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Countywide BMI surveillance and community-level approaches to improve access to nutritious food among low-income residents in San Diego, California

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Countywide BMI surveillance and community-level approaches to improve access to nutritious food among low-income residents in San Diego, California

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy

in

Public Health (Epidemiology)

by

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2015

The Dissertation of Amanda Rondinelli Ratigan is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

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2015

DEDICATION

To my supportive parents who sparked my interest in public health and epidemiology long ago; and to my husband Emmett whose love and encouragement has helped me through this journey.

EPIGRAPH

When it is obvious that the goals cannot be reached, don't adjust the goals, adjust the action steps.

Confucius

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LIST OF ACRONYMS

BMI	Body mass index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CHIS	California Health Interview Survey
CPPW	Communities Putting Prevention to Work
CPS	Current Population Survey
EBT	Electronic benefit transfer
EHR	Electronic health record
FI	Food insecurity
FV	Fruits and vegetables
HHSA	Health and Human Services Agency
NHANES	National Health and Nutrition Examination Survey
NSLP	National School Lunch Program
PSE	Policy, systems, and environmental
SANDAG	San Diego Association of Governments
SDIR	San Diego Immunization Registry
SDUSD	San Diego Unified School District
SES	Socioeconomic status
SFSP	Summer Food Service Program
SNAP	Supplemental Nutrition Assistance Program
SRA	Sub-regional area

SSI	Supplemental Security Income
USDA	United States Department of Agriculture
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children

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Chapter 2, in full, was prepared for submission for publication of the material. Co-Authors include Lemus, Hector; Chambers, Christina; Anderson, Cheryl; Cronan, Terry; Browner, Deirdre; Lindsay, Suzanne. The dissertation author was the primary investigator and author of this material.

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1. Richard S. Garfein, Katherine A. Banares, **Amanda J. Rondinelli**, Stephanie Brodine, Jazmine Cuevas, Michael Metzner, Eyasu H. Teshale. Correlates of Syringe Source Used Most Often by Injection Drug Users in a City with Limited Legal Access to Clean Syringes.

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RESEARCH PRESENTATIONS

Oral Presentations

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ABSTRACT OF THE DISSERTATION

Countywide BMI surveillance and community-level approaches to improve access to nutritious food among low-income residents in San Diego, California

by

Amanda Rondinelli Ratigan

Doctor of Philosophy in Public Health (Epidemiology)

University of California, San Diego, 2015
San Diego State University, 2015

Professor Suzanne Lindsay, Chair

Background: Policy, systems, and environmental approaches are being implemented in San Diego to promote healthy choices by improving access to healthy food among low-income populations. Also, the County of San Diego Health and Human Services Agency has developed a registry-based BMI surveillance system.

Objectives: Study one examined the demographic representativeness of the County of San Diego BMI Surveillance System. Study two determined independent predictors of ongoing use of Fresh Fund, a farmers market monetary incentive program for government nutrition assistance recipients. Study three examined monthly patterns of food insecurity among families and children attending Summer Meals, a Summer Food Service Program for low-income children.

Methods: Study one compared demographics of the BMI surveillance sample to the general population of San Diego in 2011 by sub-regional area (SRA). Study two used Poisson regression to examine the relationship of characteristics with the number of Fresh Fund visits from 2010 to 2012, and mixed effects modeling to explore the within-individual changes over time in self-reported fruit and vegetable (FV) consumption and perception of diet quality. Study three examined the association of month of Summer Meals attendance with food security in 2011.

Results: Study one: Younger (2-11 and 12-17 years old) and older (≥65 years old) aged groups in the surveillance sample (n=302,691) were representative of the general population among males and females in 90%, 75%, and 85% of SRAs, respectively; and 71% were representative for at least one racial/ethnic group. Study two: Among 7,298 participants, those who reported more servings of FV/day at baseline came to Fresh Fund a greater number of times, but only among those who came ≤6 months. The odds of an increasing number of servings of FV consumed and improved perception of diet quality increased by 2% and 10% per month of Fresh Fund use, respectively. Study three: 65% of households, 54% of adults, and 47% of children had low/very-low food security (n=325).

Conclusion: The value of San Diego BMI Surveillance System is its ability to estimate and monitor neighborhood-level BMI. In addition, this dissertation provides evidence that reassures the need for community-level programs to improve access to nutritious food among government assistance recipients and children from low-income families.

CHAPTER 1: INTRODUCTION

OVERVIEW

In 2009, the American Recovery and Reinvestment Act provided federal funding to the U.S. Health and Human Services Agency (HHSA) to support 50 U.S. communities in the implementation of the Communities Putting Prevention to Work (CPPW) initiative.[1] CPPW, led by the Centers for Disease Control and Prevention (CDC), was created to promote healthy behaviors related to obesity prevention, improving nutrition, increasing physical activity, and tobacco control and prevention. The County of San Diego HHSA was awarded funding to implement community-level activities that support healthy living by reducing risk factors for poor health, preventing or delaying chronic diseases and promoting wellness among San Diego residents. The CPPW effort in San Diego was named *Healthy Works: Paths to Healthy Living*. Fifteen interventions were implemented throughout the county to address obesity, physical inactivity and poor nutrition.

In 2010, San Diego HHSA received additional funding from the CDC for enhanced data collection and evaluation of three Healthy Works interventions, including the Healthy Foods Farmers Market Fresh Fund Incentive Project (Fresh Fund), the Healthy Schools Healthy Breakfast Program, and the Healthy Schools Summer Meals Program (Summer Meals). The supplementary funding also supported further development and implementation of a countywide body mass index (BMI) surveillance system, the County of San Diego BMI Surveillance System. This dissertation will examine data collected as part of the Fresh Fund, Summer Meals, and BMI surveillance programs.

BACKGROUND AND SIGNIFICANCE

In the United States (U.S.) 72% of men and 67% of women are described as being overweight or obese, and the trend over the past few decades suggests that the prevalence is increasing.[2,3] The obesity epidemic is largely attributed to a reduction in physical activity and the ready availability of inexpensive and unhealthy food choices.[4-7] Furthermore, due to limited resources and a lack of access to healthy, affordable foods, food insecure and low-income individuals are especially vulnerable to obesity. A multitude of socioeconomic factors are to blame including the fact that low-income neighborhoods frequently lack access to full service grocery stores.[8,9] and when available, healthy food is often more expensive, and may be of lower quality compared to choices in higher income neighborhoods.[10-12] Furthermore, low-income communities have greater availability of "fast food" restaurants especially near schools, where calorie-dense low-nutrient foods are sold at inexpensive prices.[13,14] Policy, systems and environmental (PSE) approaches are being implemented across the U.S to improve access to healthy food options among low-income populations with an overarching goal of reducing rates of overweight and obesity.[1,15] Having the ability to monitor local-level trends in obesity is essential to the evaluation and success of the PSE changes that are occurring within communities.

THE COUNTY OF SAN DIEGO BMI SURVEILLANCE SYSTEM

Body mass index (BMI) as a measure of body fat has been widely used since 1985 when the National Institutes for Health released a consensus statement recommending its use in clinical settings.[16] BMI does not directly measure body fat and

therefore has some weaknesses;[17] however, there are numerous advantages to using BMI and it continues to be the primary method to quantify prevalence of overweight and obesity in US populations. BMI is positively associated with high blood pressure, coronary heart disease, type 2 diabetes, dyslipidemia, gallbladder disease and osteoarthritis, and therefore serves as a useful tool for screening individuals at risk of obesity-related health outcomes.[18,19] County and state health departments are responsible for monitoring and promoting the health of their communities, and the ability to provide appropriate prevention and intervention programs for populations at high risk for overweight and obesity at the neighborhood level is critical to their mission. However, there are significant challenges in obtaining generalizable local surveillance data.

Current population-level BMI estimates are obtained through national or state-level surveys such as the National Health and Nutrition Examination Survey (NHANES),[20] Behavioral Risk Factor Surveillance System (BRFSS)[21] and the California Health Interview Survey (CHIS).[22] While useful, these large surveys have their limitations, such as self-report, sampling, and non-response biases; they are not necessarily geographically representative of populations at the community level; and they do not give a sufficient understanding of the problem of overweight and obesity among the sub-groups most at risk at a local level. Valid and reliable BMI estimates that are representative of local populations at the neighborhood level are needed to evaluate the effectiveness of community interventions and prevention programs designed to reduce overweight and obesity. The use of existing data collected in electronic health records (EHRs) from local medical offices and clinics is one way to capture this more useful data.

Recently there has been a surge of interest in the use of EHRs to provide data for public health purposes.[23] [24] The uptake in the use of these electronic tools by hospitals and healthcare systems has been significant; however such data is only representative of the patients served by that hospital or healthcare system. The data may be very valuable for prevention and intervention programs initiated by the hospital or healthcare care system for their members, but there are questions about its usefulness and accuracy for the local community as a whole. Obtaining comprehensive and accurate data for local communities would assist all of the health care providers in those communities as well as social service agencies, schools, churches and other non-profit and private funding agencies to recognize problems and find solutions.

The County of San Diego Health and Human Service Agency (HHSA) established the San Diego Regional Immunization Registry (SDIR) for primary care medical providers to report childhood immunizations to the HHSA in 1997.[25] In 2008, HHSA added a module for provider entry of height and weight information on children. In 2010, with CDC funding through Communities Putting Prevention to Work (CPPW),[1] in an attempt to collect accurate local data, HHSA expanded their BMI surveillance efforts to include adults by developing proof of concept electronic interfaces and linkages with 12 clinics and medical groups. These interfaces and linkages facilitated the automated transfer of clinical data to the SDIR.

As with the implementation of any new surveillance system, there are successes and challenges that need to be considered to maintain or improve the quality of the data being collected and to ensure sustainability of the program. In addition, population validity is a concern when extrapolating data collected from a convenience sample to a

larger population. It is hypothesized that the sample population captured through the 12 clinics and medical groups is not representative of the general population of San Diego County in regards to age, gender and race/ethnicity; however, it may be representative at the sub-regional level, and there may be some areas where the San Diego HHSA could have confidence in the overweight and obesity prevalence estimated using data provided by primary health care providers. This study evaluated the levels of representativeness of the SDIR/BMI sample population to the general population of San Diego at the sub-regional area (SRA) level.

HEALTHY FOODS FARMERS MARKET FRESH FUND INCENTIVE PROJECT

PSE strategies to reduce rates of overweight and obesity include approaches to improve access to better quality food sources. One such program, the Healthy Foods Farmers Market Fresh Fund Incentive Project (Fresh Fund) aimed to do just that. Fresh Fund was developed to encourage healthy food choices among low-income families receiving governmental nutrition assistance by improving access to fresh fruits and vegetables (FV) through the use of local farmers markets.

Current daily recommendations of fruit and vegetable (FV) intake range from five to thirteen servings depending on age, sex, and activity level;[26] yet less than one-third of Americans report consuming two or more servings of fruit, or three or more servings of vegetables per day.[27] Moreover, evidence suggests that consumption varies by individual and neighborhood socioeconomic status (SES) where lower SES has been linked with decreased intake of FV.[28-30] Access to food retail stores with healthier products is

associated with higher quality food consumption,[8,31-33] and people who live in low-income and minority communities have decreased access to healthier food stores.[8,14,34]

In recent years, farmers markets have become increasingly popular as an approach for improving access to nutritious fresh foods for low-income consumers who receive government nutrition assistance. From 2008 to 2014, there was a 587% increase in the number of authorized farmers markets accepting Supplemental Nutrition Assistance Program (SNAP; also known as CalFresh in California) benefits through the use of electronic benefit transfer (EBT) machines.[35] To further improve access and affordability, financial incentives to shop at farmers markets have been implemented among economically disadvantaged populations who receive SNAP and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) nutrition benefits.[36,37]

Previously published data suggests that market use is associated with increased FV consumption among SNAP and WIC beneficiaries;[38-40] and furthermore, that farmers market incentive programs may increase spending of benefit money,[41] as well as the purchase and consumption of FV.[42-48] As a result of this previous research, in 2008 the San Diego County Health and Human Services Agency (HHSA) and the San Diego International Rescue Committee created a partnership to fully implement the promising practice of financially incentivizing a primarily low-income refugee community to use government assistance monies and incentives to purchase fresh FV at the existing City Heights farmers market. In 2010, HHSA used Centers for Disease Control and Prevention (CDC) funding to expand the Fresh Fund program to four markets in low-income neighborhoods and expanded to an academic-community practice partnership that included the Division of Child Development and Community Health at the University of

California San Diego for content expertise, and the Institute for Public Health at San Diego State University for evaluation. Fresh Fund follows the CDC's leadership in shifting from a focus on individual health-risk behaviors to the implementation of policy, systems, and environmental (PSE) change for chronic disease prevention.[1,15] Policy decisions to allow farmers markets to accept government assistance monies and to incentivize their participation are substantially different than attempts to convince individuals to change their eating habits.

While promising, researchers that have examined purchase and consumption patterns of FV by low-income populations at farmers markets lacked longitudinal or multivariate analyses,[42-45] did not control for potential confounding by participant characteristics,[47] or did not examine predictors of continued usage.[48] In addition, many of the studies were short-term research projects, and did not necessarily involve attempts to permanently embed the incentive programs into the practice settings of existing farmers markets as San Diego County attempted to do. Herman and colleagues reported on the results of a six-month nutritional intervention that assigned postpartum WIC participants to either an intervention group that received vouchers for shopping at farmers markets or supermarkets, or to a control group.[46] They found that the intervention groups increased and sustained their consumption of FV for six months after the intervention ended.

A better understanding of participant characteristics associated with continued use of farmers market incentive programs, where the data collection and monitoring is a permanent part of the farmers market practice, may help in reaching the low-income populations who need it most. Therefore, the purpose of this study was to examine the

factors associated with the ongoing utilization of a farmers market incentive program among government nutrition assistance recipients in San Diego, California (CA).

HEALTHY SCHOOLS SUMMER MEALS PROGRAM

Food insecurity exists when a household is unable to obtain enough food to meet the needs of its members because of a lack of money or other resources for food.[49] Nationally, 41.4% of households with incomes below the federal poverty line in 2011 were food insecure.[49] California and San Diego share this problem. According to the 2011 CHIS, 46.7% and 50.6% of adults whose income were below the federal poverty level were food insecure in California and San Diego, respectively.[50] The United States Department of Agriculture's (USDA) National School Lunch Program (NSLP) provides free or reduced-cost meals to children from low-income families throughout the school year, and during the summer months through the Summer Food Service Program (SFSP).[51,52]

From 1995 to 2001, the U.S. Census Bureau conducted food security surveys via the Food Security Supplements to the Current Population Survey (CPS), alternating data collection between April and August or September every other year.[53] The prevalence of food insecurity during these years was consistently higher in the August/September surveys when children were not in school than in April, indicating a positive effect of the free/reduced price school meals on food insecurity. Further multivariate analyses, using CPS data, showed that low-income households with school-age children (6 to 17 years old) experienced a higher prevalence of food insecurity in the summer, after controlling for a variety of demographic and household characteristics.[54] However, it remains

unknown whether the level of food insecurity increases as summer progresses. The objective of this research was to examine monthly patterns of food insecurity throughout the summer months, controlling for demographics including socioeconomic conditions. It was hypothesized that as summer progressed, and as more time passed after having access to the free/reduced price school meals, food insecurity would increase among the families attending the Summer Meals Program.

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CHAPTER 2: COMMUNITY BMI SURVEILLANCE USING AN EXISTING IMMUNIZATION REGISTRY IN SAN DIEGO, CA

ABSTRACT

Objectives: This study examines the demographic representativeness of the County of San Diego BMI Surveillance System in order to determine if the BMI estimates being obtained from this system can be generalized to the general population of San Diego at a sub-regional level.

Methods: Height and weight were transmitted from the electronic health records systems of 12 clinics and medical groups to the San Diego Immunization Registry (SDIR). This study compares age, gender, and race/ethnicity by sub-regional area (SRA) (n=41) for the SDIR/BMI sample with general population estimates. A less than 10% difference was used to determine representativeness.

