasted 3 years and involved high school students (n=30/year) from minority backgrounds to address food access and insecurity.[20] Youth learned about food insecurity, digitally mapped the healthiness of 30 food retail stores, created recommendations to increase healthy options in liquor/corner stores, and prepared recommendations for community decision-makers. This project resulted in a new weekly farmers market, youth awareness of inequities in their communities, and youth empowerment.

Additional youth advocacy efforts that address healthy food access in corner stores exist, but they have not involved youth in the 3 advocacy steps: 1) identifying problems in the community, 2) developing a plan for improvement, and 3) meeting with decision-makers,[13–15] which research suggests is important for health behavior change.[13,23,24] The aforementioned studies also do not have robust process evaluations, which is the collection of data for the purpose of evaluating program implementation (e.g., participant satisfaction, engagement,

retention, etc.).[21,22] This is important for understanding initiatives' feasibility, acceptability, and best practices, which is information that assists programs in being adapted to different settings. Being able to adapt successful programs to different settings is important, in order to expedite implementation of evidence-based programming. Lastly, there has yet to be a youth advocacy program addressing healthy food access in urban corner stores that reports on using a set curriculum, which is also important for adaptations and scalability.

The Youth Engagement and Action for Health! (YEAH!) is a youth advocacy program addressing neighborhood physical activity barriers that has a publicly available curriculum (typically 14 sessions implemented over 10-12 weeks) and has been implemented at school and other organizations (e.g., Boys & Girls Clubs) in urban communities across the U.S. (e.g., San Diego, California, Washington D.C.).[25–28] Its framework was based off of substance control youth advocacy programs. Youth identify problems to health through neighborhood assessments (e.g., audits of neighborhood walkability, availability of parks), develop a plan to address barriers, and incorporate them into an advocacy presentation for a decision maker (e.g., school board member, local policymaker). In evaluations of YEAH!, youth reported increased self-efficacy for health behaviors, knowledge of resources, and social support for health behaviors (e.g., physical activity).[25–27] In addition, adolescents significantly increased number of days they were physically active for 60 minutes.[25–27] Environmental changes include installing lights at a community center so youth can walk at night and adding a female-only swim time to a local YMCA to increase participation from Muslim female youth.[25–27] In addition, a process evaluation was conducted with adult facilitators, gauging best practices for program implementation and program enthusiasm/engagement.[29] However, a process evaluation of youth involvement of YEAH! has not been conducted (e.g., participant engagement, program

satisfaction). Overall, YEAH! is an established youth advocacy for health programs, and it has a curriculum that can be modified to incorporate other health behaviors and settings.

For the current study, the YEAH! curriculum was adapted to empower adolescents to advocate for changes that promote healthy snacking behaviors in urban corner stores. Given that this is a new adaptation of YEAH!, a feasibility study is warranted to assess the practicality and acceptability of a novel technique before resources are used to test its efficacy and effectiveness on diet and health outcomes.[30] Thus, the aim of this study was to assess the feasibility of the adapted YEAH! that focuses on healthy snacking behaviors among adolescents by conducting a mixed methods process evaluation.

4.2 Methods

4.2.1 Study Design

The YEAH! curriculum was adapted to address adolescent snacking behaviors in urban corner stores (see *4.2.2 Adaptation of the YEAH! curriculum*), and a 5-week feasibility study (1 week data collection, 3 weeks program implementation [12 sessions total], 1 week data collection) with a mixed methods process evaluation was conducted. A process evaluation measures aspects of the implementation process, such as attendance, participant satisfaction, and participant engagement, to evaluate the practicality and acceptability of the intervention. Results from the mixed methods process evaluation will be reported in this paper.

4.2.2 Adaptation of the YEAH! Curriculum

To adapt YEAH! to address snacking, prior to this study, we conducted qualitative interviews with adolescents to explore factors that influence snacking behaviors.[6] From that study, personal (e.g., preference for unhealthy snacks, fear of obesity and chronic disease, etc.), environmental (e.g., lack of healthy snacks in corner stores, peers that snack on unhealthy

snacks, etc.), and behavioral factors (e.g., self-efficacy to purchase snacks, high food autonomy, etc.) were identified as barriers to healthy snacking. We adapted the YEAH! curriculum to address these factors and focus on snacking. For example, a nutrition lesson was added to increase knowledge of health benefits/concerns of unhealthy snacking, a TED talk was shown that discusses how food marketing reduces food autonomy, and assessments focused on facilitators and barriers to snacking were conducted at corner stores in the community. Thus, the program had the following 3 phases: 1) lessons on advocacy, nutrition, healthy snacking, & food environment, 2) photovoice corner store assessment, and 3) corner store advocacy presentations.

4.2.3 Participants and Recruitment

This study took place at a Boys & Girls Club (BGC) in NYC. The BGC is a national organization with local chapters that offers after-school programming focused on academics, leadership, and health to its 2 million youth members that are predominantly from low-income backgrounds.[31] For the feasibility study, participant inclusion criteria were: 1) members of the BGC, 2) 12-18 years old, and 3) speak, read, and understand English. For recruitment, the BGC sent an email to all adolescents and caregivers in their listserv. The email contained a recruitment flyer that explained the study and a link to a Qualtrics survey that included inclusion screening questions. If the inclusion criteria were met, caregivers were prompted to provide electronic consent, and youth were prompted to provide electronic assent. Participants were enrolled once the online, signed caregiver consent and youth assent were received. Since power calculations are not typically conducted for feasibility studies,[32–35] all eligible participants with signed caregiver consent and youth assent by the first day of data collection were enrolled in the study. Participants received $50 for completing measures at baseline and endpoint ($25 at baseline and $25 at endpoint). They also received a $360 stipend for participating in the program, which

matched the stipend amount received by adolescents at this BGC for other summer programming. Students were told that part of the stipend ($180) would disbursed halfway through the program and the remaining ($200) in the last week. They were also told they had to attend all sessions to receive the stipends. This study was approved by the Cornell University Institutional Review Board.

