Title

The State of School Wellness Policy and Farm to School in the Nation's Largest State K-12 School System: An Assessment of Factors Influencing Engagement among California Public Districts

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The State of School Wellness Policy and Farm to School in the Nation's Largest State K-12 School System: An Assessment of Factors Influencing Engagement among California Public Districts

By

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DISSERTATION

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DEDICATION

To my son, Angelo Zorn. I hope I have inspired you to live your values and pursue your dreams and goals--regardless of your age or how long it takes.

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ABSTRACT

This dissertation assesses federally mandated local school wellness policy (LSWP) quality and farm to school (F2S) engagement among California (CA) public school districts to address gaps in understanding about district factors that influence their development and adoption. To date, no such statewide evaluations have been done for CA, the nation's most populous state.

Chapter 1 describes the quality of a randomly selected sample of 200 LSWPs collected from low-income CA public districts during the 2017-18 school year. Policy quality (comprehensiveness and strength) was determined using the WellSAT 3.0 LSWP scoring tool. Multiple linear regression was used to assess associations between district demographic characteristics and LSWP quality scores. District demographic data on size, racial/ethnic makeup, student poverty, urbanicity, and presence of a district high school were obtained from the CA Department of Education (CDE). Models were also adjusted for use of a LSWP template and the date of policy adoption.

F2S links schools with local farms to bring farm-fresh, nutritious food to school campuses. Chapters 2 and 3 evaluate data from CA public districts reported in the 2019 USDA F2S Census. Chapter 2 assesses whether F2S uptake is equitable among CA public districts. Weighted, multiple logistic regression was used to evaluate associations between district demographic factors (described for Chapter 1) and report of engagement in F2S activities during the 2018-19 school year. Local food (LF) procurement for school meals is a core F2S activity yet not all districts participate in this F2S activity. Chapter 3 used weighted, multiple logistic regression to assess the influence of district demographic characteristics and school meal practices on serving LF in the school lunch program in 2018-19. School meal factors included having a salad bar, having a LF procurement policy, years of F2S engagement, and how "local" is defined by the district. Taken together these findings fill gaps in knowledge and can assist school food, F2S and child health decision makers to prioritize future policy, funding and training efforts more effectively in order to further improve school food environments at the local and national levels.

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INTRODUCTION

The US Department of Agriculture (USDA) defines food insecurity as "the limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways."[1] Experiencing food insecurity during childhood or adolescence can impair growth and cognitive development [2] and increase risk for obesity and poor physical and mental health[2] [3] that can hinder academic success.[4] Food insecurity is more common in underserved and racial/ethnic minority populations,[5] compounding risks associated with health and educational attainment. Rising rates of childhood obesity and food insecurity over the past two decades have renewed interest in improving the nutritional value of school meals as a key public health measure to support child health and educational success.

School Meals

The USDA administers the National School Lunch and Breakfast Program to provide access to low-cost or free meals and snacks at school to "promote health and educational readiness." [6] Today these programs disproportionately serve low-income students [6] [7] who consume as much as 51% of their daily calories at school and depend on these meals to support good health and educational success.[8] These factors increase the imperative for school meals to meet the Dietary Guidelines for Americans (DGA) recommendations to increase fruit, vegetable, and whole grain servings, reduce intake of sugar, salt, and saturated fat,[9] and provide evidence-based nutrition education that promotes the consumption of these nutrient-dense foods.[10]

Mandates to Improve School Food Environments

In response to these concerns, Congress adopted several mandates aimed at improving school food and physical activity environments. The first was the Child Nutrition and WIC Reauthorization Act passed unanimously in 2004,[11] and requires all public-school districts that participate in federal school meal programs to develop and adopt a local school wellness policy (LSWP) that sets nutrition guidelines

for all food available on school campuses and goals for nutrition education and physical activity. As long as these requirements are met, districts are encouraged to customize policies to support local needs and priorities. The 2010 Healthy Hunger-Free Kids Act (HHFKA) further strengthened nutrition standards for school meals and established a farm to school (F2S) program within the USDA to help school food authorities (SFA) meet the stronger nutrition standards by connecting local and regional farmers with SFAs to bring farm fresh food to school meal programs.[12] This mandate also created provisions for a geographic preference purchasing option to encourage local food procurement, and competitive grants along with technical assistance to support practices that increase local food procurement and promotion at school. In addition, the USDA must periodically administer a F2S Census to monitor progress and set goals for F2S funding and policy priorities.[13] In July of 2016, the USDA released its Final Rule affirming the DGA as the nutrition standard for school food and mandating compliance with the updated LSWP requirements set forth in the HHFKA by June 30, 2017.[14]