Results: In 2011, the SDIR/BMI sample consisted of 352,924 San Diego residents aged 2 to 100 years. The younger age groups (2-11, 12-17 years) and the oldest age group (≥65 years) were representative in 90%, 75%, and 85% of the SRAs, respectively; while those in the 18-24 (7%) and 25-44 (2%) age groups were the least representative. Furthermore, 71% of SRAs were representative for at least one racial/ethnic group.

Conclusions: The true value of this effort is its ability to estimate and monitor neighborhood-level BMI data, and the fact that the SDIR/BMI sample population appears to demographically represent some SRAs well is encouraging.

INTRODUCTION

Body mass index (BMI) as a measure of body fat has been widely used since 1985 when the National Institutes for Health released a consensus statement recommending its use in clinical settings.[1] BMI does not directly measure body fat and therefore has some weaknesses;[2] however, there are numerous advantages to using BMI and it continues to be the primary method to quantify prevalence of overweight and obesity in US populations. BMI is positively associated with high blood pressure, coronary heart disease, type 2 diabetes, dyslipidemia, gallbladder disease and osteoarthritis, and therefore serves as a useful tool for screening individuals at risk of obesity-related health outcomes.[3,4] County and state health departments are responsible for monitoring and promoting the health of their communities, and the ability to provide appropriate prevention and intervention programs for populations at high risk for overweight and obesity at the neighborhood level is critical to their mission. However, there are significant challenges in obtaining generalizable local surveillance data.

Current population-level BMI estimates are obtained through national or state-level surveys such as the National Health and Nutrition Examination Survey (NHANES),[5] Behavioral Risk Factor Surveillance System (BRFSS)[6] and the California Health Interview Survey (CHIS).[7] While useful, these large surveys have their limitations, such as self-report, sampling, and non-response biases; they are not necessarily geographically representative of populations at the community level; and they do not give a sufficient understanding of the problem of overweight and obesity among the sub-groups most at risk at a local level. Valid and reliable BMI estimates that are representative of local populations at the neighborhood level are needed to evaluate the

effectiveness of community interventions and prevention programs designed to reduce overweight and obesity. The use of existing data collected in electronic health records (EHRs) from local medical offices and clinics is one way to capture this more useful data.

Recently there has been a surge of interest in the use of EHRs to provide data for public health purposes.[8] [9] The uptake in the use of these electronic tools by hospitals and healthcare systems has been significant; however such data is only representative of the patients served by that hospital or healthcare system. The data may be very valuable for prevention and intervention programs initiated by the hospital or healthcare care system for their members, but there are questions about its usefulness and accuracy for the local community as a whole. Obtaining comprehensive and accurate data for local communities would assist all of the health care providers in those communities as well as social service agencies, schools, churches and other non-profit and private funding agencies to recognize problems and find solutions.

The County of San Diego Health and Human Service Agency (HHSA) established the San Diego Regional Immunization Registry (SDIR) for primary care medical providers to report childhood immunizations to the HHSA in 1997.[10] In 2008, HHSA added a module for provider entry of height and weight information on children. In 2010, with CDC funding through Communities Putting Prevention to Work (CPPW),[11] in an attempt to collect accurate local data, HHSA expanded their BMI surveillance efforts to include adults by developing proof of concept electronic interfaces and linkages with 12 clinics and medical groups. These interfaces and linkages facilitated the automated transfer of clinical data to the SDIR.

As with the implementation of any new surveillance system, there are successes and challenges that need to be considered to maintain or improve the quality of the data being collected and to ensure sustainability of the program. In addition, population validity is a concern when extrapolating data collected from a convenience sample to a larger population. It is hypothesized that the sample population captured through the 12 clinics and medical groups is not representative of the general population of San Diego County in regards to age, gender and race/ethnicity; however, it may be representative at the sub-regional level, and there may be some areas where the San Diego HHSA could have confidence in the overweight and obesity prevalence estimated using data provided by primary health care providers. This study evaluated the levels of representativeness of the SDIR/BMI sample population to the general population of San Diego at the sub-regional area (SRA) level.

METHODS

BMI was calculated as weight (kg)/height $(m)^2$, and procedures for measuring height and weight varied by healthcare provider. The transfer of height and weight data through SDIR began in 2011 from 12 public and private clinic systems located throughout San Diego County, including six community health clinic systems, four private medical groups, and two large medical systems. Information transmitted for the purpose of BMI surveillance included age, gender, race/ethnicity, height, weight, date of visit, and clinic visited. Data cleaning was conducted to identify and remove records with biologically implausible values and outliers. Expanded NHANES limits and regression diagnostics (leverage values and studentized residuals) were used for adult records, and

CDC anthropometric programs were used for records of children ages 2 to 18 years old.[12,13] Records for non-San Diego County residents were also removed.

By December 2011, there were over 1.5 million records containing data on height and weight. They included San Diego County residents aged 2 to 100 years old who visited one of the 12 participating clinics or medical groups for an outpatient visit in 2011 (n=352,924). Furthermore, individuals were excluded if they were missing SRA (n=30,147) or gender (n=2,086); leaving a total of 320,691 individuals for analysis.

To evaluate external validity, this study compared frequencies of demographic measures (age, gender, race/ethnicity (Hispanic, White, Black, Asian, Other/≥2 races)) by SRA for the SDIR/BMI sample in 2011 with San Diego population estimates published by San Diego Association of Governments (SANDAG) for 2011.[14] SANDAG estimates were based on U.S. Census data collected in 2010 at the County level. The 41 SRAs in San Diego County are composed of one or more census tracts, and their boundaries have remained essentially unchanged since they were defined by SANDAG prior to the 1970 Census.[15]

Data from 2011 was used because this was the closest year to Census data collection in 2010 and therefore was more comparable than population estimates from more recent years. Data were examined to determine representativeness by age and gender for each SRA in San Diego County. Because of missing or sparse data, race/ethnicity was examined separately for each SRA. Practical significance was reported in place of statistical significance because large sample sizes are more likely to detect small, and potentially inconsequential, differences during hypothesis testing. Percent difference was calculated as the ratio of the differences between the frequencies of a sub-

group in the SDIR/BMI sample and the SANDAG data. A less than 10% difference suggests a representative sample for a given SRA. This research was approved by the University of California San Diego Human Research Protection Program.

RESULTS

Among the 320,691 San Diego County residents in the SDIR/BMI sample in 2011 available for analysis, 56.1% were female, 27.1% were ages 2-11 years, 12.6% were 12-17 years, 7.7% were 18-24 years, 21.7% were 25-44 years, 21.6% were 45-64 years, and 9.3% were ≥65 years old. Almost 36% were missing a race/ethnicity designation, but among the 206,600 who had this information recorded, 35.5% were Hispanic, 49.7% White, 3.8% Black, 6.0% Asian, and 4.9% other/≥2 races. Despite this large percentage of missing values, the SDIR/BMI sample was representative for Hispanics and Whites at the overall County level, which was 32.1% Hispanic, 48.4% White, 4.6% Black, 10.8% Asian, and 4.1% other/≥2 races in 2011.

In Table 2.1, the ratio of the differences between the frequencies of age and gender sub-groups in the SDIR/BMI sample and the SANDAG data with asterisks suggesting a representative sample for a given SRA. Figure 2.1 displays the same information on maps of San Diego County by age group. Yellow shaded SRAs indicate that the SDIR/BMI sample was representative of San Diego for both males and females, red was representative for females only, and blue was representative for males only (although the respective gender was just above the 10% cut-off in these SRAs). The younger age groups (2 to 11 and 12 to 17 years) and the oldest age group (≥65 years), were representative in 90%, 75%, and 85% of the 41 SRAs, respectively; while those in

the 18 to 24 (7% of SRAs) and 25 to 44 (2% of SRAs) age groups were the least representative overall. Furthermore, 12 SRAs (29%) were representative for male gender and 13 SRAs (32%) were representative for female gender; however, an additional 19 SRAs for females and 13 for males were within five points of being categorized as representative.

Table 2.2 describes the ratio of the differences between the frequencies of racial/ethnic sub-groups in the SDIR/BMI sample and the SANDAG data with asterisks suggesting a representative sample for a given SRA. Seventy-one percent of SRAs were representative for at least one racial/ethnic group. The La Mesa SRA was representative for all racial/ethnic groups except for Asians. The SDIR/BMI sample was representative of the general Caucasian population in 16 SRAs (39%), the Black population in 15 SRAs (37%), and the Hispanic population in 13 SRAs (32%); while Asians were the least representative (10% of SRAs).

DISCUSSION

This study examined the demographic representativeness of the County of San Diego BMI Surveillance System to determine whether the BMI estimates obtained from this system can be generalized to the population of San Diego at a sub-regional level. The findings show that younger and older age groups were the most well represented in this convenience sample collected from 12 participating public and private healthcare clinic systems throughout San Diego County. This is likely reflecting the healthcare seeking population since the young adults and middle aged groups are the least likely to visit a physician. In San Diego, the 2010-2011 CHIS data estimated that 93% of children 2 to 11

years old, 92% of adolescents 12 to 17 years old, and 95.7% of seniors 65 years and older had at least one doctor visit in the past year; and that less than 80% of adults 18 to 64 years old visited the doctor once in the past year.[16]

The number of SRAs that were representative for certain age groups, namely 2 to 11, 12 to 17 and ≥65 year olds, suggests that the continuation of this effort could confidently estimate the BMI of these San Diego populations. The County of San Diego HHSA can improve upon capturing a more representative sample of the young adult and middle age groups by securing data use agreements with additional medical institutions (e.g., Kaiser Permanente, Veterans Affairs (VA) San Diego Healthcare System, or military healthcare clinics), and potentially tapping into outside sources of BMI data, including student health services at local universities, county jails and prisons, urgent care visits, health fairs, flu vaccination clinics, certain work forces that require annual physicals, or maybe even from insurance companies that require annual physicals. However, confidentiality concerns among these sources of data would need to be adequately addressed. Arguably, the young adults are ideal for weight management and nutritional interventions because they likely have yet to develop obesity-related chronic diseases; and capturing a representative sample of these age groups would prove useful in monitoring local and regional trends of overweight and obesity over time.

While the proportions of racial/ethnic groups within the San Diego SRAs were not as accurately represented in the SDIR/BMI sample as some of the age and gender groups, some SRAs were more representative than others. Namely, La Mesa was the most representative with all sub-populations represented except for Asians. The results of this study suggest that neighborhood-level BMI estimates obtained from the SDIR/BMI

sample could reflect BMI changes due to community interventions implemented to reduce overweight and obesity among certain race/ethnicities in particular SRAs. Specifically, one-quarter of the Hispanic population in San Diego lives in the South Bay, Chula Vista, and Southeastern San Diego SRAs, all of which appear to be accurately represented by this sample. Conversely, among the Black population in San Diego, the largest proportion live in the Southeastern San Diego (17%), Mid-City (13%) and Central San Diego (8%) SRAs; none of which were representative in the SDIR/BMI sample at the 10% difference cut-off. It is recommended that the San Diego HHSA takes actions to improve the complete reporting of race/ethnicity by healthcare provider offices to reduce the proportion of missing data.

Additional secondary analyses were conducted to examine the overall prevalence of overweight and obesity among adults in the SDIR/BMI sample and to compare these results to the population estimates produced by CHIS. In the 2010-2011 SDIR/BMI sample, 40% of men (vs. 45.5% of men in CHIS) and 29.1% of women (vs. 28.3% of women in CHIS) were overweight, and 30.6% of men (vs. 21.4% of men in CHIS) and 31.9% of women (vs. 22.7% of women in CHIS) were obese. Average BMI was slightly higher in the SDIR/BMI sample than in CHIS (28.2 vs. 27.3 for men and 28.0 vs. 26.4 for women). The higher BMI among the SDIR/BMI sample could be attributed to a number of factors. First, height and weight was self-reported in CHIS and it has been recognized that height and weight estimates obtained in this manner tend to be over- or under-exaggerated depending on gender and BMI.[17,18] In addition, healthcare seeking populations may have higher BMI than general populations because of comorbidities associated with excess weight. Previous analyses on the SDIR/BMI data examining the

CHIS population estimates found an average BMI of 26.9 for clinic visitors and 26.6 for non-visitors.[19] Additional analyses are needed to determine whether the BMI estimates from the healthcare seeking SDIR/BMI sample are accurately measuring the BMI of the general population at the SRA level. CHIS provides weighted averages of BMI by age groups, gender, and HHSA region, but this information is not currently available at the SRA level which would be needed to properly make this comparison. CHIS has recently launched an online tool (AskCHIS neighborhood edition) to provide health estimates at the zip code, city, and county legislative district levels. To further investigate the value of this BMI surveillance system, future research should include conversion of this data to San Diego SRAs and comparison of SDIR/BMI vs. CHIS estimates of overweight and obesity in SRAs that we found to be representative compared to those that were not.

Limitations must be kept in mind when interpreting the results of this study. The SDIR/BMI sample was selected from only 12 clinics and medical groups, many of which were community health clinics, and does not represent all of the health care providers in San Diego County since low-income populations were overrepresented. To obtain more accurate local surveillance data, the comprehensiveness of the healthcare and clinic system participation is needed. Also, the SDIR/BMI sample population represents a convenience sample of individuals who visited their healthcare provider for outpatient services in 2011, and they may not be representative of neighborhoods that the clinic systems serve. The medical reason for the visit was not collected, so it is unknown if the data are disproportionally representing individuals who were in poorer health than the general population. In general, persons overweight or obese may have other health problems that make them more likely to visit their healthcare provider, and thus we might

expect that BMI estimates for patients visiting a health care provider might be higher than those not visiting. However, children visit the doctor on a regular basis for well-child visits which should have no association to health condition. One of the primary purposes of this study was to determine how demographically similar this sample of health care seeking individuals was relative to all those who lived in the sub-region where the health care system provides services. This study was limited in its ability to draw conclusions on the representativeness of the racial/ethnic groups because of the large proportion of patients who were missing information. An analysis of age and gender differences determined that a larger proportion of those who were missing race/ethnicity, compared to those who were not, were male (45.5% vs 43.0%), in the 2 to 11 (32.6% vs 22.2%) and 12 to 17 (16.5% vs 9.7%) age ranges; while a smaller proportion were in the 45 to 64 (16.8% vs 25.3%) and the 65 and older age groups (4.2% vs 12.9%; data not shown).

This study improves our understanding of the generalizability of neighborhood-level BMI surveillance data collected through the combined use of EHR from 12 clinics and medical groups. Comprehensive, longitudinal, community-wide BMI surveillance is needed to track trends in the obesity epidemic at the local level, and to evaluate interventions aimed at reducing rates of overweight and obesity in U.S. communities. In its current state, a combined use of registry data could be useful in estimating BMI among certain populations in a portion of SRAs. However, our study suggests that a large enough proportion of SRAs were representative for the younger and older age groups to make this effort worthwhile. Other counties with access to similar electronic tools and technology could benefit from a model of neighborhood BMI surveillance such as this to estimate BMI among children and seniors. Because the people encompassed by SDIR are

the healthcare seeking population of San Diego, it was these populations to which conclusions can be drawn. The level of representativeness to the entire general population of San Diego depends on the number of health care provider systems willing to share their data. However, there are already county-wide estimates of BMI from sources such as CHIS and NHANES. The true value of this effort is its ability to estimate and monitor neighborhood-level data, and the fact that the SDIR/BMI population appears to demographically represent some SRAs well is encouraging. This could provide the opportunity to evaluate local efforts (including collective impact efforts) to reduce overweight and obesity in those specific SRAs. In an era when the hope is strong that electronic data will assist with our ability to improve population health, this study contributes to our understanding of the value of existing registries and EHR data as a surveillance tool.