4.2.4 Procedures

This study took place over 5 weeks (July-August 2021), and adolescents were split into 2 classes (i.e., 3-5pm and 5-7pm classes), based on their preferred meeting time. Identical study procedures took place during each class. Since this program was held in-person during the Coronavirus disease 2019 (Covid-19) pandemic, masks were required. In addition, the room where the program was held was cleaned between sessions.

Baseline data collection was held during class time the first week (Monday-Thursday), and participants answered questions about demographic characteristics (see *4.2.5 Measures*). Additional data that were collected (i.e., snacking behaviors, advocacy behaviors, anthropometrics, dermal carotenoid levels, and 3-day diet records) will not be presented as these data are not relevant to the aim of this paper (i.e., process evaluation).

Program implementation started after baseline data collection and lasted for twelve 2-hour sessions over 3 weeks (i.e., Monday-Thursday). All sessions were facilitated by the lead researcher (NG), and there was a minimum of two undergraduate student research assistants at each session, as well as a BGC staff member. There were 3 main phases to the program: 1) lessons on advocacy, nutrition, healthy snacking, & food environment, 2) photovoice corner store assessment, and 3) corner store advocacy presentations. The program began with lessons about advocacy, nutrition, healthy snacking, and the food environment. Participants in each class

were then split into groups of 4-6 students. In groups, participants conducted their corner store assessments using photovoice methods, which involves "giving cameras to people to take photographs that illustrate issues that concern them."[36,37] They took photos at corner stores in their community for facilitators and barriers to healthy snacking. Then, as a class, we discussed photos using the SHOWeD method.[38] The SHOWeD method is a strategy to foster discussion about photographs using the following series of questions: "What did you *S*ee here? What is really *H*appening? How does this relate to *O*ur lives? *W*hy does this problem or strength exist? What can we *D*o about it?" Next, in groups, participants brainstormed a corner store improvement plan and created a presentation detailing their solutions. Lastly, groups presented their corner store advocacy presentations (15 minutes) to 3 food policy expert panelists that were invited by researchers. Food policy expert panelists were given 5 minutes after each presentation to ask the group questions.

After each session, participants completed a session satisfaction survey. Also, the same research assistant completed a process evaluation checklist during each session (see *4.2.5 Measures*). After the 12-session program, adolescents completed endpoint measures following the same procedures as baseline. In addition to endpoint measures, participants completed an end-of-program survey and engaged in a focus group to explore participants' experience with the program (see *4.2.5 Measures*). The focus group was facilitated by the lead researcher (NG), who has experience with qualitative methods. A research assistant, who was trained by the lead researcher following published training principles,[39] was the note taker. Focus groups were audio-recorded and transcribed verbatim by a professional transcription service. Endpoint measures culminated with a celebration where youth were given certificates of completion and celebrated program conclusion.

4.2.5 Measures

4.2.5.1 Demographic Characteristics

Participants reported their age, sex (female, male), gender (female, male, trans male/trans man, trans female/trans woman, genderqueer/gender non-conforming, different identity), race/ethnicity (Asian, Black/African American, Hispanic, Middle Eastern or North African, Native Hawaiian or Pacific Islander White), and grade in school.

4.2.5.2 Mixed Methods Process Evaluation

The following process evaluation measures were examined and adapted from prior literature: 1) recruitment, 2) reach, 3) dose delivered, 4) fidelity, and 5) dose received.[40–42] Table 4-1 defines these process evaluation measures in more detail. The process evaluation checklist is in Appendix B.

Recruitment, reach, dose delivered, fidelity, and dose received were assessed quantitatively. Dose received was also qualitatively assessed through focus groups. A semi-structured focus group guide was based off prior process evaluation research.[42] It assessed satisfaction with and recommendations for the overall program and the three program phases (1) lessons on advocacy, nutrition, healthy snacking, & food environment, 2) photovoice corner store assessment, and 3) corner store advocacy presentations). Questions included: What did you like about [program phase]? What did you learn from the [program phase]? How can we improve [program phase]? The full focus group guide is in Appendix C.

Table 4-1. Process Evaluation Measures, Instruments, Data Collection Methods, and Data Summary of a Youth Advocacy Program

Measure	Definition	Instrument	Method	Data Summary
Recruitment	Proportion of individuals participating in intervention (retention rate)	Process evaluation checklist	Research assistants marked if any participants formally dropped out of the intervention and their reasons why	-Number of participants that dropped out -Reasons for drop out -Retention rate
Reach	Participant attendance	Process evaluation checklist	Research assistants marked attendance each session	-Attendance for overall program -Attendance for each session
	Barriers to attendance	End-of-program survey	Participants answered a survey question about barriers to attendance	-Reasons that participants were unable to attend session
Dose delivered	Amount of intervention that was delivered	Process evaluation checklist	Research assistants marked whether the session activity was completed (1=completed, 0=not completed)	-Proportion of activities completed in overall program -Proportion of activities completed in each session
			Research assistants marked how many minutes each session was	-Session length for overall program -Session length for each session
Fidelity	Extent to which the intervention was implemented according to curriculum	Process evaluation checklist	Research assistants marked how well the session activity was implemented in accordance with the curriculum (on a scale of 1-5)	-Fidelity percentage for overall program -Fidelity percentage for each session
Dose received	Participant engagement in intervention	Process evaluation checklist	Research assistants marked how engaged participants were in the session activity (on a scale of 1-5; 1=0% participants engaged, 5=100% participants engaged)	-Engagement score for overall program -Engagement score for each session
	Participant satisfaction with intervention	End-of-program survey	Participants answered questions about program satisfaction, how likely they are to recommend the program, and how likely they are to participate again	-Satisfaction score and survey questions for overall program
		After-session survey	Participants marked how satisfied they were with the session (on a scale of 1-5)	-Satisfaction score for sessions
		Focus groups	Focus groups were conducted with participants to assess satisfaction	-Emergent themes from focus groups

4.2.6 Analysis

For quantitative data, means and standard deviations were calculated for continuous variables and frequencies and percentages for categorical variables. All quantitative analyses were conducted in Stata Statistical Software: Release 15 and RStudio. For the focus groups, trained coders (NG and a research assistant) analyzed transcripts using thematic analysis in NVivo (Version 12). Two coders followed the 6 phase coding approach[43] where they: 1) independently read through transcripts, 2) independently open coded 10% of transcripts 3) met and developed a preliminary codebook, 4) independently coded all transcripts with preliminary codebook, 5) met to discusses any new emergent ideas and revise codebook, and 6) met to draft a narrative of themes.