Impact of School Food Mandates

School meal evaluations following the HHFKA indicated overall improvements in the nutritional value of school meals and competitive food and beverage offerings along with increased student purchases of these healthier offerings.[15] [16] [17] [18] In addition, a recent national evaluation found dietary intakes from foods purchased and consumed on school campuses were of higher quality than non-school sourced foods for all students regardless of income or food security status.[7] However, it is more difficult to connect these positive improvements in the nutritional value of school food directly to reductions in childhood obesity or specific health outcomes due to the complex interactions of biological and social determinants that can influence weight and health.[19] [20] Regardless, there is little disagreement that physical and mental health impact learning[21] and that improving school food and physical activity environments should be part of a comprehensive national strategy to improve child health and academic success.[10] [21]

National and regional evaluations show most districts have developed a LSWP,[22] but overall, policy language is generally weak with varying levels of compliance meeting all mandated policy components.[23] [24] While neither mandate required F2S adoption, state support for F2S programs has increased across the country,[25] bolstered by growing evidence of co-benefits from local food procurement on health and educational outcomes, local agricultural economies, and the potential for reduced food processing and transportation to lower the carbon footprint of school meals.[26] [27] [28] Data reported in the 2019 USDA Census Report showed an overall increasing national trend in adoption of F2S strategies from 42% of Census respondents in 2013 to 72% in 2019.[29] There is limited peer reviewed F2S research literature because F2S has not been an interest of scholarly activity until recently.[30] Of the studies to date, most focused on the effectiveness of increasing fruit and vegetable consumption with F2S strategies.[28] A handful of national and regional studies indicated that district size, urbanicity and serving large numbers of low-income and minority students may add additional financial and/or geographic barriers to F2S adoption.[31] [32] [33] Students in such districts likely would benefit the most from F2S programs, hence understanding barriers and supports to F2S adoption warrants further investigation.

Need for California Evaluations

As the most populous state with the highest public district enrollment in the nation,[34] California (CA) provides an important setting to study school meal mandates. The state is home to over 1,000 public districts attended by 6 million children, with more than 60% of these students representing racial/ethnic minorities and underserved demographic groups associated with the highest risk for both food insecurity and obesity.[35] CA is also a key agricultural producer[36] and among the first states to promote F2S.[37] There is a robust state F2S Program within the Office of Farm to Fork (COFF) under the Department of Food and Agriculture (CDFA)[38] working to expand F2S networks within the state and to "promote and protect CA's agriculture, lessen the impact of food insecurity, foster healthy

environments and improve market access – through coordination, education and outreach."[39] More research is needed to improve understanding about the LSWP and F2S landscape in the state to help school food and child health leaders advocate for and appropriately prioritize funding and policies that further improve school meals and support state food security, climate, and economic goals.

Dissertation Aims

The focus of this dissertation is to assess overall engagement in LSWP and F2S among CA public districts. The central hypothesis is that certain district characteristics such as size, locale, racial/ethnic and/or income demographics and school meal practices may negatively influence the development and/or adoption of these practices. Improving understanding about potential district level barriers and supports for these strategies will address key gaps in knowledge.

Chapter 1 analyzes the comprehensiveness and strength of a county-stratified, randomly selected sample of LSWP from low-income CA public districts using the WellSat 3.0,[23] a nationally validated LSWP scoring tool. Multiple linear regression is used to evaluate district demographic factors associated with policy comprehensiveness and strength scores. District demographic data (enrollment, racial/ethnic makeup, % of students eligible for the federal free and reduced-price meal program (FRPM), and grade range) were obtained from the CA Department of Education (CDE).[40] Models are adjusted for whether a LSWP model template was used in policy development and the date of policy adoption.

Expanding F2S through school meal programs holds the potential to make a child's school a strategic access point to support consumption of nutritious food. This access is especially important for low-income and minority children who are more likely to live in "food deserts," which are defined as areas with reduced access to fresh food.[41] [42] Recent availability of data from the 2019 USDA F2S Census[43] provides an ideal opportunity to assess CA's F2S progress up to the 2018-19 school year, the last "normal" academic year prior to pandemic-related disruptions, to determine whether F2S adoption

barriers similar to national findings are present in CA. Chapters 2 and 3 use data from the 2019 USDA F2S Census matched with demographic data from CDE to examine factors associated with adoption of F2S practices among CA public school districts during the 2018-19 school year.