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Table 2.1 – Percent difference[a] of age and gender sub-groups between SANDAG population estimates and SDIR/BMI sample data by sub-regional area (SRA), San Diego County, 2011

	Total		2-11		12-17		18-24		25-44		45-64		≥65	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
San Diego County	13.2	-11.7	-0.2*	0.2*	4.9	-5.0	42.5	-34.4	36.0	-27.4	11.9*	-10.3*	2.8*	-2.1*
Sub-Regional Area														
Palomar-Julian	7.2*	-6.5*	-4.3*	4.2*	-0.2*	0.2*	4.1*	-3.9*	29.5	-21.3	8.5*	-7.7*	5.7*	-5.2*
Chula Vista	5.2*	-4.6*	0.6*	-0.6*	5.9*	-5.9*	34.5	-26.7	27.1	-20.6	2.5*	-2.2*	8.9*	-5.6*
South Bay	5.9*	-5.7*	2.7*	-2.7*	5.0*	-5.2*	30.1	-25.2	23.6	-20.7	1.3*	-1.2*	0.4*	-0.3*
Poway	7.4*	-6.6*	-1.3*	1.4*	3.3*	-3.4*	12.4	-12.2	23.7	-17.9	9.0*	-7.7*	5.5*	-4.2*
Mid-City	14.8	-12.7	-0.7*	0.7*	5.3*	-5.2*	43.8	-29.3	34.5	-26.3	9.7*	-8.7*	2.7*	-2.0*
Fallbrook	11.4	-10.2	-3.7*	3.8*	-5.8*	6.7*	17.1	-16.3	23.5	-19.2	11.7	-9.9*	7.5*	-6.5*
Kearny Mesa	14.6	-12.6	-1.0*	1.1*	7.8*	-7.8*	40.5	-27.9	44.0	-32.8	10.5	-9.4*	0.8*	-0.6*
North San Diego	6.3*	-5.6*	-1.3*	1.4*	2.8*	-2.9*	14.7	-13.3	20.9	-15.9	11.1	-9.2*	2.2*	-1.6*
San Dieguito	3.3*	-3.1*	-1.1*	1.2*	2.7*	-2.9*	17.4	-16.5	44.6	-30.1	15.9	-13.1	-7.6*	6.5*
Carlsbad	4.8*	-4.3*	1.5*	-1.5*	4.6*	-4.8*	23.6	-20.5	34.5	-24.8	14.7	-11.9	1.6*	-1.2*
Del Mar-Mira Mesa	7.5*	-7.0*	-0.2*	0.2*	-2.4*	2.7*	28.1	-25.8	31.0	-23.4	15.7	-13.2	-4.3*	3.7*
Sweetwater	2.3*	-2.2*	-2.8*	3.0*	6.1*	-6.2*	17.1	-14.9	28.5	-20.4	13.6	-10.9	5.8*	-4.4*
National City	18.6	-16.5	-1.9*	2.0*	8.1*	-7.7*	66.1	-57.1	45.8	-34.7	20.4	-15.5	9.2*	-5.7*
Southeast San Diego	16.6	-13.5	-0.9*	0.9*	9.6*	-9.1*	55.9	-36.4	46.6	-30.7	14.8	-11.8	8.4*	-5.5*
Coastal	14.4	-13.3	-6.1*	6.8*	-0.6*	0.6*	29.8	-22.2	46.3	-38.3	14.5	-13.3	-0.9*	0.8*
University	16.1	-13.6	4.5*	-4.6*	-6.1*	7.5*	19.0	-14.8	36.8	-30.5	13.9	-11.1	0.4*	-0.3*
Elliott-Navajo	12.3	-10.3	3.0*	-2.9*	4.1*	-4.2*	34.0	-24.6	44.1	-30.8	14.3	-11.3	-6.1*	4.9*
Spring Valley	15.3	-12.6	-1.4*	1.5*	7.7*	-7.6*	50.3	-33.5	46.0	-30.3	13.7	-11.1	8.8*	-6.2*
La Mesa	17.4	-13.6	-1.7*	1.8*	9.9*	-9.5*	40.4	-27.5	46.1	-31.5	16.8	-13.1	-3.2*	2.1*
El Cajon	15.5	-12.9	0.8*	-0.8*	8.0*	-7.7*	31.8	-24.2	35.3	-25.8	23.7	-18.3	3.7*	-2.6*
Santee	12.0	-10.1	3.7*	-3.7*	-3.4*	3.9*	40.6	-29.2	31.1	-22.5	18.4	-14.3	3.6*	-2.5*
Oceanside	18.3	-15.2	-2.8*	3.0*	6.3*	-6.5*	54.0	-36.2	46.9	-33.0	25.7	-19.6	4.8*	-3.4*

[a] Percent difference calculated as (SANDAG-(SDIR/BMI))/(SANDAG+(SDIR/BMI))/2))

Table 2.1– Percent difference[a] of age and gender sub-groups between SANDAG population estimates and SDIR/BMI sample data by sub-regional area (SRA), San Diego County, 2011, continued.

	Total		2-11		12-17		18-24		25-44		45-64		≥65	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
El Cajon	15.5	-12.9	0.8*	-0.8*	8.0*	-7.7*	31.8	-24.2	35.3	-25.8	23.7	-18.3	3.7*	-2.6*
Santee	12.0	-10.1	3.7*	-3.7*	-3.4*	3.9*	40.6	-29.2	31.1	-22.5	18.4	-14.3	3.6*	-2.5*
Oceanside	18.3	-15.2	-2.8*	3.0*	6.3*	-6.5*	54.0	-36.2	46.9	-33.0	25.7	-19.6	4.8*	-3.4*
Vista	14.6	-12.9	-2.0*	2.1*	5.9*	-5.9*	46.2	-34.3	35.4	-27.8	17.4	-14.9	6.1*	-4.5*
Valley Center	13.8	-12.3	1.2*	-1.3*	9.8*	-9.8*	14.9	-13.0	34.6	-25.6	14.6	-12.5	6.2*	-5.9*
San Marcos	11.2	-9.7*	-0.6*	0.7*	1.4*	-1.5*	36.3	-27.3	38.7	-27.9	15.7	-12.8	4.9*	-3.4*
Lemon Grove	20.4	-16.1	2.2*	-2.2*	1.8*	-1.7*	60.3	-39.2	44.5	-30.2	16.3	-13.5	20.3	-11.9
Lakeside	14.6	-12.4	0.4*	-0.5*	0.0*	0.0*	42.0	-29.9	41.6	-29.2	20.8	-16.6	10.9	-7.8*
Ramona	16.3	-14.1	4.3*	-4.2*	5.9*	-6.2*	31.0	-25.8	30.6	-23.4	14.7	-12.7	14.0	-11.2
Escondido	17.5	-14.7	2.4*	-2.5*	6.0*	-6.0*	39.3	-28.5	41.8	-30.0	15.9	-13.4	10.9	-7.6*
Harbison Crest	7.5*	-6.9*	-5.9*	7.2*	11.5	-11.6	59.9	-39.4	39.2	-28.0	-7.3*	7.6*	11.7	-9.1*
Central San Diego	12.2	-13.0	-1.1*	1.2*	12.7	-11.8	51.8	-45.8	22.7	-22.3	-0.8*	1.0*	0.4*	-0.3*
Peninsula	22.9	-21.9	-0.7*	0.8*	12.6	-12.4	78.4	-71.1	45.3	-35.9	2.9*	-3.1*	-4.8*	4.1*
Anza-Borrego Springs	9.6*	-8.9*	-3.3*	3.2*	-23.2	32.4	38.8	-31.8	33.8	-24.5	19.9	-16.1	3.5*	-3.7*
Coronado	41.7	-37.7	-3.2*	3.7*	41.9	-29.6	84.6	-96.6	93.8	-67.8	18.6	-13.9	2.4*	-2.0*
Jamul	21.7	-23.4	0.5*	-0.6*	11.7	-13.0	73.9	-69.6	46.3	-48.6	29.3	-26.3	-2.5*	2.6*
Pendleton	73.7	-77.3	5.7*	-5.6*	17.2	-15.2	164.5	-140.1	122.6	-66.6	63.4	-29.0	200.0	-42.9
Miramar	72.2	-94.7	4.6*	-4.8*	-29.8	38.8	124.7	-141.3	104.9	-90.7	200.0	-69.2	200.0	200.0
Laguna-Pine Valley	-11.4	14.8	-28.2	39.6	7.2*	-7.7*	-2.2*	4.2*	-1.8*	2.1*	-13.2	16.0	-37.3	64.1
Pauma	18.1	-16.2	15.6	-14.4	-1.6*	1.9*	40.7	-33.3	33.5	-26.1	16.3	-14.4	0.3*	-0.3*
Alpine	6.2*	-5.7*	22.5	-21.0	-14.8	19.6	5.8*	-5.7*	32.2	-23.5	0.0*	0.0*	-12.8	12.9
Mountain Empire	10.4	-11.0	-11.0	14.2	29.0	-33.5	56.1	-40.2	62.5	-42.7	-8.3*	10.2	-9.2*	11.4

[a] Percent difference calculated as (SANDAG-(SDIR/BMI))/(SANDAG+(SDIR/BMI))/2))

Table 2.2 – Percent difference[a] of race/ethnicity between SANDAG population estimates and SDIR/BMI sample data by sub-regional area (SRA), San Diego County, 2011

	Total	Hispanic	White	Black	Asian	Other
San Diego County	0.0*	-9.9*	-2.8*	17.7	56.5	-17.8
Sub-Regional Area						
La Mesa	76.2	2.1*	-1.9*	-8.4*	35.3	-5.9*
Coastal	4.6*	48.0	-0.9*	-1.2*	-6.0*	-63.6
Peninsula	54.3	23.8	-4.1*	-2.0*	0.9*	11.4
Ramona	-98.8	14.4	-6.9*	-1.2*	-6.6*	94.4
Sweetwater	77.4	7.5*	-0.5*	0.6*	46.0	-114.5
Chula Vista	67.2	1.5*	3.4*	-9.2*	59.0	-80.5
Pendleton	179.1	-9.4*	3.8*	-13.5	36.9	-0.6*
Elliott-Navajo	53.1	28.2	-5.7*	5.1*	21.1	-25.2
South Bay	69.5	0.5*	-13.2	-2.7*	64.5	-64.2
Spring Valley	67.6	-4.3*	5.1*	-18.8	77.5	-36.3
Lemon Grove	65.6	2.8*	-1.5*	-16.9	67.3	-24.0
Santee	46.7	-5.6*	1.0*	-53.0	17.5	19.4
Palomar-Julian	14.8	-2.7*	-11.7	-52.2	3.1*	180.6
Southeast San Diego	50.5	-9.1*	-17.0	-25.5	100.0	-38.3
Mid-City	52.4	1.9*	-16.6	-18.2	87.6	-45.4
Jamul	71.2	-2.3*	12.3	107.5	20.9	-127.8
Pauma	-20.6	-8.7*	-21.4	52.1	-18.6	127.1
National City	72.7	-13.2	4.9*	11.3	75.0	-41.7
Miramar	54.6	20.7	2.6*	74.1	-86.3	-50.7
Alpine	100.9	-15.0	1.0*	17.6	55.2	18.1
Valley Center	-45.7	-32.4	4.4*	-34.8	73.8	133.1
Mountain Empire	115.0	-15.0	8.4*	-14.4	27.5	28.2
Kearny Mesa	52.9	27.4	-12.2	-9.7*	42.9	-36.6

[a] Percent difference calculated as (SANDAG-(SDIR/BMI))/(SANDAG+(SDIR/BMI))/2))

Table 2.2– Percent difference[a] of race/ethnicity between SANDAG population estimates and SDIR/BMI sample data by sub-regional area (SRA), San Diego County, 2011, continued

Sub-Regional Area	Total	Hispanic	White	Black	Asian	Other
University	8.9*	44.2	-16.7	3.0*	54.3	-98.9
Del Mar-Mira Mesa	2.5*	29.4	-11.5	-3.4*	35.7	-85.7
North San Diego	-37.3	30.3	-14.9	5.9*	44.1	-35.2
San Dieguito	16.4	-61.9	19.0	5.5*	35.5	-61.4
Carlsbad	28.7	-42.0	11.7	-3.7*	46.3	-56.4
Escondido	-100.7	-22.8	21.5	7.5*	46.1	36.9
Central San Diego	7.8*	22.0	-12.1	-12.7	19.2	-12.2
Coronado	96.7	53.5	-15.2	132.2	54.9	12.7
Poway	-59.2	19.9	-10.6	19.7	46.9	-17.8
El Cajon	-39.3	-20.2	10.3	-17.7	85.5	-10.9
Lakeside	-5.0*	-46.5	13.2	-31.1	63.6	51.0
Harbison Crest	23.4	-70.8	26.5	-68.2	20.3	-35.1
Oceanside	-7.7*	-36.0	23.7	21.2	82.5	50.5
San Marcos	-63.1	-40.3	32.6	25.1	50.7	24.0
Vista	-20.9	-26.2	27.5	11.7	73.6	45.1
Fallbrook	-55.7	47.0	-26.0	91.3	67.9	78.0
Laguna-Pine Valley	138.7	-65.0	14.8	-102.1	200.0	138.7
Anza-Borrego Springs	49.3	44.0	-22.8	200.0	200.0	200.0

[a] Percent difference calculated as (SANDAG-(SDIR/BMI))/(SANDAG+(SDIR/BMI))/2))

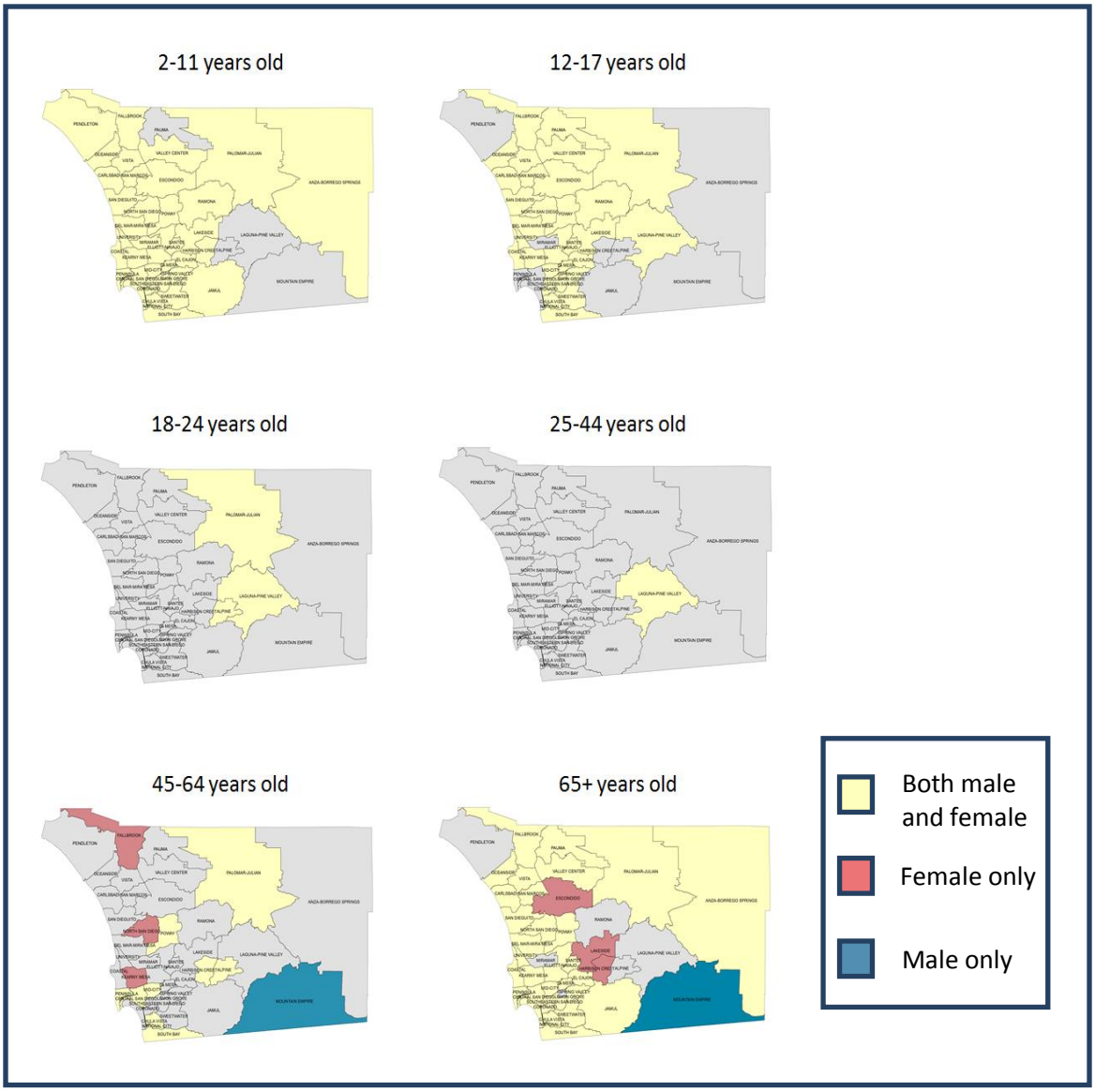

Figure 2.1— Age and gender representativeness of SDIR/BMI sample to SANDAG population estimates by sub-regional area, San Diego, 2011

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CHAPTER 3: FACTORS ASSOCIATED WITH CONTINUED PARTICIPATION IN A MATCHED MONETARY INCENTIVE PROGRAM AT LOCAL FARMERS MARKETS IN LOW-INCOME NEIGHBORHOODS IN SAN DIEGO, CA

ABSTRACT

Objective: The Farmers Market Fresh Fund Incentive Program is a policy, system, and environmental intervention designed to improve access to fresh fruits and vegetables for low-income participants on governmental assistance. The aim of this study was to examine factors associated with ongoing participation in this matched monetary incentive program.