4.3 Results

Participants (n=36) were, on average, 14.7 years old. There were 19 participants in the first class (3-5pm) and 17 participants in the second class (5-7pm). There were nearly equal numbers of male (44.44%) and female (55.56%) participants. Most participants were Black/African American (61.11%). Participants were in grades 7-12, with largest percentage of participants (36.11%) in 9th grade. Additional baseline characteristics are in Table 4-2.

Table 4-2. Baseline Characteristics Among Adolescent Participants Participating in a Youth Advocacy Program Promoting Healthy Snacking in Corner Stores from a Boys and Girls Club in New York City (n=36)

Characteristics	N (%)
Age, mean (SD)	14.67 (1.53)
Sex	
Male	16 (44.44%)
Female	20 (55.56%)
Race/ethnicity[a]	
Hispanic, Latino, or Spanish origin	11 (30.56%)
Black or African American	22 (61.11%)
Asian	1 (2.78%)
Mixed	2 (5.56%)
Grade	
7	1 (2.78%)
8	4 (11.11%)
9	13 (36.11%)
10	9 (25%)
11	5 (13.89%)
12	4 (11.11%)

[a]Participants were able to select more than 1 race/ethnicity and those that did have been categorized as "Mixed"

4.3.1 Quantitative Process Evaluation Findings

4.3.1.1 Recruitment

The retention rate was 94.74%. Two participants dropped out of the study, as they moved out of the neighborhood, reducing the final analytic sample from 38 to 36 participants.

4.3.1.2 Reach

Average attendance for the overall program was 93.52% (SD=5.07). For each of the twelve sessions, attendance ranged from 83.33% to 100% (Table 4-3). In the end-of-program survey, when asked to select all the reasons why they missed a session, six participants (16.67%) stated because of a healthcare appointment, 4 (11.11%) because they did not feel like attending, 3 (8.33%) because they were sick, 2 (5.56%) because of a job, and 2 (5.56%) because of home/childcare responsibilities. Other reasons that participants indicated that they could not

attend the program (via open-ended response) included bad weather, religious holiday, and birthday celebration.

4.3.1.3 Dose Delivered

Dose delivered (i.e., amount of intervention that was delivered) for the overall program was 98.94% (score=93; possible range=0-94). For each session, the range was 90-100%. The average session length was 109.33 minutes (range=95-120; SD=7.23).

4.3.1.4 Fidelity

The fidelity (i.e., extent to which the intervention was implemented according to curriculum) of the overall program was 98.5% (score=463; possible range=0–470). For each session, the range was 90-100%.

4.3.1.5 Dose Received

Dose received (i.e., participant engagement and participant satisfaction) was 4.97/5 (range=4.88-5) for engagement and 4.02/5 (SD=0.82) for the mean satisfaction with sessions (from after-session survey). Average program satisfaction from the end-of-program survey was 4/5 (SD=1.03). Out of the 33 participants that completed the satisfaction questions in the end-of-program survey, 14 (42.42%) indicated that they were “very likely” to recommend this program to someone else, and 6 (18.18%) said they were “extremely likely” to recommend it. In response to whether participants would participate again in the program, 14 (42.42%) said they were “very likely” to, and 7 (21.21%) stated they were “extremely likely” to.

Table 4-3. Process Evaluation Results of a Youth Advocacy Program Promoting Healthy Snacking in Corner Stores by Session and Overall Program

Session	Attendance (%)	Satisfaction (out of 5)	Dose delivered (%)	Session length (min.)	Fidelity (%)	Engagement (out of 5)
1	94.44	4.13	100	95.0	100	5
2	97.22	4.26	100	102.5	97.5	4.88
3	97.22	3.89	100	113.5	100	5
4	91.67	3.97	100	120.0	100	5
5	100.00	4.06	100	107.0	100	5
6	83.33	3.88	90	112.5	90	4.89
7	91.67	3.86	100	120.0	98	5
8	91.67	4.04	100	101.5	100	5
9	94.44	3.97	100	110.0	100	5
10	94.44	4.03	100	110.0	100	5
11	100.00	4.00	100	110.0	100	5
12	86.11	4.13	100	110.0	100	4.88
Overall	93.52	4.02	98.94	109.33	98.51	4.97

4.3.2 Qualitative Process Evaluation Findings

4.3.2.1 Dose Received

Six focus groups that lasted an average of 41.5 minutes were conducted with 28 participants (median=6, range=4-7). Participants discussed their satisfaction with 1) overall program, 2) lessons on advocacy, nutrition, healthy snacking, & food environment, 3) photovoice corner store assessment, and 4) corner store advocacy presentations. Themes emerged for each of the aforementioned categories that fit under the groupings “positive aspects” and “recommendations.” These themes are described below and are summarized with additional supporting quotes in Table 4-4.

4.3.2.2 Overall Program

Regarding positive aspects of the overall program, participants enjoyed the program, content, and learning topics not taught in school. There was also a significant, positive social aspect to program participation. One participant captured these sentiments by saying, “This

program was really fun. I did not expect this to be this fun. I thought it was going to be like a real boring program, but it actually was fun, and I got new friends." In addition, participants also formed relationships with the research assistants: "You guys are my favorite. I mean we got really close here and, we can tell you our things, like reasons why we could not come to the program." Lastly, participants enjoyed working in groups and improved groupwork skills.