Design: Poisson regression was used to assess the relationship of baseline factors with the total number of Fresh Fund visits. Mixed effects modeling was used to explore the within-individual changes in consumption of fruits and vegetables, and overall diet quality reported at baseline and each follow-up assessment.

Setting: San Diego, California, USA.

Subjects: Participants included recipients of Supplemental Nutrition Assistance Program (SNAP); Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); and Supplemental Security Income (SSI) who attended one of five participating farmers markets between 2010 and 2012 (n=7,298).

Results: Among those who participated in the program for ≤6 months, the factors that were associated with a greater number of Fresh Fund visits include reporting more servings/day of fruits and vegetables at baseline, being Vietnamese or Asian/Pacific Islander, and eligibility because of SNAP/CalFresh or SSI compared to WIC. Among those who came 6-12 months, being Asian/Pacific Islander, eligibility because of SNAP/CalFresh and enrolling in the fall, winter or spring months were associated with a greater number of Fresh Fund visits. Among those who came >12 months, being male

and eligibility because of SSI was associated with a greater number of visits. Overall, the odds of increasing number of servings of fruits and vegetables consumed increased by 2% per month, and the odds of improved perception of diet quality increased by 10% per month.

Conclusions: Sustaining and increasing Fresh Fund-type program operations should be a top priority for future policy decisions concerning farmers market use in low-income neighborhoods.

INTRODUCTION

Current daily recommendations of fruit and vegetable (FV) intake range from five to thirteen servings depending on age, sex, and activity level;[1] yet less than one-third of Americans report consuming two or more servings of fruit, or three or more servings of vegetables per day.[2] Moreover, evidence suggests that consumption varies by individual and neighborhood socioeconomic status (SES) where lower SES has been linked with decreased intake of FV.[3-5] Access to food retail stores with healthier products is associated with higher quality food consumption,[6-9] and people who live in low-income and minority communities have decreased access to healthier food stores.[7,10,11]

In recent years, farmers markets have become increasingly popular as an approach for improving access to nutritious fresh foods for low-income consumers who receive government nutrition assistance. From 2008 to 2014, there was a 587% increase in the number of authorized farmers markets accepting Supplemental Nutrition Assistance Program (SNAP; also known as CalFresh in California) benefits through the use of electronic benefit transfer (EBT) machines.[12] To further improve access and affordability, financial incentives to shop at farmers markets have been implemented among economically disadvantaged populations who receive SNAP and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) nutrition benefits.[13,14]

Previously published data suggests that market use is associated with increased FV consumption among SNAP and WIC beneficiaries;[15-17] and furthermore, that farmers market incentive programs may increase spending of benefit money,[18] as well as the purchase and consumption of FV.[19-25] As a result of this previous research, in 2008 the

San Diego County Health and Human Services Agency (HHSA) and the San Diego International Rescue Committee created a partnership to fully implement the promising practice of financially incentivizing a primarily low-income refugee community to use government assistance monies and incentives to purchase fresh FV at the existing City Heights farmers market. In 2010, HHSA used Centers for Disease Control and Prevention (CDC) funding to expand the Fresh Fund program to four markets in low-income neighborhoods and expanded to an academic-community practice partnership that included the Division of Child Development and Community Health at the University of California San Diego for content expertise, and the Institute for Public Health at San Diego State University for evaluation. Fresh Fund follows the CDC's leadership in shifting from a focus on individual health-risk behaviors to the implementation of policy, systems, and environmental (PSE) change for chronic disease prevention.[26,27] Policy decisions to allow farmers markets to accept government assistance monies and to incentivize their participation are substantially different than attempts to convince individuals to change their eating habits.

While promising, researchers that have examined purchase and consumption patterns of FV by low-income populations at farmers markets lacked longitudinal or multivariate analyses,[19-22] did not control for potential confounding by participant characteristics,[24] or did not examine predictors of continued usage.[25] In addition, many of the studies were short-term research projects, and did not necessarily involve attempts to permanently embed the incentive programs into the practice settings of existing farmers markets as San Diego County attempted to do. Herman and colleagues reported

on the results of a six-month nutritional intervention that assigned postpartum WIC participants to either an intervention group that received vouchers for shopping at farmers markets or supermarkets, or to a control group.[23] They found that the intervention groups increased and sustained their consumption of FV for six months after the intervention ended.

A better understanding of participant characteristics associated with continued use of farmers market incentive programs, where the data collection and monitoring is a permanent part of the farmers market practice, may help in reaching the low-income populations who need it most. Therefore, the purpose of this study was to examine the factors associated with the ongoing utilization of a farmers market incentive program among government nutrition assistance recipients in San Diego, California (CA).

METHODS

Study population, study design and data collection

From June 1, 2010 through January 31, 2012 individuals were invited to participate in Fresh Fund at five farmers markets in San Diego County if they received government assistance from the SNAP, WIC, or Supplemental Security Income (SSI/Disability). Individuals younger than 18 years were eligible if they received disability income, or were eligible for WIC because of pregnancy or having children under the age of five. All 7,298 Fresh Fund participants were invited to complete voluntary, self-reported paper surveys at baseline and at three-month intervals through the end of the evaluation period. Information collected in the surveys included demographics, diet, food purchasing behavior and perceptions of the program. The

International Rescue Committee's Fresh Fund program staff administered the surveys to participants who had limited literacy or those who spoke a language other than English.

The Fresh Fund incentive consisted of 1:1 matching for each dollar exchanged to receive Fresh Fund tokens up to $20 per month. An enrollment and exchange booth was permanently established at each of the participating markets to allow participants to enroll and then exchange public assistance money for tokens to be used to buy FV at the markets. Purchased and matched incentive tokens could be spent only at vendors who sold fresh produce or packaged foods, such as jams/spreads, breads, eggs, pasta, cheese, and fish; however, tokens purchased using WIC funds, could only be spent at vendors selling fresh produce. Records of market attendance were collected and maintained by trained Fresh Fund program staff at each participating market and were used to determine the total number of Fresh Fund booth visits. In addition, the amount of government assistance or personal money participants exchanged to receive matched incentive tokens was also documented at each visit. Thus, program staff collected information about visits and money exchanged each time the participant came to the market. More detailed survey data were only collected every three months. Participating farmers markets were promoted through local outreach and media efforts by non-profit organizations, and included television and print campaigns, Fresh Fund mailers and flyers, and posters placed inside buses and bus shelters.

Statistical Analysis

The first outcome of interest was the total number of Fresh Fund visits. The exposure variables that were examined were collected at baseline and included age,

gender, race/ethnicity, number of people living in each household, source of government funding (WIC, SNAP/Cal Fresh, SSI), language in which the survey was conducted (English, Spanish, Vietnamese, Chinese, Somali), the farmers market attended, season of Fresh Fund enrollment in 2010 or 2011 (Spring: Mar 20; Summer: Jun 21; Fall: Sep 22 (Sep 23 for 2011); Winter: Dec 21), the amount of money exchanged to receive tokens (sum of personal cash/credit and government assistance money), and self-reported measures of daily consumption of FV(1, 1-2, 3-4 and ≥ 5 serving/day), overall diet quality (very healthy, healthy, average, unhealthy and very unhealthy), and weekly spending on FV (<$10, $10-19, $20-29, $30-39, and ≥ $40).

Descriptive statistics were computed for all variables by the total months of Fresh Fund use (categorized as ≤ 6 months, 6-12 months, and > 12 months), including median and interquartile range (IQR) for continuous variables, and frequency and percentage for categorical variables. The total number of Fresh Fund visits per visitor was not evenly distributed across months of Fresh Fund visits. For example, an individual could have visited 14 times in six months, while another individual may have visited 2 times in 12 months. Presuming that the variables associated with number of visits may be different by the length of time the person participated in Fresh Fund, Poisson regression analyses were stratified by categorical months of Fresh Fund use (≤ 6 months, 6-12 months, and > 12 months). The relationship of exposure variables to the number of Fresh Fund visits in each of the three categories of months of Fresh Fund use was analyzed. Variables found to be significant at $P<0.20$ through bivariate analyses were included in the multivariate model building procedures. Backward stepwise regression was conducted to produce the

most parsimonious model with only variables significant at $P<0.20$ remaining in the final model. Rate ratios with 95% confidence intervals (CI) and *P* values were reported to show the strength and direction of these associations. Tolerance values were calculated to assess collinearity among independent variables.

Additional analyses were conducted using linear regression to examine the relationship of government assistance and personal money exchanged with baseline daily consumption of FV and the perception of overall diet quality. Multivariate models were adjusted for age, gender, race/ethnicity, source of government funding, enrollment market, and season of enrollment. In addition, mixed effects modeling with a random intercept was used to explore within-individual changes in the amount of money exchanged over the study period, and the average number of daily servings of FV and the perception of overall diet quality that was reported at baseline and at each follow-up assessment. Data were analyzed using SPSS Version 22 (International Business Machine Corp, Armonk, NY) and SAS Version 9.3 (Cary, NC); analyses were two-sided with $P<0.05$ considered to be statistically significant. The original Fresh Fund evaluation was approved by the San Diego State University Institutional Review Board. Separate approval for this analysis was also obtained from the University of California San Diego Human Research Protection Program.

RESULTS

A total of 7,298 people enrolled in Fresh Fund from June 1, 2010 through January 31, 2012 at participating farmers markets in San Diego County. Overall, the median age was 34 years (range: 7-100), 84.6% were female, approximately half were Hispanic

(49.5%), and 56% were eligible because of receiving WIC benefits (Table 3.1). More than half of participants (55%) only visited Fresh Fund once (range: 1-36 visits), while the total length of Fresh Fund use ranged from zero to 20 months.

Tables 3.2 and 3.3 display the results of univariate and multivariate Poisson regression analyses stratified by total months of Fresh Fund use, respectively. Among those who came to Fresh Fund six months or less, the unadjusted models showed all variables except weekly spending on fruits and vegetables at baseline to be statistically significant for number of Fresh Fund visits. Multivariate Poisson regression showed that individuals identifying as Hispanic ethnicity (vs. Whites; OR=0.92; CI 0.87, 0.97), enrolling in the fall (vs. summer; OR=0.77; CI 0.74, 0.81) and attending the Southeast San Diego (OR=0.71; CI 0.63, 0.80), San Marcos (OR=0.78; CI 0.74, 0.82), or Golden Hill (OR=0.77; CI 0.72, 0.82) market (vs. City Heights) had fewer visits after controlling for all other characteristics. More visits to the market were independently associated with identifying as Vietnamese (OR=1.18; CI 1.07,1.30) and other Asian race/ethnicity (OR=1.11; CI 1.03,1.20); SNAP (OR=1.26; CI 1.20, 1.32) and SSI assistance (OR=1.29; CI 1.19, 1.32) (vs. WIC); attending the Linda Vista (OR=1.19; CI 1.13, 1.26) market (vs. City Heights); and baseline reporting of 1-2 servings of FV/day (OR=1.24, CI 1.08, 1.43), 3-4 servings (OR=1.24, CI 1.09, 1.43), and ≥ 5 servings (OR=1.26, CI 1.09, 1.44) (vs. <2 servings of FV/day). Baseline perception of diet quality as "very unhealthy" was marginally associated (P=0.05) with more Fresh Fund visits compared to healthier perceptions of diet quality. Among those who came to Fresh Fund 6-12 months, controlling for all other variables in the model, fewer visits was associated with

identifying as African American (OR=0.80, CI 0.64, 0.99) and attending the San Marcos market (OR=0.82, CI 0.73, 0.93); and a greater number of visits was associated with identifying as other Asian race/ethnicity (OR=1.23, CI 1.04, 1.46), SNAP assistance (OR=1.22, CI 1.09, 1.35); and winter (OR=1.29, CI 1.13, 1.48) and spring (OR=1.23, CI 1.08, 1.38) enrollment. Among those who came to the markets more than 12 months, controlling for all other variables, SSI assistance continued to be associated with a greater number of visits (OR=1.30; CI 1.03, 1.63). The only other variable marginally associated number of visits for these ≥12 month users was male gender (OR=1.16; CI 1.00,1.35). In linear regression analyses, after adjustment, those who reported consuming a greater number of servings of FV daily (vs. <1 serving/day) and those who reported a healthy or very healthy diet (vs. a very unhealthy diet) at baseline exchanged significantly more money, but only among those who came to Fresh Fund for 6 months or less. These associations were not significant for the groups who came longer than 6 months (Table 3.4).

Finally, the results from the mixed effects modeling showed that, on average, the total amount of money exchanged increased by $0.12 per month of Fresh Fund use ($P<0.001$), and that the within-individual odds of an increasing number of servings of FV consumed increased by 2% per month of Fresh Fund use (CI: 1.01,1.03; $P=0.003$), and the odds of improved perception of diet quality increased by 10% per month of Fresh Fund use (CI: 1.09, 1.11; $P<0.001$; data not shown).

DISCUSSION

Our analysis of this PSE intervention contributes to the evidence that farmers market monetary incentive programs may improve affordability and access to fresh FV among low-income individuals and families. Over 7,000 government nutrition assistance recipients enrolled in Fresh Fund during the evaluation period, with significant increases in self-reported FV consumption, improvement in the perception of overall diet quality, and increased spending of personal money and government assistance money seen with continued use of Fresh Fund. These findings are consistent with previous U.S. studies in which increased spending and consumption of FV was found to be associated with the use of incentive programs among SNAP and WIC users.[18,19,21-24] Although other similar studies have found positive associations between incentive program use and consumption of FV, this is the first of its kind to find increased consumption with continued market use among low-income consumers using monetary incentives. Furthermore, upon the examination of independent predictors of repeated Fresh Fund use, participants who reported unhealthier diets at baseline were found to be marginally more likely to return to Fresh Fund a greater number of times than those who reported a healthier diet, but only among short-term users (six months or less).

Seasonal and market differences were significantly associated with continued use of Fresh Fund. Among those who came to the market only for 6 months, those who enrolled in the fall compared to the summer were less likely to have multiple visits; however, among those who stayed 6 to 12 months, winter and spring enrollment were both associated with more visits than summer enrollment. This could be because those

who enrolled in winter and spring had more reason or desire to return during the spring and summer months when there was likely to be a wider variety of produce available at the markets; whereas those who enrolled in the summer would have less time before the fall and winter months when variety may have been more limited. Clearly the City Heights and Linda Vista markets were more likely to have repeat visitors than the other Fresh Fund markets. These were also the most established of the markets in their neighborhoods; in fact both markets had functioning community advisory committees. Interestingly, the Linda Vista neighborhood also had a large Asian population, which may have influenced these results. The one factor most highly associated with number of visits for both short, medium, and long-term participants was their use of government assistance money in the form of SNAP or SSI. SSI participating patrons who stayed for over 12 months were 1.3 times more likely to have a greater number of visits. Many SSI participants may be elderly or disabled and thus may have been more likely to continue using the market for food resources longer than the generally younger WIC participants who were of child-bearing age. It was interesting that the three Poisson regression models for short, medium and long-term users demonstrated different results, with more variables (including baseline very unhealthy diets) being associated with number of visits for short term users than long-term users. The number of visits for shorter-term participants was related to ethnicity, type of government assistance, enrollment market, season of enrollment, baseline servings/day of FV and perceived diet quality. Longer participation was predominantly associated with type of income. SSI recipients who used

the market for 12 months or more were the most likely to have the greatest number of visits.