In terms of overall program recommendations, the most salient was increased time in the program, as participants were enjoying themselves and wanted to stay in the program longer. One participated described this by saying, "the program doesn't last for like more than two hours, so I like it to be one more hour of the day."

4.3.2.3 Lessons on Advocacy, Nutrition, Healthy Snacking, & Food environment

Through the lessons, participants gained an understanding of food environment disparities and related these issues to their own lives. One participant discussed a TED talk on food justice that was watched during the program, saying it "opened my eyes, like when I saw that, how my community is kind of targeted." Participants also expressed enjoying the nutrition lesson where they were given commonly consumed corner store snacks and, using them, learned how to read a nutrition facts label and compare nutrient contents. Participants specifically mentioned that they gained new knowledge about how to read a nutrition facts label and about specific nutrients (i.e., added sugar, saturated fat). For example, "I learned about the added sugars. I didn't know that they add sugars; I thought it was just like the food already has sugars in it, but, you know, they added some, and now we are looking out for that actually." Several participants also made behavior changes based on what they learned: "I looked at calories before, but necessarily high calories doesn't mean like, it is really unhealthy, but you really have to look at like sugar and sodium. So, I will be doing more of that."

In terms of recommendations for the program, participants expressed wanting more nutrition education lessons. They also wished they learned more about healthy snack options: "Even though we sifted through like, the unhealthy snacks to see which one is the most healthiest and the most unhealthiest, we didn't necessarily go through healthy snacks."

4.3.2.4 Photovoice Corner Store Assessment

Many participants' favorite part of the program was the photovoice corner store assessment, with one participant mentioning that they felt like an "investigator" taking photos during it. They also learned about food environment disparities manifesting in their community's corner stores: "It kind of like helped me understand that some bodegas around here are kind of like...maybe they should improve some things, and I did not really notice this before."

Out of all the aspects of the program, participants had the most recommendations for the assessment. One recommendation included assessing more corner stores. Another recommendation was to visit stores that promote healthy snacking. A participant said that the assessments should include "examples of a healthy deli and example of an unhealthy deli. It would be helpful to know like what a natural, healthy one looks like versus an unhealthy one." Lastly, students recommended that the program incorporate additional fieldwork, such as interviewing community members and corner store owners.

4.3.2.5 Corner Store Advocacy Presentation

Many participants stated that they enjoyed brainstorming their corner store improvement plan, creating presentations, and delivering them. One participant remarked, "my favorite part about making the presentations was actually coming up with solutions, so solving issues in bodegas." They also enjoyed interacting with panelists, who they thought respected them and helped them to think more deeply about their plans: "What I learned from the panelists was that

when you have an idea, I feel like you got to think more about it than just think about this simple goal. You have to think about how to get to that goal, what might stop or what might not stop it." Participants also improved public speaking skills through the presentation process: "I usually do not like presenting because I am shy... but like I say that this presentation, it kind of made me like, you know, out of my shell and like, made me want to kind of present more." They also learned about advocacy, with one participant stating, "I was always nervous about being an advocate and just like handing out stuff, you know, getting the word out, but now I know that I can do it different ways, and now I know that I can actually be an advocate."

In terms of recommendations, participants wanted more time and resources for the corner store improvement projects, such as more information about "exact people or branches [of government]" that could support their improvement plans, as well as lectures from food advocates.

Table 4-4. Quotes from Adolescent Participants Describing Experiences in Youth Advocacy Program Promoting Healthy Snacking in Corner Stores

Themes	Example Quotes
Overall program: Positive aspects	
Enjoyed content	"My favorite part about this program was the lessons because I learned something that I wouldn't learn in regular school.... We learned about things beneficial in our life now."
Ability to socialize and form new relationships	"I like how we had like Gen Z counselors and stuff, like people around that age.... It was a comfortable setting, somewhere I could chill, but also work."
Ability to participate in group work and improve group work skills	"About the groups, like it actually made me more passive. So, like to listen more to people's opinions about something. Because usually I am in a group where like, nobody wants to do work or anything and I have to like be aggressive or passive aggressive. Sometimes I have to be like that and then it gets annoying, but when I was doing this project, I had to like be more passive and actually listen more"
Overall program: Recommendations	
Increased time in program	"Every time when we come here like two hours.... It feels so short and like we just wish we could still stay here."
Lessons: Positive aspects	
Learned about food environment disparities	"It really like made me realize that it is mostly the neighborhoods that colored people are mostly in, and that we mostly have like most of the same unhealthy stores. There is barely any healthy stuff. You just always see the same unhealthy snacks, and you really do not have a choice whether to eat healthy because all you see is unhealthy. So, that is what you want mostly go for."
Enjoyed the nutrition lesson	"It was a very interactive lesson. Like I know some people are more hands on.... Yeah, I really liked that we were able to look at different products."
Learned about nutrition	"Most of the snacks have a lot of saturated fat and like, I knew about fat in food obviously, but I didn't know about saturated fat, so that is one thing that I learned."
Made nutrition behavior changes based on lessons	"It kind of makes me want to like see the back of like a bottle of Arizona or anything I buy, a drink or like a snack, to make me look in the back of it to see if it is healthy for me or not."
Lessons: Recommendations	
More nutrition education	"We can learn more about nutrition and like, maybe not necessarily having homework, but additional or optional assignments that we can do to broaden our knowledge about healthy nutrition and physical activity."
More information about healthy snacks	"They could have been like, 'instead of buying chips, buy this. Or instead of buying this Hershey's bar, you could get this granola bar or something.'"

Assessments: Positive aspects	
Enjoyed the assessment process	"My favorite part was when we went to the deli, and we got to take pictures and notes of how it looked."
Learned about food environment disparities	"When you walk into a store, the unhealthy snacks is advertised way more than unhealthy snacks, and like when you actually see the healthy snacks, they are all the way in the back, and they look unappealing."
Assessments: Recommendations	
Visit more bodegas	"I do think that we should go to more stores around the community, just because there are a lot of stores next to each other in this community. So, to be able to research and look at more stores would be helpful."
Visit bodegas focused on healthy snacking	"Like going to a healthy store and seeing what they have there can help like us come up with ideas for things that can go inside the deli and that would improve healthy eating habits in communities around."
Conduct additional fieldwork	"I think we should have the community's opinion, you know, since we're trying to help the community.... I think we should get their opinion and see what they want to change as to how they view the store and asking the questions, like we gotta see if they agree or disagree, or what can we improve."
Presentations: Positive aspects	
Enjoyed creating presentations	"I love making presentation because it opened up my mind. I liked the part where we were making presentations because it allowed me to get creative and it allowed my brain to flow on what it is that we are going to do and what steps that we are going to take to make a change."
Enjoyed delivering presentations	"I like doing the presentation, although I am not a speaking person, but it was nice to let people know about the community."
Benefited from interacting with panelists	"What I liked about it is like, how they paid close attention to us, and they gave us all of their attention and they respected us."
Improved public speaking skills	"Before I came to this program, I am not really like big on public speaking either, like I kind of have anxiety and get nervous, but, you know, I wanted to push myself to get better because public speaking, like, it is kind of like a big thing in a lot of places. And if I begin high school or college, I am going to have to kind of not be as nervous, so this kind of trained me for it and made me a little better at public speaking than I was before."
Improved advocacy knowledge and efficacy	"I learned that children have a big say in what goes on in communities because children are the future."
Presentations: Recommendations	
More time and resources to create presentations	"We could have had more time to create the presentation, because even though this was low stakes, maybe if we were making more high stakes, and have more time to practice it, we could have made like, even more like a bigger impact."

4.4 Discussion

The purpose of this study was to conduct a mixed methods process evaluation of the adapted YEAH! curriculum that focuses on snacking behaviors among adolescents in an urban community. Results from the process evaluation revealed high rates of participant retention (94.74%), participant attendance (93.52%), dose delivered (98.94%), intervention fidelity (98.5%), participant engagement (4.97/5), and participant program satisfaction (4/5). This suggests that adapting YEAH! to include nutrition and snacking is both feasible and acceptable. Possible reasons for high retention, attendance, engagement, and satisfaction alongside recommendations that may improve future interventions are discussed below.

Program implementation during the summer and at a non-school organization like the BGC may have contributed to high attendance and retention. In the summer, youth may have fewer competing priorities compared to the academic year. In a study where YEAH! adult facilitators were surveyed and interviewed to evaluate program implementation, they reported that "sports and school" and "standardized testing" were reasons for absences.[29] In this study, there were no academic or school-related reasons for missing sessions, rather reasons included healthcare appointments and home/childcare responsibilities. Consistent attendance may also be due to this program being at the BGC. One of the recommendations from the study with YEAH! facilitators was to hold the program at venues that have regular attendance.[29] The BGC is an organization that meets regularly throughout the school year and summer, possibly promoting consistent attendance among adolescents. Another study of YEAH! also compared psychosocial and health behavior outcomes at school versus non-school based clubs, like the BGC.[28] Though attendance was not measured, the study reported that non-school based clubs had improved psychosocial outcomes compared to school clubs. This may be due to the different environment

in non-school based clubs that may be more enjoyable to youth. School based clubs are more focused on fostering knowledge and skills, while non-school based clubs have an environment focused on promoting youth and social development.[28]

The provision of a stipend to youth in this program may have also contributed to attendance and retention. Retention in this study is higher, but comparable to other studies of YEAH! One evaluation of YEAH! reported a retention rate of 73% and another 72%, and that was primarily due to 2 of the clubs that hosted the program dropping out of the study (versus the participants themselves).[25,27] In an evaluation, YEAH! adult facilitators from both these studies were asked to pick reasons for participant retention from a list of 8 different choices, and the top reason was incentives, such as a stipend, gifts, and prizes.[29] They also remarked that the prospect of the incentive at the end of program kept students "returning each week." This present study had a similar incentive structure, where stipends were staggered throughout the program. This method may have promoted retention. In addition, there is research suggesting that stipends promote attendance and retention as they allow youth to be a part of a program that they might not otherwise be a part of due to financial reasons (i.e., having to work instead).[44,45]

High participant satisfaction and engagement may have been related to the youth advocacy aspect, which involved adolescents as change agents and engaged them in transformation. Research reveals that adolescents strive to be autonomous and exercise agency, especially regarding food.[9] As such, programs that harness autonomy and agency may be especially favorable among adolescents. There is little research on adolescent satisfaction with other youth advocacy for health programs, but studies that have components involving adolescents as change agents also report participant satisfaction. For example, in one study, a corner store was redesigned to promote healthy eating, and adolescents were involved in the

marketing campaign.[46] Focus groups with adolescent revealed that they enjoyed the process due to their participation in decision making. Another intervention attempted to promote healthier eating by capitalizing on adolescents' desire to participate and make change.[47] The randomized-controlled trial consisted of a nutrition education session that exposed practices of the food industry that promote unhealthy eating (i.e., deceptive labeling, etc.) to encourage adolescents to "take a stand" against junk food and food companies. A day after the intervention, students who received the education chose fewer junk food choices compared to a control group. These studies, alongside results from this process evaluation, reveal that youth advocacy is a technique that can be used in a wide variety of nutrition interventions to cultivate participant satisfaction and possibly even improved dietary outcomes.

Another reason for positive process evaluation results may be the ability to socialize and relationship building fostered during the program. In focus groups, participants mentioned that they have not socialized much during the Covid-19 pandemic, and this was one of the first times they were able to do so in-person. As such, this program may have fulfilled social needs. Research suggests that one of the reasons adolescents participate in programming is to make friends.[48] As such, this program provided that opportunity as adolescents may not have been attending in-person school or programs for approximately a year during the Covid-19 pandemic. Similarly, in the study with YEAH! facilitators, some reported some students dropped out of the program because their friends also did so or were not participating.[29] This further describes the benefit of having friends participate together in a program. Overall, an environment that promotes socializing and friendship may increase intervention satisfaction and retention.