Limitations must be kept in mind when interpreting these results. Because Fresh Fund was a PSE intervention, it was not meant to manipulate individuals' behaviors, and the data available for this analysis was limited to the information collected among a convenience sample of those who voluntarily chose to participate in the baseline and follow-up surveys. In addition, perception of overall diet quality, daily consumption of FV, and weekly spending of FV were self-reported and therefore may introduce reporting bias into the data. The generalizability of the results to populations in other geographic regions may be limited. However, our sample consisted of WIC, SNAP and SSI recipients with a diverse make-up of sexes (15% male), ages (7 to 100 years), and various racial/ethnic groups, which may improve the external validity of these results as they might apply to government nutrition assistance recipients in other urban locations. Fresh Fund was conducted in San Diego where weather likely plays a role in the availability of and attendance to farmers markets throughout the year, whereas markets in colder climates likely close during the winter months. However, evaluations of farmers market incentive programs taking place in cities with significant winter weather (Philadelphia (Philly Food Bucks) and New York (Health Bucks)) have found similar results with increased spending and self-reported consumption of FV among SNAP and WIC participants.[18,19,22] Since this was not a behavioral intervention, the design did not include plans to actively retain participants, but rather to examine participation patterns over time. Participants continued to visit the market based on their own perceptions of need,

and over half of participants (55%) visited the market only once. However, Dimitri and colleagues had a similar retention rate (49%) in their longitudinal pilot study among SNAP and WIC shoppers.[25] It is unknown whether participants continued to shop at the farmers markets if they chose not to obtain Fresh Fund incentive tokens, in which case they were not required to report to the Fresh Fund booth; however, this is unlikely. Despite these limitations, this study has multiple strengths. There was a large sample comprised of racially diverse groups, a wide range of ages, and a reasonable proportion of male participants. Additionally, the analysis incorporated longitudinal measures, adding to the current cross-sectional evidence surrounding farmers market incentive programs.

Given the robust health benefits of diets rich in FV, and the evidence that the general US population does not consume nearly enough servings of FV, farmers market incentive programs have the potential to affect the health of low-income populations. Results showed that SSI government funding remained the factor most associated with number of visits to the market for those who remained 12 months or more. In addition, the total amount of money spent at a Fresh Fund market increased monthly with the length of participation, as did the self-reported number of servings of FV consumed, and the perception of diet quality. The results of this study can be used to inform future PSE interventions to ensure that such programs improve access to and affordability of FV among economically disadvantaged populations Sustaining and increasing Fresh Fund type program operations and utilization by minority populations should be a top priority for future policy decisions concerning farmers market use in low-income neighborhoods.

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Table 3.1 – Characteristics of Fresh Fund participants. San Diego, CA, 2010-2012 (n=7,298)[a]

	Total	6 Months (n=6127)	12 Months (n=692)	>12 Months (n=479)	
Characteristic	n (%)	n (%)	n (%)	n (%)	*P* [b]
Age (years) (n=7,275)					<0.001
Median (range)	34 (7-100)	34 (7-100)	36 (13-90)	36 (9-99)	
Gender (n=7,285)					0.007
Men	1121 (15.4)	908 (14.8)	121 (17.6)	92 (19.3)	
Women	6164 (84.6)	5215 (85.2)	565 (82.4)	384 (80.7)	
Race/Ethnicity					<0.001
Hispanic	3612 (49.5)	3106 (50.7)	298 (43.1)	208 (43.4)	
White	1316 (18.0)	1167 (19.1)	100 (14.5)	49 (10.2)	
Vietnamese	787 (10.8)	596 (9.7)	118 (17.1)	73 (15.2)	
Other Asian	758 (10.4)	593 (9.7)	87 (12.6)	78 (16.3)	
African American	481 (6.6)	415 (6.8)	41 (8.5)	25 (5.2)	
East African	212 (2.9)	128 (2.1)	41 (5.9)	43 (9.0)	
Multiple/Other	132 (1.8)	122 (2.0)	7 (1.0)	3 (0.6)	
Survey language					<0.001
English	4826 (66.1)	4134 (67.5)	458 (66.2)	234 (48.9)	
Spanish	1827 (25.0)	1521 (24.8)	156 (22.5)	150 (31.3)	
Vietnamese	470 (6.4)	347 (5.7)	57 (8.2)	66 (13.8)	
Chinese	89 (1.2)	79 (1.3)	2 (0.3)	8 (1.7)	
Somali	86 (1.2)	46 (0.8)	19 (2.8)	21 (4.4)	
Household members (n=7,293)					0.011
Median (range)	4.0 (1-14)	4.0 (1-14)	4.0 (1-14)	4.0 (1-11)	
Government assistance					<0.001
WIC	4092 (56.1)	3571 (58.3)	324 (46.8)	197 (41.1)	
SNAP/Cal Fresh	1958 (26.8)	1550 (25.3)	221 (31.9)	187 (39.0)	
SSI	1248 (17.1)	1006 (16.4)	147 (21.2)	95 (19.8)	
Season of enrollment					<0.001
Spring	1238 (17.0)	936 (15.3)	218 (31.5)	84 (17.5)	
Summer	3839 (52.6)	3349 (54.7)	200 (28.9)	290 (60.5)	
Fall	1892 (25.9)	1643 (26.8)	145 (21.0)	104 (21.7)	
Winter	329 (4.5)	199 (3.3)	129 (18.6)	1 (0.2)	
Enrollment market					<0.001
City Heights	3112 (42.6)	2234 (36.5)	485 (70.1)	393 (82.1)	
Southeast	232 (3.2)	222 (3.6)	10 (1.5)	0 (0)	
San Marcos	2039 (27.9)	1780 (29.1)	173 (25.0)	86 (18.0)	
Golden Hill	982 (12.5)	961 (15.7)	21 (3.0)	0 (0)	
Linda Vista	933 (12.8)	930 (15.2)	3 (0.4)	0 (0)	

[a] Totals equal 7,298 unless otherwise indicated; [b] p-values are based on chi-square tests or non-parametric Wilcoxon rank sum tests, and demonstrate overall significance of differences between total months of Fresh Fund use by each characteristic; [c] Self-reported during baseline assessment

Table 3.1 – Characteristics of Fresh Fund participants. San Diego, CA, 2010-2012 (n=7,298)[a], continued

	Total	6 Months (n=6127)	12 Months (n=692)	>12 Months (n=479)	
Characteristic	n (%)	n (%)	n (%)	n (%)	*P* [b]
Number of visits					<0.001
Median (range)	1.0 (1-36)	1.0 (1-14)	6.0 (2-24)	9.0 (2-36)	
One	3976 (54.5)	3976 (64.9)	0 (0)	0 (0)	<0.001
Two	1159 (15.9)	1013 (16.5)	115 (16.6)	31 (6.5)	
Three	596 (8.2)	487 (8.0)	72 (10.4)	37 (7.7)	
Four	358 (4.9)	258 (4.2)	71 (10.3)	23 (3.1)	
≥ Five	1209 (16.6)	393 (6.4)	434 (62.7)	382 (79.8)	
Total months of FF use					
Median (range)	0 (0-20)	0 (0-5.9)	9.0 (6-11.9)	15.4 (12.2-19.5)	
Total money exchanged					<0.001
Median (range)	20.0 (1-711)	20 (0-320)	100 (6-560)	147 (15-711)	
Servings/day of FV[c] (n=6,688)					<0.001
< 1	167 (2.5)	125 (2.2)	22 (3.5)	20 (4.3)	
1-2	1819 (27.2)	1489 (26.7)	182 (28.7)	148 (31.5)	
3-4	3061 (45.8)	2557 (45.8)	283 (44.6)	221 (47.0)	
≥ 5	1614 (24.5)	1413 (25.3)	147 (23.2)	81 (17.2)	
Perceived diet quality[c] (n=6,709)					<0.001
Very unhealthy	326 (4.9)	191 (3.4)	57 (9.0)	78 (16.4)	
Unhealthy	1171 (17.5)	717 (12.8)	200 (31.7)	254 (53.4)	
Average	2384 (35.5)	2049 (36.6)	202 (32.0)	133 (27.9)	
Healthy	2111 (31.5)	1972 (35.2)	130 (20.6)	9 (1.9)	
Very healthy	717 (10.7)	673 (12.0)	42 (6.7)	2 (0.4)	
Weekly spending on FV [c] (n=6724)					<0.001
Less than $10	258 (3.8)	203 (3.6)	24 (3.8)	31 (6.5)	
$10 - $19	1555 (23.1)	1242 (22.1)	166 (26.1)	147 (31.0)	
$20 - $29	1928 (28.7)	1556 (22.7)	211 (33.2)	161 (33.9)	
$30 - $39	1173 (17.4)	996 (17.7)	106 (16.7)	71 (6.1)	
$40 or more	1810 (26.9)	1616 (28.8)	129 (20.3)	65 (13.7)	

[a] Totals equal 7,298 unless otherwise indicated; [b] p-values are based on chi-square tests or non-parametric Wilcoxon rank sum tests, and demonstrate overall significance of differences between total months of Fresh Fund use by each characteristic; [c] Self-reported during baseline assessment

Table 3.2 – Unadjusted Poisson regression analysis of the relationship of selected baseline characteristics with the number of Fresh Fund visits by total length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298)

	6 Months			12 Months			> 12 Months		
Characteristic	RR	(95% CI)	*P*	RR	(95% CI)	*P*	RR	(95% CI)	*P*
Age (10 year interval)	1.07	(1.06, 1.08)	<0.001	1.07	(1.04, 1.09)	<0.001	1.03	(0.99, 1.07)	0.073
Men	1.21	(1.15, 1.28)	<0.001	1.25	(1.13, 1.39)	<0.001	1.20	(1.05, 1.37)	0.009
Race/Ethnicity			<0.001			<0.001			0.040
White	1.00			1.00			1.00		
Hispanic	0.86	(0.81, 0.90)		0.87	(0.76, 0.99)		1.12	(0.91, 1.38)	
Vietnamese	1.56	(1.47, 1.67)		1.25	(1.09, 1.44)		1.38	(1.09, 1.73)	
Other Asian	1.13	(1.07, 1.23)		1.37	(1.18, 1.58)		1.28	(1.02, 1.61)	
African American	0.95	(0.87, 1.04)		0.93	(0.76, 1.15)		1.04	(0.76, 1.44)	
East African	1.18	(1.04, 1.34)		1.06	(0.87, 1.23)		1.21	(0.93, 1.57)	
Multiple/Other	1.03	(0.89, 1.18)		0.87	(0.56, 1.37)		0.72	(0.29, 1.80)	
Survey language			<0.001			<0.001			0.104
English	1.00			1.00			1.00		
Spanish	0.87	(0.84, 0.92)		0.80	(0.74, 0.86)		1.06	(0.99, 1.13)	
Vietnamese	1.58	(1.48, 1.69)		1.24	(1.12, 1.37)		1.22	(1.13, 1.32)	
Chinese	0.91	(0.77, 1.09)		1.56	(1.01, 2.43)		0.87	(0.68, 1.10)	
Somali	1.10	(0.89, 1.35)		1.02	(0.85, 1.22)		1.21	(1.06, 1.38)	
Household members	0.98	(0.97, 0.99)	<0.001	0.97	(0.96, 0.99)	0.036	1.00	(0.97, 1.03)	0.870
Government assistance			<0.001			<0.001			0.003
WIC	1.00			1.00			1.00		
SNAP/Cal Fresh	1.36	(1.30, 1.42)		1.36	(1.24, 1.50)		1.16	(1.02, 1.32)	
SSI	1.51	(1.44, 1.59)		1.45	(1.31, 1.61)		1.28	(1.10, 1.49)	
Season of enrollment			<0.001			<0.001			0.523
Summer	1.00			1.00			1.00		
Fall	0.88	(0.84, 0.92)		1.24	(1.09, 1.40)		0.92	(0.80, 1.06)	
Winter	0.97	(0.87, 1.09)		1.49	(1.32, 1.40)		1.05	(0.90, 1.21)	
Spring	0.92	(0.87, 0.98)		1.33	(1.19, 1.49)		1.05	(0.90, 1.21)	

[a] n=0

Table 3.2 – Unadjusted Poisson regression analysis of the relationship of selected baseline characteristics with the number of Fresh Fund visits by total length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298), continued

	6 Months			12 Months			> 12 Months		
Characteristic	RR	(95% CI)	*P*	RR	(95% CI)	*P*	RR	(95% CI)	*P*
Enrollment market			<0.001			<0.001			<0.001
City Heights	1.00			1.00			1.00		
Southeast San Diego	0.67	(0.59, 0.75)		0.93	(0.72, 1.19)		--[a]	--	
San Marcos	0.73	(0.69, 0.76)		0.71	(0.65, 0.76)		0.66	(0.61, 0.72)	
Golden Hill	0.70	(0.66, 0.74)		0.88	(0.73, 1.05)		--[a]	--	
Linda Vista	1.26	(1.19, 1.32)		0.79	(0.48, 1.28)		--[a]	--	
Servings/day of FV			0.060			0.062			0.828
< 1	1.00			1.00			1.00		
1-2	1.23	(1.05, 1.43)		0.78	(0.63, 0.98)		1.03	(0.77, 1.39)	
3-4	1.21	(1.04, 1.41)		0.74	(0.59, 0.92)		1.09	(0.81, 1.46)	
≥ 5	1.22	(1.05, 1.42)		0.74	(0.59, 0.94)		1.09	(0.80, 1.48)	
Perceived diet quality			<0.001			0.275			0.025
Very unhealthy	1.00			1.00			1.00		
Unhealthy	0.85	(0.76, 0.96)		1.05	(0.88, 1.24)		1.02	(0.87, 1.18)	
Average	0.88	(0.79, 0.98)		0.99	(0.83, 1.19)		0.82	(0.69, 0.97)	
Healthy	0.96	(0.86, 1.07)		1.14	(0.95, 1.36)		0.89	(0.58, 1.38)	
Very healthy	1.00	(0.89, 1.13)		1.12	(0.88, 1.41)		1.15	(0.53, 2.53)	
Weekly spending on FV			0.262			<0.001			<0.001
$40 or more	1.00			1.00			1.00		
$30 - $39	0.95	(0.89, 1.01)		0.99	(0.89, 1.10)		0.98	(0.88, 1.10)	
$20 - $29	1.02	(0.96, 1.07)		1.03	(0.94, 1.13)		1.10	(1.01, 1.21)	
$10 - $19	0.99	(0.94, 1.05)		1.08	(0.98, 1.75)		1.16	(1.05, 1.27)	
Less than $10	0.98	(0.88, 1.10)		1.46	(1.25, 1.70)		1.23	(1.08, 1.40)	

[a] n=0

Table 3.3 – Multivariate Poisson regression analysis[a] of the relationship of selected baseline characteristics with the number of Fresh Fund visits by total length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298)

	6 Months			12 Months			> 12 Months		
Characteristic	RR	(95% CI)	*P*	RR	(95% CI)	*P*	RR	(95% CI)	*P*
Age (10 year interval)	0.98	(0.99, 1.00)	0.176	--[b]	--	--	0.96	(0.91, 1.01)	0.128
Men	--	--	--	--	--	--	1.16	(1.00, 1.33)	0.052
Race/Ethnicity			<0.001			<0.001			--
White	1.00			1.00			--		
Hispanic	0.92	(0.87, 0.97)		0.91	(0.80, 1.04)		--	--	
Vietnamese	1.18	(1.07, 1.30)		1.13	(0.95, 1.35)		--	--	
Other Asian	1.11	(1.03, 1.20)		1.23	(1.04, 1.46)		--	--	
African American	0.94	(0.86, 1.02)		0.80	(0.64, 0.99)		--	--	
East African	1.01	(0.88, 1.17)		0.89	(0.72, 1.10)		--	--	
Multiple/Other	1.00	(0.88, 1.13)		0.84	(0.53, 1.33)		--	--	
Survey language			0.173			--			--
English	1.00			--			--		
Spanish	1.00	(0.95, 1.06)		--	--		--	--	
Vietnamese	1.04	(0.94, 1.15)		--	--		--	--	
Chinese	0.70	(0.52, 0.95)		--	--		--	--	
Somali	0.99	(0.80, 1.25)		--	--		--	--	
Government assistance			<0.001			<0.001			0.081
WIC	1.00			1.00			1.00		
SNAP/CalFresh	1.26	(1.20, 1.32)		1.22	(1.09, 1.35)		1.04	(0.92, 1.20)	
SSI	1.29	(1.19, 1.32)		1.10	(0.95. 1.28)		1.30	(1.03, 1.63)	