4.4.1 Limitations and Strengths

This study systematically assessed feasibility of a youth advocacy program promoting healthy snacking. Nevertheless, limitations exist. Firstly, the study did not utilize external evaluators. However, evaluators were trained in process evaluation methodology and hired to the research group specifically for the evaluation, which reduced bias. Additionally, the focus groups conducted at the end of the program focused on participant perspectives. Other process evaluations have included stakeholder evaluations,[29,42,49] which may provide additional insight on feasibility and acceptability. However, this study has important strengths. Process evaluation measures were operationalized through a thorough review of the literature, establishing best practices for future process evaluation studies. This study's strengths also include utilizing a mixed methods approach, which allows for the triangulation of findings and yields specific recommendations for improving feasibility and acceptability in future iterations of the adapted YEAH! curriculum.

4.4.2 Implications for Theory, Policy, and Practice

Overall, this study reveals that youth advocacy related to snacking is feasible and acceptable. Other interventions targeting adolescent health should consider utilizing youth advocacy as a method to engage adolescents, implementing programs in the summer, providing staggered stipends, and encouraging socializing during programming. Future research should modify this youth advocacy program based on the results of this process evaluation and use a sample size with sufficient power to assess the program's efficacy in improving snacking behaviors.

4.5 Acknowledgments

This research study received funding from the Tuft Foundation. The authors would also

like to thank the staff and youth members of the Boys and Girls Club for their support and continued collaboration, all of which made this research possible.

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CHAPTER 5

CONCLUSION

The overall aims of this dissertation are to: 1) investigate differences in the snacking behaviors of adolescents by socioeconomic status through analysis of National Health and Nutrition Examination Survey data, 2) explore factors that influence the snacking behaviors of adolescents from urban communities through interviews, and 3) assess the feasibility of a youth advocacy program promoting healthy snacking among adolescents at a Boys & Girls Club in New York City through a mixed methods process evaluation. Implications of this dissertation on future research, practice, and policy are discussed below.

5.1 Additional Research Needed on Adolescent Snacking Behaviors by Sociodemographic Characteristics

This dissertation explored socioeconomic status differences in types of foods/beverages and nutrients consumed by adolescents when snacking. Analysis revealed that adolescents from lower-income backgrounds have poorer snacking behaviors than those from higher-income backgrounds. However, there is still further research needed on adolescent snacking by various sociodemographic characteristics. For example, additional analysis of National Health and Nutrition Examination Survey (NHANES) data to examine differences in types of foods/beverages and nutrients consumed by adolescents when snacking by racial/ethnic background and geographic location (urban versus rural) should be conducted. In addition, evidence in this dissertation suggests that there are influences on snacking behaviors that are unique to adolescents in New York City (NYC). As such, analyzing datasets specific to NYC would provide a more detailed description of NYC adolescent snacking behaviors than nationally representative data. An example of an NYC-specific dataset is the NYC NHANES. However, the

most recent cycle of the NYC NHANES was conducted in 2013-2014, highlighting the need for another cycle of NYC NHANES. Overall, these analyses would provide critical information for the design of additional targeted efforts to improve adolescent snacking, as well as efforts to remediate disparities in this eating occasion.

5.2 Additional Qualitative Research Needed on Factors that Influence Snacking Behaviors of Adolescents from NYC

This dissertation explored factors that influence snacking among adolescent members of a Boys & Girls Club (BGC) in NYC through interviews. Although this study provided useful information, there were some interview findings that could be further qualitatively explored to better understand nuances in snacking behaviors among adolescents from NYC. In the interviews, family culture emerged as a factor that influences snacking behaviors among adolescents from NYC. Adolescents reported that family culture impacts snack foods consumed at home and influences adolescents to purchase certain snacks to get a break from cultural foods. An additional qualitative exploration of cultural snack food consumption, such as when they are eaten and if they are perceived as healthy or not, may help in designing interventions to address snacking among diverse adolescents from NYC. In addition, corner stores emerged as important in influencing availability and accessibility to unhealthy snacks among adolescents. Further exploring adolescents' engagements with corner stores may be important. Another study qualitatively examined this with adolescents in Philadelphia and uncovered information about who adolescents visit corner stores with and why they visit certain corner stores over others.[1] Given the high availability and accessibility of corner stores in NYC, it is important to conduct this among adolescents in NYC. This information would be important in refining efforts to improve adolescent snacking in NYC.

In addition, the qualitative study in this dissertation was used as formative work to adapt the Youth Engagement and Action for Health! (YEAH!) curriculum to focus on promoting healthy snacking in corner stores. Based on interview findings, a nutrition lesson was added to increase knowledge of health benefits/concerns of unhealthy snacking, a TED talk was shown that discusses how food marketing reduces food autonomy, and assessments focused on facilitators and barriers to snacking were conducted at corner stores in the community. As such, this qualitative study, and future qualitative studies further exploring influences of snacking among adolescents, can also be used to create additional healthy snacking programs that address other snacking influences.

5.3 Best Practices and Recommendations for Future Implementations of the Adapted YEAH! Curriculum to Promote Healthy Snacking Behaviors in Corner Stores

The mixed methods process evaluation in this dissertation evaluated the practicality and acceptability of the YEAH! curriculum adapted to focus on healthy snacking in corner stores among adolescents from a BGC in NYC. From this experience emerged the following best practices and recommendations for future studies interested in implementing this adapted version of the YEAH! curriculum.

5.3.1 Best Practices

5.3.1.1 Partnering with a Boys & Girls Club

Partnering with a BGC is important for engaging adolescents, building trust in the community, and ensuring program sustainability. We were able to work with the BGC in NYC for both the formative work (i.e., interviews), as well as program implementation. Since the program was implemented with the same demographic of youth as the formative work, we were able to properly target factors that influence snacking among these youth, which may have added

to program relevance and adolescent engagement. Through the continued partnership, we were also able to build trust and rapport with the BGC's adolescent membership, which may have additionally contributed to high participant satisfaction and engagement. Lastly, hosting the program at a BGC is important for sustainability. Staff can be trained on the curriculum, and the program can be adopted for use with adolescent members of the BGC for years to come.

5.3.1.2 Utilizing Photovoice for the Corner Store Assessment

Adolescents stated that the photovoice corner store assessment was one of the most enjoyable aspects of the program. Other youth advocacy initiatives have utilized assessment tools, such as paper inventories or digital mapping.[2,3] However, continuing to use photovoice as an assessment tool, versus these other methods, may contribute to high participant satisfaction and engagement in future iterations of this program.

5.3.2 Recommendations

5.3.2.1 Additional Trainings on Advocacy, Nutrition, and Healthy Snacking

Through focus groups assessing program satisfaction at endpoint data collection, youth expressed wanting additional information specific to food advocacy. As such, there should be a lesson specifically on food advocacy efforts and NYC agencies and organizations that could be involved in the implementation of adolescents' corner store improvement plans. Adolescents also enjoyed the nutrition lessons and asked for more nutrition information. The nutrition lesson in this project was added to the original YEAH! curriculum and taught youth how to read a nutrition facts label using commonly purchased snack foods/beverages from the corner store as examples. It focused on educating adolescents on dietary components to limit (i.e., added sugar, sodium, etc.). An additional lesson that may be beneficial is teaching adolescents how to identify healthy snacks in corner stores as alternatives to the energy-dense, nutrient-poor snacks

commonly purchased. This may include instructions on identifying whole grain and assessing fiber content.

5.3.2.2 Additional Community Assessments

Adolescents mentioned wanting to assess more corner stores and conduct further fieldwork, such as interviewing corner store staff and surveying community members. They remarked that this information would be useful in developing their corner store improvement plans and ensuring community buy-in. As community member interviews and surveys are options in the original YEAH! curriculum and have been implemented in other youth advocacy programs,[2,4] adding them into this adaptation, alongside the assessment of additional corner stores, would be feasible.

5.3.2.3 Establish Partnerships with Decision-Makers

To make more progress on corner store improvement plans, it may be beneficial to have partnerships with decision-makers and decision-making organizations throughout program implementation. In this project, decision-makers were brought in to meet with adolescents at the end of the program. However, other youth advocacy efforts involving corner stores have engaged decision-makers at program conception, which allowed for swift implementation of corner store improvement plans.[2,5,6] In addition, a study of YEAH! examined the presence of partnerships with city and county health departments throughout program implementation and found that school-based clubs with these partnerships were better able to achieve advocacy goals.[7] One method to incorporate decision-makers throughout the program would be to have decision-makers give a presentation on their agency's involvement in advocacy work during the introductory lessons. Overall, having decision-maker partnerships throughout program

implementation would be beneficial for supporting adolescents' knowledge of advocacy, as well as achieving advocacy goals leading to healthier corner store environments.

5.3.2.4 Increase Number of Sessions

To accommodate the aforementioned changes, many of which include adding components to the curriculum, additional sessions are required. This would be an acceptable change from the participant standpoint, since one of the recommendations that adolescents had in this project's focus groups was to increase time spent in it. Additionally, YEAH! is designed to be a 14-session curriculum, so lengthening this adapted version is feasible. There are several sessions that could be added, including decision-maker presentations on their food advocacy experiences, an additional nutrition lesson, additional community assessments, and a celebration (as is part of the original YEAH! curriculum). If these 4 sessions are added, with the current program structure (Monday – Thursday), the program could be extended a week and could continue to be implemented in the summer, which was also a factor in high participant attendance and retention.

5.4 Continued Efforts Needed to Engage Adolescents as Advocates in Improving Nutrition

This dissertation revealed that engaging adolescents as advocates for healthier snacking is powerful for a variety of reasons. In terms of improving nutrition behaviors that are subject to personal, behavioral, and environmental factors, adolescents are experts in their own lives and communities. As such, it is important to acknowledge that adolescents may have their own, viable solutions to nutrition problems. These solutions may even be more effective than solutions determined by researchers, who oftentimes have less exposure and lived experience with the factors that influence nutrition behaviors.

In addition, this dissertation's mixed methods process evaluation reported high rates of participant attendance, retention, engagement, and satisfaction. These successes may be due to the utilization of youth advocacy. Adolescents crave independence, autonomy, and exercising agency, and youth advocacy is a method that harnesses these values. Ultimately, if the goal is to promote health, it is important for researcher to acknowledge adolescents' values and goals, strive to foster their ambitions, and engage adolescents as change agents in the health promotion process.

5.5 Summary

This dissertation advanced knowledge of adolescent snacking behaviors and the feasibility of a youth advocacy program promoting healthy snacking among adolescents in NYC. Findings from each of this dissertation's projects have implications for more targeted efforts to address poor snacking behaviors among adolescents. Information from this dissertation can also be used to identify best practices to empower adolescents to be advocates for their own health, as well as the health of their communities.

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APPENDIX A

FACTORS THAT INFLUENCE SNACKING INTERVIEW GUIDE

Phone Interview Guide

Thank you for joining me for today's interview and for filling out all the required forms. My name is Navika and I will be leading you through the interview. Before we start, I want to review some information about the study, which you also read in the form you signed online.

We work at Cornell University, which is a college in upstate New York. We are doing this study to learn about youth's snacking behaviors because we don't know a lot about them. Over the next hour, you will participate in an interview, and it will be audio-recorded. In the interview, I will ask you questions about your snacking habits.

The questions we will ask are only about what you think. There are no right or wrong answers. In addition, we won't link your name to any information we use from the study. You can ask questions about this study at any time. If you decide at any time not to finish, you can ask us to stop. At the end of the study, I will confirm your mailing address and we will send you a Visa gift card for participating in the study.