[a] Adjusted for all other variables in the multivariate model; [b] Dashes indicate variables that were not included in the multivariate model; [c] n=0

Table 3.3 – Multivariate Poisson regression analysis[a] of the relationship of selected baseline characteristics with the number of Fresh Fund visits by total length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298), continued

	6 Months			12 Months			> 12 Months		
Characteristic	RR	(95% CI)	*P*	RR	(95% CI)	*P*	RR	(95% CI)	*P*
Season of enrollment			<0.001			<0.001			--
Summer	1.00			1.00			--	--	
Fall	0.77	(0.74, 0.81)		1.14	(1.00, 1.30)		--	--	
Winter	0.93	(0.84, 1.03)		1.29	(1.13, 1.48)		--	--	
Spring	1.01	(0.95, 1.06)		1.23	(1.08, 1.38)		--	--	
Enrollment market			<0.001			0.027			<0.001
City Heights	1.00			1.00			1.00		
Southeast San Diego	0.71	(0.63, 0.80)		0.94	(0.67, 1.32)		--[c]	--	
San Marcos	0.78	(0.74, 0.82)		0.82	(0.73, 0.93)		0.68	(0.57, 0.80)	
Golden Hill	0.77	(0.72, 0.82)		0.98	(0.76, 1.27)		--[c]	--	
Linda Vista	1.19	(1.13, 1.26)		1.10	(0.51, 2.37)		--[c]	--	
Servings/day of FV			0.012			--			--
< 1	1.00			--	--		--	--	
1-2	1.24	(1.08,1.43)		--	--		--	--	
3-4	1.24	(1.09, 1.43)		--	--		--	--	
≥ 5	1.26	(1.09, 1.44)		--	--		--	--	
Perceived diet quality			0.050			--			0.060
Very unhealthy	1.00			--	--		1.00		
Unhealthy	0.90	(0.81, 1.00)		--	--		1.05	(0.90, 1.22)	
Average	0.92	(0.83, 1.02)		--	--		0.87	(0.73, 1.03)	
Healthy	0.94	(0.86, 1.04)		--	--		1.12	(0.73, 1.74)	
Very healthy	0.98	(0.88, 1.10)					1.29	(0.46, 3.60)	

[a] Adjusted for all other variables in the multivariate model; [b] Dashes indicate variables that were not included in the multivariate model; [c] n=0

Table 3.4 –Linear regression analysis of the relationship of selected baseline characteristics with government assistance and personal money exchanged by length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298)

	6 Months				12 Months				>12 Months			
	Unadjusted		Adjusted[a]		Unadjusted		Adjusted[a]		Unadjusted		Adjusted[a]	
Characteristic	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*
Age (10 year interval)	2.90±0.20	<0.001	-0.04±0.03	0.213	11.77±1.54	<0.001	0.15±0.26	0.565	7.75±3.26	0.018	-1.25±0.53	0.020
Men	7.29±0.95	<0.001	-1.3±1.03	0.205	36.95±6.62	<0.001	7.36±7.32	0.316	46.11±12.99	0.004	34.6±14.4	0.017
Race/Ethnicity		<0.001		<0.001		<0.001		<0.001		<0.001		0.487
White	Reference		Reference		Reference		Reference		Reference		Reference	
Hispanic	-6.25±0.87		-3.56±0.88		-24.28±7.25		-7.28±7.4		-10.63±17.56		-0.97±18.38	
Vietnamese	19.53±1.28		10.18±1.55		33.60±8.53		33.1±10.78		52.92±20.46		40.87±24.54	
Other Asian	4.65±1.28		3.16±1.41		39.48±9.20		38.59±10.35		39.60±20.20		17.83±22.02	
African American	-3.28±1.45		-3.36±1.47		-2.08±11.64		-12.71±12.09		-1.96±27.23		-14.94±27.95	
East African	3.43±2.37		-0.83±2.5		0.65±11.64		-9.76±12.26		14.76±23.15		-2.12±24.8	
Multiple/Other	-1.31±2.42		-2.40±2.32		-37.37±24.53		-48.98±24.56		-47.24±65.90		-20.74±65.76	
Government assistance		<0.001		<0.001		<0.001		<0.001		<0.001		0.009
WIC	Reference		Reference		Reference		Reference		Reference		Reference	
SNAP/Cal Fresh	11.69±0.78		10.32±0.88		51.78±5.40		41.09±6.38		51.04±11.19		37.97±14.19	
SSI	16.64±0.91		10.57±1.60		58.49 ±6.15		16.87±11.1		66.96±13.69		66.23±24.21	
Season of enrollment		<0.001		<0.001		<0.001		0.005		0.714		0.453
Summer	Reference		Reference		Reference		Reference		Reference		Reference	
Fall	-4.01±0.80		-8.03±0.82		23.84±7.10		16.26±7.25		-12.48±12.94		-17.43±12.95	
Winter	-3.78±1.93		-5.82±1.87		50.14±7.35		26.06±7.85		28.14±113.41		81.37±111.07	
Spring	-3.97±0.98		-1.37±0.94		37.08±6.37		19.78±7.18		4.90±14.03		3.00±14.17	

[a] Adjusted for all other variables in the multivariate model; [b] n=0

Table 3.4 – Linear regression analysis of the relationship of selected baseline characteristics with government assistance and personal money exchanged by length of Fresh Fund use. San Diego, CA, 2010-2012 (n=7,298), continued

	6 Months				12 Months				>12 Months			
	Unadjusted		Adjusted[a]		Unadjusted		Adjusted[a]		Unadjusted		Adjusted[a]	
Characteristic	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*	$\beta \pm$ SE	*P*
Enrollment market		<0.001		<0.001				0.034				0.014
City Heights	Reference		Reference		Reference		Reference		Reference		Reference	
Southeast San Diego	-10.99±1.80		-8.42±1.85		-25.42±21.28		-18.03±19.62		--[c]		--[c]	
San Marcos	-7.55±0.81		-4.37±0.86		-27.04±5.90		3.80±6.37		-52.82±13.25		-37.28 ± 15.16	
Golden Hill	-6.60±0.99		-3.06±1.03		6.89±14.85		27.11±14.72		--[c]		--[c]	
Linda Vista	12.21±1.00		8.76±1.09		-33.25±33.58		2.19±43.53		--[c]		--[c]	
Servings/day of FV		0.005		0.001		0.025		0.058		0.837		0.201
< 1	Reference		Reference		Reference		Reference		Reference		Reference	
1-2	6.42±2.40		6.23±2.26		-42.85±15.34		-27.22±13.96		-2.14±27.11		21.88±26.95	
3-4	7.06±2.36		7.27±2.23		-45.86±15.05		-25.12±13.87		8.67±26.57		40.51±26.72	
≥ 5	8.17±2.40		8.30±2.27		-40.45±15.54		-13.44±14.45		6.34±28.42		43.61±28.46	
Perceived diet quality		<0.001		<0.001		0.011		0.887		0.249		0.458
Very unhealthy	Reference		Reference		Reference		Reference		Reference		Reference	
Unhealthy	-4.63±2.10		-2.79±1.97		8.90±10.22		2.06±9.29		-3.00±14.64		0.21±14.93	
Average	-0.82±1.96		0.58±1.85		2.89±10.21		3.18±9.46		-28.33±16.13		-19.35±16.35	
Healthy	3.29±1.96		2.40±1.86		25.15±10.81		7.90±10.4		-24.12±39.82		11.48±39.57	
Very healthy	4.62±2.12		3.17±2.01		29.08±13.84		10.58±13.05		25.82±81.00		74.61±110.57	

[a] Adjusted for all other variables in the multivariate model; [b] n=0

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CHAPTER 4: FOOD INSECURITY AMONG FAMILIES ATTENDING SUMMER MEALS SITES IN THE SAN DIEGO UNIFIED SCHOOL DISTRICT

ABSTRACT

Introduction: Determining how the summer impacts food insecurity among low-income children and their families may inform future policy and funding decisions on summer food assistance programs. Data collected from Summer Meals, the San Diego Unified School District's Summer Food Service Program, was used to examine monthly patterns of food security among families who attended select Summer Meals sites.

Methods: From June through August 2011, a convenience sample of parents/guardians of children ages 2 to18 years who attended selected Summer Meals sites with their children were eligible to participate in a voluntary survey to assess food security using the United States Department of Agriculture Household Food Security survey. Bivariate and multivariate ordinal regression was used to examine the association of month of Summer Meal attendance with household, adult, and child food security.

Results: Sixty-five percent of all households surveyed, 54% of adults and 47% of children had low or very-low food security. Univariately, the odds of being more food insecure were greater in July and August than in June for all three outcomes. However, after adjustment for potential confounders, parental age and neighborhood socioeconomic status (SES) were the two factors most strongly associated with food insecurity, and month of Summer Meals attendance was no longer associated with food insecurity.

Conclusions: A high prevalence of childhood food insecurity was reported among this sample with low and very-low income, indicating the need for successful food and nutrition assistance programs to reach the children and families who need it most.

INTRODUCTION

Food insecurity exists when a household is unable to obtain enough food to meet the needs of its members because of a lack of money or other resources for food.[1] Nationally, 41.4% of households with incomes below the federal poverty line in 2011 were food insecure.[1] California and San Diego share this problem. According to the 2011 CHIS, 46.7% and 50.6% of adults whose income were below the federal poverty level were food insecure in California and San Diego, respectively.[2] The United States Department of Agriculture's (USDA) National School Lunch Program (NSLP) provides free or reduced-cost meals to children from low-income families throughout the school year, and during the summer months through the Summer Food Service Program (SFSP).[3,4]

From 1995 to 2001, the U.S. Census Bureau conducted food security surveys via the Food Security Supplements to the Current Population Survey (CPS), alternating data collection between April and August or September every other year.[5] The prevalence of food insecurity during these years was consistently higher in the August/September surveys when children were not in school than in April, indicating a positive effect of the free/reduced price school meals on food insecurity. Further multivariate analyses, using CPS data, showed that low-income households with school-age children (6 to 17 years old) experienced a higher prevalence of food insecurity in the summer, after controlling for a variety of demographic and household characteristics.[6] However, it remains unknown whether the level of food insecurity increases as summer progresses. The objective of this research was to examine monthly patterns of food insecurity throughout the summer months, controlling for demographics including socioeconomic conditions. It

was hypothesized that as summer progressed, and as more time passed after having access to the free/reduced price school meals, food insecurity would increase among the families attending the Summer Meals Program.

METHODS

Study design, study population and data collection

The federal Summer Meals SFSP was developed to enhance the nutrition of children living in low-income neighborhoods during the summer months when they could not take advantage of the lunches provided during the school year through the NSLP. This study used data that were collected in the summer of 2011 to evaluate the need and impact of Summer Meals programs in specific low and very low-income neighborhoods in the San Diego Unified School District (SDUSD). Expansion of Summer Meals Programs and their evaluation was funded in part by the Centers for Disease Control and Prevention's (CDC) Communities Putting Prevention to Work (CPPW) program which implemented policy, system and environmental (PSE) interventions for the improvement of community health. In the present study, these data were used to examine patterns of household, adult and child food insecurity as described by a parent/guardian whose child was attending these Summer Meals programs.

The Summer Meals program operates out of schools, churches, parks and recreation centers, and other community organizations located in low-income neighborhoods. Food security surveys were conducted from June through August 2011 during 23 lunch events at seven Summer Meals sites located within the SDUSD. These sites were selected because of the low SES of their neighborhood, high Summer Meals

participation, and they were near middle schools with a high percentage of students participating in the NSLP during the school year. The sites operated Monday through Friday for either 27 or 47 days depending on whether the middle school that served each neighborhood was a year-round school or a traditional calendar-year school. All children ages 2 to 18 years who attended a Summer Meals site were eligible to receive a free meal regardless of their household income, and no enrollment was necessary.

A convenience sample (n=325) of parents/guardians who attended one of seven selected Summer Meals sites with their children were invited to participate in a voluntary, 5-minute, interviewer-administered survey to assess food insecurity. The USDA Household Food Security survey is a validated 18-item survey that was first implemented in 1995 and is used to measure the degree of food insecurity experienced in the past 30 days by a household as a whole, as well as among adults and children separately within the household.[7] Household scores range from 0 to18 (adult 0 to 10; child 0 to 8) with a higher score indicating higher food insecurity, and are categorized into high, marginal, low and very low food security.[8] Demographic information, including age, gender, and race/ethnicity was also collected after receiving verbal consent.

Statistical Analysis

The dependent variables of interest were household food security (categorized as high (score=0), marginal (1-2), low (3-7) and very low (8-18)); adult food security (categorized as high (0), marginal (1-2), low (3-5), and very low (6-10); and child food security (categorized as high or marginal (0-1), low (2-4) and very low (5-8)). The independent variable of interest was the month when the parent/guardian and child attended the Summer Meals program. (June, July, or August); however, additional

analyses were conducted with the number of days a site was operating as the independent variable to account for schools that were not on a traditional schedule. Covariates that were examined include: age, gender, race/ethnicity of the respondent, location of Summer Meal site, as well as a proxy variable for participant's SES, based on the median household income of the zip code where the Summer Meals site was located. The SES proxy variable was categorized as medium/low and very low. Three Summer Meals sites were located in medium/low socioeconomic neighborhoods while four sites were located in very low socioeconomic neighborhoods. Although the survey was anonymous, participants were asked whether or not they had previously attended a Summer Meals event and taken the Summer Meals survey. Surprisingly, there were very few parents/guardians who reported that their family had attended more than one Summer Meals event, indicating that different families were surveyed in June, July, and August.

Descriptive statistics were computed for all variables, stratified by month of Summer Meals attendance, and included mean and standard deviation (SD) or median and interquartile range (IQR) for continuous variables, depending on whether the data were normally distributed; and frequency and percentage for categorical variables. Chi-square, ANOVA or non-parametric Wilcoxon rank sum were used to test differences among each variable by month of Summer Meals use. Bivariate ordinal logistic regression analyses were used to assess the relationship of month of Summer Meal attendance with each outcome separately (household, adult and child food security). Multivariate ordinal regression was then used to examine the independent effects of month of Summer Meal attendance with all three outcomes, while controlling for covariates. Odds ratios with 95% CI and *P*-values were reported to show the strength and

direction of these associations. Data were analyzed using SAS 9.3 (Cary, NC); analyses were two-sided with $P < .05$ considered to be statistically significant. The original Summer Meals evaluation was approved by the San Diego State University Institutional Review Board. Separate approval for this analysis was also obtained from the University of California San Diego Human Research Protection Program.

RESULTS

A total of 325 surveys were completed among adults with children who attended one of the seven Summer Meals sites in San Diego from June through August 2011. Overall, 90% were female; the average age was 36.7 years (SD: 8.8); most participants were Hispanic (62%), followed by White (16%), Asian (9.1%), and Black (8.4%); and most had low (37.2%) or very low household food security (27.1%; Table 4.1). Significant differences were found among household, adult and child food security by month of attendance. Household and child scores were significantly higher (i.e. more food insecure) among July and August attendees than among June attendees. In addition, a larger proportion of July and August attendees had low or very low household, adult and child food security than June attendees.

Ordinal logistic regression was conducted to examine the association of month of Summer Meals attendance with household, adult and child food security separately (Table 4.2). In univariate models, the odds of being more food insecure were greater in July and August than in June for all three outcomes. However, after adjustment, month of attendance was no longer associated with food insecurity. In the multivariate analysis, the age of the parent/guardian who accompanied the child to the Summer Meals site and the

SES proxy variable were the variables that were independently associated with food insecurity after controlling for all other variables in the model. The odds of being more food insecure according to household and child scores increased by 23% (95%CI: 1.09-1.40) and 17% (95%CI: 1.02-1.34), respectively for each 5-year increase in age of the adult respondent. The scores increased by 3.3 times (95%CI: 1.92-5.73) and 5.5 times (95%CI: 2.93-10.28) more for those attending sites in very low SES neighborhoods than those in medium/low SES neighborhoods, respectively. Furthermore, the odds of being more food insecure among adults increased by almost three times (95%CI: 1.77-4.90) more for those attending sites in very low SES neighborhoods than for those in medium/low neighborhoods. Additional analyses found that the number of days the site was operating did not account for the relationships between the month of Summer Meals attendance and food insecurity scores, nor was it independently associated with food insecurity (data not shown).

DISCUSSION

This study of food insecurity among families attending Summer Meals sites in San Diego, CA demonstrated that food insecurity was significantly higher in August than in June or July in bivariate analyses; however, the association did not persist after controlling for the demographic characteristics of the parent/guardian who completed the survey especially neighborhood SES. The increasing percentage of food insecurity as the summer progressed appears to be a function of an increasing number of families of very low income attending the Summer Meals programs in August. Notable was the extraordinarily high prevalence of food insecurity that was reported among this sample

(65% of households, 54% of adults and 47% of children with low/very-low food security). Given that prior research indicated that federal summer food service programs positively impacted food security among children, it is worrisome that less than an estimated 3% of the children eligible to receive free/reduced school lunches in the SDUSD actually participate in the SFSP in San Diego.[6,9,10] Taken together, this information indicates the critical need for food and nutritional assistance programs accessible to children in low-income neighborhoods of San Diego during the summer months.

The U.S. Household Food Security survey provides a measure of food security for the 30 days prior to assessment; therefore, the June surveys in our study overlapped with the end of the school year, when some of these children would have been receiving the free/reduced priced school meals, and we would have expected to see less food insecurity in June than in July or August after controlling for demographic factors. One possible explanation for this lack of association could be related to the age of the children, which was not collected as part of the original program evaluation. If the children were too young to attend school, then the free/reduced price school means would not have any impact on the food security of these families.

Significant associations of food insecurity with the SES of the neighborhood where the Summer Meals site was located, and the age of the parent/guardian completing the survey were found. Parents/guardians who were older and attended Summer Meals sites in lower SES neighborhoods were significantly more food insecure with regards to household and child food security, and those attending sites in lower SES neighborhoods had higher adult food insecurity as well. While it seems logical that lower income and

poverty would be synonymous with food insecurity, the two do not go hand-in-hand. The USDA estimated that in 2010, less than half of households (40.2%) below the federal poverty line were food insecure, and more than 7% of households with incomes above 185% of the poverty line were also food insecure.[1] Qualitative studies reported inverse associations between income and food insecurity; however, it was suggested that the relationship may fluctuate with changes in income throughout the year. In the present study, this relationship could not examined because our information was limited and because of the cross-sectional study design.[11-13] Interestingly, the age of the parent/guardian was not associated with adult food security, but it was associated with child and household food security. Similarly, other studies have also reported that maternal age is independently associated with child food security.[14,15]

The results of this study should be interpreted with its limitations in mind. First, the data for this study were collected as part of a PSE intervention evaluation among a convenience sample of parents/guardians who attended a Summer Meals site with their children, and who volunteered to participate in the USDA Household Food Security surveys. Therefore, the generalizability of these results to other low-income populations even within San Diego may be limited. This analysis excludes families of children who may have been brought to the Summer Meals site by a friend or neighbor, because only parents/guardians were invited to participate in the survey. Nevertheless, the results of this study describe the food security situation of the families whose parent/guardians attended the Summer Meals program with their child(ren). While the cross-sectional nature of these data prevents any conclusions from being drawn within individual families over the course of the summer, our analysis aimed to examine differences

between the families who attended the program at the beginning of the summer and those who came at the end of the summer, eliminating the need for follow-up data. These results are also clearly biased toward a greater prevalence of food insecurity because of the method used to select neighborhoods for the Summer Meals programs. The results describe food insecurity in predominantly low and very low-income neighborhoods. Self-selection of the families is also a factor because those with the greatest need may be the ones who attend the Summer Meals events. Finally, the household food security survey was interviewer-administered; therefore, participants may have been reluctant to report their true food security situation. However, the surveys were anonymous, which should have encouraged participants to be truthful during the interview.

An astoundingly high prevalence of food insecurity among families attending the Summer Meals program was found, indicating the need for successful and sustainable food and nutrition assistance programs to reach the children who need it most, particularly in the summer. The results of this study should be used to aid in the guidance of the placement of Summer Meals programs and the direction of future funding for these nutritional assistance programs. The results can also inform future outreach and marketing campaigns to inform the public that these programs are available in their communities, particularly those in very low-income neighborhoods.

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Table 4.1 – Characteristics of adults with children who attended the Summer Meals Program by month of attendance (n=325),[a] San Diego, California, 2011

Characteristic[b]	June (n=97)	July (n=66)	August (n=162)	*P* Value[c]
Household food security score				
Median (IQR)	3 (0-6)	5 (2-10)	5 (1-9)	.009
High (0)	29 (29.9)	8 (12.1)	34 (21.0)	.03
Marginal (1-2)	17 (17.5)	11 (16.7)	17 (10.5)	
Low (3-7)	34 (35.1)	23 (34.8)	64 (39.5)	
Very Low (8-18)	17 (17.5)	24 (36.4)	47 (29.0)	
Adult food security score				
Median (IQR)	2 (0-4)	3 (1-5)	3 (1-6)	.08
High (0)	32 (33.0)	11 (16.7)	40 (24.7)	.01
Marginal (1-2)	23 (23.7)	20 (30.3)	24 (14.8)	
Low (3-5)	29 (29.9)	19 (28.8)	52 (32.1)	
Very Low (6-10)	13 (13.4)	16 (24.2)	46 (28.4)	
Child food security score				
Median (IQR)	1 (0-2)	2 (1-5)	2 (0-3)	<.001
High or Marginal (0-1)	65 (67.0)	30 (45.4)	77 (47.5)	<.001
Low (2-4)	24 (24.7)	18 (27.3)	62 (38.3)	
Very Low (5-8)	8 (8.3)	18 (27.3)	23 (14.2)	
Days of operation, median (IQR)	11 (9-15)	34 (34-36)	60 (56-65)	<.001
Age (years) (n=305)[d]				.07
Mean (SD)	38.27 (8.8)	36.87 (9.5)	35.59 (8.5)	
Sex (n=316)[d]				.95
Female	86 (89.6)	60 (90.9)	138 (89.6)	
Male	10 (10.4)	6 (9.1)	16 (10.4)	
Race/ethnicity (n=320)[d]				<.001
Hispanic	41 (42.3)	51 (78.5)	106 (67.1)	
White	28 (28.9)	2 (3.1)	20 (12.7)	
Asian	10 (10.3)	6 (9.2)	13 (8.2)	
Black	10 (10.3)	5 (7.7)	12 (7.6)	
≥ 2 races	4 (4.1)	1 (1.5)	6 (3.8)	
Don't know/refuse to answer	4 (4.1)	0 (0)	1 (0.6)	

[a] Totals equal 325 unless otherwise indicated; [b] Values are n (%) unless otherwise indicated; [c] Based on χ^2 tests, ANOVA, or non-parametric Wilcoxon rank sum tests, and demonstrate overall significance of differences between month of attendance by each characteristic; [d] Does not equal 325 due to unanswered questions or missing data

Table 4.1 – Characteristics of adults with children who attended the Summer Meals Program by month of attendance (n=325),a San Diego, California, 2011, continued

Characteristic[b]	June (n=97)	July (n=66)	August (n=162)	*P* Value[c]
Summer Meals site				<.001
Allied Gardens	15 (15.5)	0 (0)	20 (12.4)	
Azalea	8 (8.2)	0 (0)	14 (8.6)	
City Heights	0 (0)	39 (59.1)	47 (29.0)	
Colina Park	0 (0)	27 (40.9)	34 (21.0)	
Kearny Mesa	44 (45.4)	0 (0)	12 (7.4)	
Mira Mesa	13 (13.4)	0 (0)	17 (10.5)	
Stockton	17 (17.5)	0 (0)	18 (11.1)	
Socioeconomic status proxy				<.001
Medium/Low (AG, KM, MM)	72 (74.2)	0 (0)	49 (30.2)	
Very low (AZ, CH, CP, ST)	25 (25.8)	66 (100)	113 (69.8)	

[a] Totals equal 325 unless otherwise indicated; [b] Values are n (%) unless otherwise indicated; [c] Based on χ^2 tests, ANOVA, or non-parametric Wilcoxon rank sum tests, and demonstrate overall significance of differences between month of attendance by each characteristic; [d] Does not equal 325 due to unanswered questions or missing data

Table 4.2 – Ordinal logistic regression of food security among adults with children who attended the Summer Meals Program (n=325), San Diego, California, 2011

Characteristic	Unadjusted OR (95% CI)	*P* Value[a]	Adjusted OR (95% CI)	*P* Value[b]
HOUSEHOLD FOOD SECURITY				
Month of Attendance				
June	1.00	.004	1.00	.50
July	1.85 (1.17-2.93)		1.36 (0.80-2.31)	
August	2.52 (1.41-4.47)		1.16 (0.57-2.38)	
Age (5 years)	1.13 (1.00-1.27)	.05	1.23 (1.09-1.40)	.001
Socioeconomic status proxy				
Medium/Low (AG, KM, MM)	1.00	<.001	1.00	<.001
Very low (AZ, CH, CP, ST)	3.26 (2.13-4.98)		3.32 (1.92-5.73)	
ADULT FOOD SECURITY				
Month of Attendance				
June	1.00	.01	1.00	.28
July	1.96 (1.24-3.09)		1.28 (0.77-2.14)	
August	1.78 (1.01-3.13)		0.86 (0.43-1.69)	
Age (5 years)	1.13 (1.01-1.27)	.03	-- [c]	
Socioeconomic status proxy				
Medium/Low (AG, KM, MM)	1.00	<.001	1.00	<.001
Very low (AZ, CH, CP, ST)	2.83 (1.86-4.29)		2.94 (1.77-4.90)	
CHILD FOOD SECURITY				
Month of Attendance				
June	1.00	.002	1.00	.55
July	2.13 (1.28-3.54)		1.28 (0.69-2.36)	
August	2.93 (1.58-5.42)		0.98 (0.45-2.11)	
Age (5 years)	1.04 (0.92-1.17)	0.56	1.17 (1.02-1.34)	.02
Socioeconomic status proxy				
Medium/Low (AG, KM, MM)	1.00	<.001	1.00	<.001
Very low (AZ, CH, CP, ST)	4.77 (2.92-7.80)		5.49 (2.93-10.28)	

Abbreviations: OR, odds ratio; CI, confidence interval

[a] By ordinal logistic regression with categorized food security as the dependent variable

[b] By ordinal logistic regression with categorical food security as the dependent variable and all other variables listed as independent variables, unless otherwise indicated

[c] Not included in multivariate model

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CHAPTER 5: DISCUSSION AND CONCLUSIONS

THE COUNTY OF SAN DIEGO BMI SURVEILLANCE SYSTEM

This study examined the demographic representativeness of the County of San Diego BMI Surveillance System to determine whether the BMI estimates obtained from this system can be generalized to the population of San Diego at a sub-regional level. The findings show that younger and older age groups were the most well represented in this convenience sample collected from 12 participating public and private healthcare clinic systems throughout San Diego County. This is likely reflecting the healthcare seeking population since the young adults and middle aged groups are the least likely to visit a physician. In San Diego, the 2010-2011 CHIS data estimated that 93% of children 2 to 11 years old, 92% of adolescents 12 to 17 years old, and 95.7% of seniors 65 years and older had at least one doctor visit in the past year; and that less than 80% of adults 18 to 64 years old visited the doctor once in the past year.[1]

The number of SRAs that were representative for certain age groups, namely 2 to 11, 12 to 17 and ≥65 year olds, suggests that the continuation of this effort could confidently estimate the BMI of these San Diego populations. The County of San Diego HHSA can improve upon capturing a more representative sample of the young adult and middle age groups by securing data use agreements with additional medical institutions (e.g., Kaiser Permanente, Veterans Affairs (VA) San Diego Healthcare System, or military healthcare clinics), and potentially tapping into outside sources of BMI data, including student health services at local universities, county jails and prisons, urgent care visits, health fairs, flu vaccination clinics, certain work forces that require annual physicals, or maybe even from insurance companies that require annual physicals. However, confidentiality concerns among these sources of data would need to be

adequately addressed. Arguably, the young adults are ideal for weight management and nutritional interventions because they likely have yet to develop obesity-related chronic diseases; and capturing a representative sample of these age groups would prove useful in monitoring local and regional trends of overweight and obesity over time.

While the proportions of racial/ethnic groups within the San Diego SRAs were not as accurately represented in the SDIR/BMI sample as some of the age and gender groups, some SRAs were more representative than others. Namely, La Mesa was the most representative with all sub-populations represented except for Asians. The results of this study suggest that neighborhood-level BMI estimates obtained from the SDIR/BMI sample could reflect BMI changes due to community interventions implemented to reduce overweight and obesity among certain race/ethnicities in particular SRAs. Specifically, one-quarter of the Hispanic population in San Diego lives in the South Bay, Chula Vista, and Southeastern San Diego SRAs, all of which appear to be accurately represented by this sample. Conversely, among the Black population in San Diego, the largest proportion live in the Southeastern San Diego (17%), Mid-City (13%) and Central San Diego (8%) SRAs; none of which were representative in the SDIR/BMI sample at the 10% difference cut-off. It is recommended that the San Diego HHSA takes actions to improve the complete reporting of race/ethnicity by healthcare provider offices to reduce the proportion of missing data.

Additional secondary analyses were conducted to examine the overall prevalence of overweight and obesity among adults in the SDIR/BMI sample and to compare these results to the population estimates produced by CHIS. In the 2010-2011 SDIR/BMI sample, 40% of men (vs. 45.5% of men in CHIS) and 29.1% of women (vs. 28.3% of

women in CHIS) were overweight, and 30.6% of men (vs. 21.4% of men in CHIS) and 31.9% of women (vs. 22.7% of women in CHIS) were obese. Average BMI was slightly higher in the SDIR/BMI sample than in CHIS (28.2 vs. 27.3 for men and 28.0 vs. 26.4 for women). The higher BMI among the SDIR/BMI sample could be attributed to a number of factors. First, height and weight was self-reported in CHIS and it has been recognized that height and weight estimates obtained in this manner tend to be over- or under-exaggerated depending on gender and BMI.[2,3] In addition, healthcare seeking populations may have higher BMI than general populations because of comorbidities associated with excess weight. Previous analyses on the SDIR/BMI data examining the CHIS population estimates found an average BMI of 26.9 for clinic visitors and 26.6 for non-visitors.[4] Additional analyses are needed to determine whether the BMI estimates from the healthcare seeking SDIR/BMI sample are accurately measuring the BMI of the general population at the SRA level. CHIS provides weighted averages of BMI by age groups, gender, and HHSA region, but this information is not currently available at the SRA level which would be needed to properly make this comparison. CHIS has recently launched an online tool (AskCHIS neighborhood edition) to provide health estimates at the zip code, city, and county legislative district levels. To further investigate the value of this BMI surveillance system, future research should include conversion of this data to San Diego SRAs and comparison of SDIR/BMI vs. CHIS estimates of overweight and obesity in SRAs that we found to be representative compared to those that were not.

Limitations must be kept in mind when interpreting the results of this study. The SDIR/BMI sample was selected from only 12 clinics and medical groups, many of which were community health clinics, and does not represent all of the health care providers in

San Diego County since low-income populations were overrepresented. To obtain more accurate local surveillance data, the comprehensiveness of the healthcare and clinic system participation is needed. Also, the SDIR/BMI sample population represents a convenience sample of individuals who visited their healthcare provider for outpatient services in 2011, and they may not be representative of neighborhoods that the clinic systems serve. The medical reason for the visit was not collected, so it is unknown if the data are disproportionally representing individuals who were in poorer health than the general population. In general, persons overweight or obese may have other health problems that make them more likely to visit their healthcare provider, and thus we might expect that BMI estimates for patients visiting a health care provider might be higher than those not visiting. However, children visit the doctor on a regular basis for well-child visits which should have no association to health condition. One of the primary purposes of this study was to determine how demographically similar this sample of health care seeking individuals was relative to all those who lived in the sub-region where the health care system provides services. This study was limited in its ability to draw conclusions on the representativeness of the racial/ethnic groups because of the large proportion of patients who were missing information. An analysis of age and gender differences determined that a larger proportion of those who were missing race/ethnicity, compared to those who were not, were male (45.5% vs 43.0%), in the 2 to 11 (32.6% vs 22.2%) and 12 to 17 (16.5% vs 9.7%) age ranges; while a smaller proportion were in the 45 to 64 (16.8% vs 25.3%) and the 65 and older age groups (4.2% vs 12.9%; data not shown).