We received your permission online, but I just want to confirm. Please say "Yes" if you would like to participate in this study.

Icebreaker

Great! So, I wanted to start with a question that would help me get to know you. Tell me about some of your favorite snacks to eat or drink.

Main Questions

1. **When I say the word "snack," what do you think of?**
    a. How is a snack different than a meal?
    b. What do you think about a drink being a snack?
2. **When you want a snack, how do you decide what to snack on?**
    a. Think about some of your go-to snacks. What are some reasons you snack on them?
    b. Think about some of the times that you have snacked on something you didn't really like. What were some of the reasons that you snacked on those things?
    c. What do you know about how snacking affects your health?
        i. What about how different snacks affect your health?
        ii. How does what you know about snacking and health play a role in what you snack on?

d. How does where you are influence what you snack on?

    i. What about when you're at home?

    ii. What about when you're at school?

    iii. Tell me about some of the things you do after-school.

        1. What about when you're at [after-school activity]?

    iv. Tell me about some of the places you buy snacks.

        1. What about when you're at [type of store]?

e. How does who you are with influence what you snack on?

    i. What about family?

    ii. What about friends?

f. When you want a specific snack, how sure are you that you are able to eat what you want?

    i. How does that compare to meals?

3. When I say the phrase "healthy snacks," what do you think of?

a. What makes those snacks healthy?

b. How does that differ from a regular snack?

c. Some people say snacks with whole grains are healthy. What do you know about those foods?

d. Some people say fruits and vegetables are healthy. What do you know about those foods?

4. You told me what you think healthy snacks are. What are some of the reasons that you choose healthy snacks to snack on?

a. How do you feel when you choose a healthy snack?

b. How does your health play a role in whether you choose a healthy snack?

c. How does where you are influence whether you have a healthy snack?

i. What about when you're at home?

ii. What about when you're at school?

iii. What about when you're at [after-school activity]?

iv. What about when you're at [type of store]?

d. How does who you are with influence whether you have a healthy snack?

i. What about family?

ii. What about friends?

e. When you want a healthy snack, how sure are you that you can eat a healthy snack?

APPENDIX B

PROCESS EVALUATION DOCUMENT

Checklist

Session #: Time:	Was this component implemented?	If Yes, on a scale of 1-5, how well was this implemented in accordance with curriculum?	If Yes, on a scale of 1-5, how engaged were participants?	Field Notes (observational: observations about physical/social environment; methodological: comments about the actual activity itself; technical: use of technology; personal: personal experience)
Activity #1: Start time: End time:	☐ Yes ☐ No	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	
Activity #2: Start time: End time:	☐ Yes ☐ No	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	
Activity #3: Start time: End time:	☐ Yes ☐ No	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	
Activity #4: Start time: End time:	☐ Yes ☐ No	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	
Activity #5: Start time: End time:	☐ Yes ☐ No	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5	

Attendance

How many participants were at today's session? _____ out of _____

What were the names of the participants that were missing?

Overall field notes:

1) Observational: observations about physical/social environment

2) Methodological: comments about the session itself that could impact intervention outcome

3) Technical: use of technology

4) Personal: personal experience

5) What factors in the organization, community, social/political context, or other situational issues could potentially affect either intervention implementation or the intervention outcome?

APPENDIX C

PROCESS EVALUATION FOCUS GROUP GUIDE

Focus Group Guide

Hello, everyone. Welcome to the focus group. Today, we're going to talk a little about the program, what you liked about it, what you learned from it, what you didn't like about it, and what we can improve. We really want to know what you all think, so we're taking this time to ask you. We're even audio-recording this so we can listen back on the feedback you gave us and make changes. Because we're audio-recording it's really important you all follow the following instructions:

1. I will ask questions. When I finish asking questions, I will open up the floor for responses. However, only one person can talk at one time, or the audio-recording will be difficult to understand.
2. Therefore, if you want to speak, please hold up your name plate and wait until I say your name, and then you can respond.
3. If you would like to follow-up with something the previous person said, please also raise your name plate.
4. If you have any questions or clarifications about a question, please also raise your name plate.
5. I may call on you to clarify something or tell me more about it, in that case you do not have to raise your name plate. But only the person I called should respond.
6. Also, because you are wearing masks, please speak up.

Any questions? Okay, we will go ahead and start the audio-recorders.

1. Tell me about your experience in the program.

2. What did you like most about the program?

    1. Let's talk about the introductory lessons:
        a. In those lessons, we brainstormed what communities we were part of, learned about advocates/played the advocates game, and watched the food justice video. What did you like about those lessons?

        b. What did you learn about food justice?

        c. What did you learn about advocacy and the impact you can make in your community?

        d. How can we improve the community and advocacy lessons?

2. Let's talk about the snacking nutrition lesson:
    a. What did you like about the snacking nutrition lesson?

    b. What did you learn about snacking and nutrition from the snacking nutrition lesson?

        1. Tell me about some snacking behaviors you plan to change or have changed after the snacking nutrition lesson.

    c. How can we improve the snacking nutrition lesson?

3. Let's talk about the photography project and coming up with your bodega improvement plan:
    a. What did you like about the project?

    b. What did you learn from the project?

        1. What did you learn about bodegas from your communities in this project?

        2. What did you learn the availability and access to healthy snacking in your community?

    c. How can we improve this project?

4. Let's talk about the presentations:
    a. What did you like about the presentations?

    b. What did you learn from doing your presentations with the panelists?

        1. What did you learn from the panelists?

    c. How can we improve the presentations with panelists?

3. What are some things we haven't discussed that you gained or learned from being in the program?

    1. Tell me about some people you got to know from the program that you didn't know before or that you got to know better.

        a. What about anything you gained from the program leaders?

4. What did you like least about the program?

    a. How can we improve those things?

5. Anything else you all would like to add about the program?