This study improves our understanding of the generalizability of neighborhood-level BMI surveillance data collected through the combined use of EHR from 12 clinics

and medical groups. Comprehensive, longitudinal, community-wide BMI surveillance is needed to track trends in the obesity epidemic at the local level, and to evaluate interventions aimed at reducing rates of overweight and obesity in U.S. communities. In its current state, a combined use of registry data could be useful in estimating BMI among certain populations in a portion of SRAs. However, our study suggests that a large enough proportion of SRAs were representative for the younger and older age groups to make this effort worthwhile. Other counties with access to similar electronic tools and technology could benefit from a model of neighborhood BMI surveillance such as this to estimate BMI among children and seniors. Because the people encompassed by SDIR are the healthcare seeking population of San Diego, it was these populations to which conclusions can be drawn. The level of representativeness to the entire general population of San Diego depends on the number of health care provider systems willing to share their data. However, there are already county-wide estimates of BMI from sources such as CHIS and NHANES. The true value of this effort is its ability to estimate and monitor neighborhood-level data, and the fact that the SDIR/BMI population appears to demographically represent some SRAs well is encouraging. This could provide the opportunity to evaluate local efforts (including collective impact efforts) to reduce overweight and obesity in those specific SRAs. In an era when the hope is strong that electronic data will assist with our ability to improve population health, this study contributes to our understanding of the value of existing registries and EHR data as a surveillance tool.

HEALTHY FOODS FARMERS MARKET FRESH FUND INCENTIVE PROJECT

Our analysis of this PSE intervention contributes to the evidence that farmers market monetary incentive programs may improve affordability and access to fresh FV among low-income individuals and families. Over 7,000 government nutrition assistance recipients enrolled in Fresh Fund during the evaluation period, with significant increases in self-reported FV consumption, improvement in the perception of overall diet quality, and increased spending of personal money and government assistance money seen with continued use of Fresh Fund. These findings are consistent with previous U.S. studies in which increased spending and consumption of FV was found to be associated with the use of incentive programs among SNAP and WIC users.[5-10] Although other similar studies have found positive associations between incentive program use and consumption of FV, this is the first of its kind to find increased consumption with continued market use among low-income consumers using monetary incentives. Furthermore, upon the examination of independent predictors of repeated Fresh Fund use, participants who reported unhealthier diets at baseline were found to be marginally more likely to return to Fresh Fund a greater number of times than those who reported a healthier diet, but only among short-term users (six months or less).

Seasonal and market differences were significantly associated with continued use of Fresh Fund. Among those who came to the market only for 6 months, those who enrolled in the fall compared to the summer were less likely to have multiple visits; however, among those who stayed 6 to 12 months, winter and spring enrollment were both associated with more visits than summer enrollment. This could be because those

who enrolled in winter and spring had more reason or desire to return during the spring and summer months when there was likely to be a wider variety of produce available at the markets; whereas those who enrolled in the summer would have less time before the fall and winter months when variety may have been more limited. Clearly the City Heights and Linda Vista markets were more likely to have repeat visitors than the other Fresh Fund markets. These were also the most established of the markets in their neighborhoods; in fact both markets had functioning community advisory committees. Interestingly, the Linda Vista neighborhood also had a large Asian population, which may have influenced these results. The one factor most highly associated with number of visits for both short, medium, and long-term participants was their use of government assistance money in the form of SNAP or SSI. SSI participating patrons who stayed for over 12 months were 1.3 times more likely to have a greater number of visits. Many SSI participants may be elderly or disabled and thus may have been more likely to continue using the market for food resources longer than the generally younger WIC participants who were of child-bearing age. It was interesting that the three Poisson regression models for short, medium and long-term users demonstrated different results, with more variables (including baseline very unhealthy diets) being associated with number of visits for short term users than long-term users. The number of visits for shorter-term participants was related to ethnicity, type of government assistance, enrollment market, season of enrollment, baseline servings/day of FV and perceived diet quality. Longer participation was predominantly associated with type of income. SSI recipients who used the market for 12 months or more were the most likely to have the greatest number of visits.

Limitations must be kept in mind when interpreting these results. Because Fresh Fund was a PSE intervention, it was not meant to manipulate individuals' behaviors, and the data available for this analysis was limited to the information collected among a convenience sample of those who voluntarily chose to participate in the baseline and follow-up surveys. In addition, perception of overall diet quality, daily consumption of FV, and weekly spending of FV were self-reported and therefore may introduce reporting bias into the data. The generalizability of the results to populations in other geographic regions may be limited. However, our sample consisted of WIC, SNAP and SSI recipients with a diverse make-up of sexes (15% male), ages (7 to 100 years), and various racial/ethnic groups, which may improve the external validity of these results as they might apply to government nutrition assistance recipients in other urban locations. Fresh Fund was conducted in San Diego where weather likely plays a role in the availability of and attendance to farmers markets throughout the year, whereas markets in colder climates likely close during the winter months. However, evaluations of farmers market incentive programs taking place in cities with significant winter weather (Philadelphia (Philly Food Bucks) and New York (Health Bucks)) have found similar results with increased spending and self-reported consumption of FV among SNAP and WIC participants.[5,7,8] Since this was not a behavioral intervention, the design did not include plans to actively retain participants, but rather to examine participation patterns over time. Participants continued to visit the market based on their own perceptions of need, and over half of participants (55%) visited the market only once. However, Dimitri and colleagues had a similar retention rate (49%) in their longitudinal pilot study among SNAP and WIC shoppers.[11] It is unknown whether participants continued to shop at the

farmers markets if they chose not to obtain Fresh Fund incentive tokens, in which case they were not required to report to the Fresh Fund booth; however, this is unlikely. Despite these limitations, this study has multiple strengths. There was a large sample comprised of racially diverse groups, a wide range of ages, and a reasonable proportion of male participants. Additionally, the analysis incorporated longitudinal measures, adding to the current cross-sectional evidence surrounding farmers market incentive programs.

Given the robust health benefits of diets rich in FV, and the evidence that the general US population does not consume nearly enough servings of FV, farmers market incentive programs have the potential to affect the health of low-income populations. Results showed that SSI government funding remained the factor most associated with number of visits to the market for those who remained 12 months or more. In addition, the total amount of money spent at a Fresh Fund market increased monthly with the length of participation, as did the self-reported number of servings of FV consumed, and the perception of diet quality. The results of this study can be used to inform future PSE interventions to ensure that such programs improve access to and affordability of FV among economically disadvantaged populations Sustaining and increasing Fresh Fund type program operations and utilization by minority populations should be a top priority for future policy decisions concerning farmers market use in low-income neighborhoods.

HEALTHY SCHOOLS SUMMER MEALS PROGRAM

This study of food insecurity among families attending Summer Meals sites in San Diego, CA demonstrated that food insecurity was significantly higher in August than

in June or July in bivariate analyses; however, the association did not persist after controlling for the demographic characteristics of the parent/guardian who completed the survey especially neighborhood SES. The increasing percentage of food insecurity as the summer progressed appears to be a function of an increasing number of families of very low income attending the Summer Meals programs in August. Notable was the extraordinarily high prevalence of food insecurity that was reported among this sample (65% of households, 54% of adults and 47% of children with low/very-low food security). Given that prior research indicated that federal summer food service programs positively impacted food security among children, it is worrisome that less than an estimated 3% of the children eligible to receive free/reduced school lunches in the SDUSD actually participate in the SFSP in San Diego.[12-14] Taken together, this information indicates the critical need for food and nutritional assistance programs accessible to children in low-income neighborhoods of San Diego during the summer months.

The U.S. Household Food Security survey provides a measure of food security for the 30 days prior to assessment; therefore, the June surveys in our study overlapped with the end of the school year, when some of these children would have been receiving the free/reduced priced school meals, and we would have expected to see less food insecurity in June than in July or August after controlling for demographic factors. One possible explanation for this lack of association could be related to the age of the children, which was not collected as part of the original program evaluation. If the children were too young to attend school, then the free/reduced price school means would not have any impact on the food security of these families.

Significant associations of food insecurity with the SES of the neighborhood where the Summer Meals site was located, and the age of the parent/guardian completing the survey were found. Parents/guardians who were older and attended Summer Meals sites in lower SES neighborhoods were significantly more food insecure with regards to household and child food security, and those attending sites in lower SES neighborhoods had higher adult food insecurity as well. While it seems logical that lower income and poverty would be synonymous with food insecurity, the two do not go hand-in-hand. The USDA estimated that in 2010, less than half of households (40.2%) below the federal poverty line were food insecure, and more than 7% of households with incomes above 185% of the poverty line were also food insecure.[15] Qualitative studies reported inverse associations between income and food insecurity; however, it was suggested that the relationship may fluctuate with changes in income throughout the year. In the present study, this relationship could not examined because our information was limited and because of the cross-sectional study design.[16-18] Interestingly, the age of the parent/guardian was not associated with adult food security, but it was associated with child and household food security. Similarly, other studies have also reported that maternal age is independently associated with child food security.[19,20]

The results of this study should be interpreted with its limitations in mind. First, the data for this study were collected as part of a PSE intervention evaluation among a convenience sample of parents/guardians who attended a Summer Meals site with their children, and who volunteered to participate in the USDA Household Food Security surveys. Therefore, the generalizability of these results to other low-income populations even within San Diego may be limited. This analysis excludes families of children who

may have been brought to the Summer Meals site by a friend or neighbor, because only parents/guardians were invited to participate in the survey. Nevertheless, the results of this study describe the food security situation of the families whose parent/guardians attended the Summer Meals program with their child(ren). While the cross-sectional nature of these data prevents any conclusions from being drawn within individual families over the course of the summer, our analysis aimed to examine differences between the families who attended the program at the beginning of the summer and those who came at the end of the summer, eliminating the need for follow-up data. These results are also clearly biased toward a greater prevalence of food insecurity because of the method used to select neighborhoods for the Summer Meals programs. The results describe food insecurity in predominantly low and very low-income neighborhoods. Self-selection of the families is also a factor because those with the greatest need may be the ones who attend the Summer Meals events. Finally, the household food security survey was interviewer-administered; therefore, participants may have been reluctant to report their true food security situation. However, the surveys were anonymous, which should have encouraged participants to be truthful during the interview.

An astoundingly high prevalence of food insecurity among families attending the Summer Meals program was found, indicating the need for successful and sustainable food and nutrition assistance programs to reach the children who need it most, particularly in the summer. The results of this study should be used to aid in the guidance of the placement of Summer Meals programs and the direction of future funding for these nutritional assistance programs. The results can also inform future outreach and

marketing campaigns to inform the public that these programs are available in their communities, particularly those in very low-income neighborhoods.

CONCLUSION

San Diego is one of the first cities in the U.S. to implement a registry-based community-wide BMI surveillance system to monitor and track rates of overweight and obesity at the local-level. In its current state, the County of San Diego BMI Surveillance System is capturing a representative sample of children and older adults. The HHSA can use the results of this research to improve upon the sampling frame by including additional sources of height and weight data to hopefully capture the early adult and middle age groups. In addition, with more thorough data collection and entry at the healthcare provider offices, the quality of the race/ethnicity data would improve. With more complete race/ethnicity data, the HHSA could better determine whether the population being sampled is representing the correct proportions of racial/ethnic groups in areas of San Diego that could use targeted obesity prevention interventions. While the County of San Diego BMI Surveillance System is still in its infancy, it has the potential to become a robust tool with which the County of San Diego HHSA can have in their toolbox to effectively combat the obesity epidemic in their communities.

PSE changes can be successful and sustainable public health strategies to be used along with other approaches to improve the overall health of communities. In San Diego, Healthy Foods Farmers Market Fresh Fund Incentive Project was developed to improve access to and consumption of nutritious food among low-income populations by making it possible for government nutrition assistance recipients to use their benefit money at

local farmers market. In addition, financial incentives were provided to increase the affordability of healthy foods with the goal of having it translate to increased consumption. The results of this research indicate that participants reported increased consumption of FV and improvements in self-perceived diet quality with continued use of the program over time. While these results are promising, the most significant barrier to the success of Fresh Fund was the continued use of the program. More than half of Fresh Fund enrollees did not return after their enrollment visit, and almost 85% came for six months or less. Determining the reasons for discontinued participation could allow program improvements to aid in the success of farmers market incentive programs among low-income populations in San Diego.

The Healthy Schools Summer Meals Program in the San Diego Unified School District provides a much needed service to the children of San Diego. Our original hypothesis was that food insecurity would increase as the summer progressed; however, the results did not support this hypothesis. Regardless, with almost half of survey participants reporting low or very-low child food security, the need for these programs is evident. Even if the hungriest children and families are the ones who are attending these events, subsequently driving up the prevalence of food insecurity found in our research, the results still indicate that expanded Summer Food Services Programs would benefit the children of San Diego through improved nutrition and ultimately provide a positive impact on their health.

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APPENDIX

Table 2.3 – Sub-regional areas of San Diego County that are representative for age, gender,[a] and race/ethnicity in The County of San Diego BMI Surveillance System, 2011

	Age Groups					
Race	**2-11**	**12-17**	**18-24**	**25-44**	**45-64**	**≥65**
Hispanic	Chula Vista Jamul La Mesa Lemon Grove Mid-City Palomar-Julian Pendleton Santee South Bay Southeast SD Spring Valley Sweetwater	Chula Vista La Mesa Lemon Grove Mid-City Palomar-Julian Pauma Santee South Bay Southeast SD Spring Valley Sweetwater	Palomar-Julian		Chula Vista Mid-City Palomar-Julian Santee South Bay Spring Valley	Chula Vista Jamul La Mesa Mid-City Palomar-Julian Pauma Santee South Bay Southeast SD Spring Valley Sweetwater
White	Chula Vista Coastal Elliott-Navajo La Mesa Lemon Grove Miramar National City Pendleton Peninsula Santee Spring Valley Sweetwater Ramona Valley Center	Chula Vista Coastal Elliott-Navajo La Mesa Lemon Grove National City Santee Spring Valley Sweetwater Ramona Valley Center	Alpine		Chula Vista Mountain Empire[b] Peninsula Santee Spring Valley	Chula Vista Coastal Elliott-Navajo La Mesa Mountain Empire[b] National City Peninsula Santee Spring Valley Sweetwater Valley Center
Black	Carlsbad Chula Vista Coastal Del Mar-Mira Mesa Elliott-Navajo Escondido Kearny Mesa La Mesa North SD Peninsula San Dieguito South Bay Sweetwater Ramona University	Carlsbad Chula Vista Coastal Del Mar-Mira Mesa Elliott-Navajo Escondido Kearny Mesa La Mesa North SD San Dieguito South Bay Sweetwater Ramona University			Chula Vista Kearny Mesa[c] North SD[c] Peninsula South Bay	Carlsbad Chula Vista Coastal Del Mar-Mira Mesa Elliott-Navajo Escondido[c] Kearny Mesa La Mesa North SD Peninsula San Dieguito South Bay Sweetwater University

[a] Representative for both men and women unless otherwise specified; [b] Men only; [c] Women only

Table 2.3 – Sub-regional areas of San Diego County that are representative for age, gender,[a] and race/ethnicity in The County of San Diego BMI Surveillance System, 2011, continued

	Age Groups					
Race	**2-11**	**12-17**	**18-24**	**25-44**	**45-64**	**≥65**
Asian	Coastal Palomar-Julian Peninsula Ramona	Coastal Palomar-Julian Ramona	Palomar-Julian		Palomar-Julian Peninsula	Coastal Palomar-Julian Peninsula
Other	La Mesa Pendleton	La Mesa				La Mesa

[a] Representative for both men and women unless otherwise specified; [b] Men only; [c] Women only