Chapter 2 evaluates district characteristics associated with F2S adoption among SFAs serving CA public school districts that responded to the 2019 F2S Census. Weighted multiple logistic regression is used to evaluate whether district size, racial/ethnic makeup, % of FRPM eligible students, per-pupil spending or urbanicity are associated with engagement in F2S activities during the 2018-19 school year.

Local food procurement for school meals is the key F2S strategy to increase access to nutritious food at school, yet not all districts with F2S programs adopt this practice.[29] Therefore, the aim for Chapter 3 is to evaluate district characteristics and school meal practices associated with serving LF in the national school lunch program (NSLP). Weighted, multiple logistic regression is used to assess whether the district demographic characteristics identified in Chapter 2 and/or SFA practices such as use of salad bars, local food procurement policies, years of F2S engagement, or district definition of "local" food are associated with serving local food in the NSLP during the 2018-19 school year.

The identification of disparities, barriers and facilitators to LSWP and F2S engagement and adoption among public districts can inform future policy and funding decisions in CA to ensure adequate support for nutritious fresh food to reach the most at-risk students while also promoting food security, climate goals, and local agriculture systems in the state.

Chapter 1: The Strength and Comprehensiveness of School Wellness Policies among Low-Income California Public School Districts

ABSTRACT

Importance: School districts participating in the national school meal program must adopt a local school wellness policy (LSWP) to set standards for school food, nutrition education, and physical activity. Strong, comprehensive policies indicate commitment and support implementation and accountability.

Objective(s): Examine the quality of LSWP from a sample of low-income California public districts and assess the influence of district characteristics, model policy template, use and policy adoption date on policy quality.

Design, Setting, and Participants: A randomly selected, county-stratified sample of 200 LSWPs were chosen from California public districts with at least one school serving ≥ 50% of students eligible for the free and reduced-price meal program. LSWPs were collected during spring 2018.

Variables Measured: LSWPs were coded for strength and comprehensiveness scores using the WellSat3.0 validated assessment tool. Use of model templates was assessed with a method adapted from another state. District demographic data for the 2017-18 school year was collected from the California Department of Education and National Center for Education Statistics.

Analysis: Mean (95% CI) policy comprehensiveness and strength scores were reported overall and by district characteristics and policy factors. Adjusted linear regression was used to assess the relationship between the district and policy characteristics and policy strength and comprehensiveness scores.

Results: On a scale of 0−100, mean comprehensiveness was 65.0 (63.2-66.7) and strength was 37.3 (35.3-39.2). Overall template use among districts was high (> 80%), with 13% of the sample modeling a stronger national template. Half the policies were adopted before the USDA Final Rule which clarified LSWP update requirements. Larger district enrollment (≥ 1,000 students) and modeling a national LSWP template were associated with higher comprehensiveness and strength scores.

Conclusions and Implications: LSWP quality scores were low, modeling of templates was high, and half of the policies were not updated, indicating limited engagement in LSWP. Alignment of LSWPs within related mandated school health and funding frameworks may increase engagement and accountability.

INTRODUCTION

Childhood food insecurity is associated with obesity and physical and mental health challenges that can impede academic success.[2 3 4] Schools play an important role in addressing food insecurity by providing access to nutritious food and supporting positive health behaviors.[7 10] Providing this support at school is crucial for low-income students who are at the highest risk for food insecurity and may consume as much as 51% of their daily calories at school.[7 8]

Recognizing this critical role, Congress passed the Child Nutrition and WIC Reauthorization Act in 2004, requiring all public-school districts that participate in federal school meal programs to develop and adopt a local school wellness policy (LSWP) by the 2006-2007 academic year.[11] Each district policy must include (1) written goals for nutrition education, physical activity, and other wellness promotion activities; (2) nutrition guidelines for all foods available on school campuses; (3) assurance that school meals meet federal requirements; (4) a plan for measuring implementation; and (5) involve parents, students, school food authority, school board, school administrators, and the public in LSWP development. If all required components are met, districts may customize a LSWP to meet local needs.[11]

In 2010, the Healthy, Hunger-Free Kids Act (HHFKA) updated and strengthened the LSWP mandate by giving the U.S. Department of Agriculture (USDA) authority to set nutrition standards for all foods and beverages sold during the school day.[12] The HHFKA also required regulation of food and beverage marketing, increased access to drinking water, set standards for nutrition education and physical activity, and broadened district wellness team membership, assessment and oversight.[12] In July of 2016, the USDA released the final rule which codified HHFKA nutrition standards and mandated school districts to comply with the updated LSWP requirements by June 30, 2017.[14]

A 2016 evaluation found 95% of districts nationwide had adopted a LSWP by the 2013-14 school year. LSWP quality also has improved over time, but significant variability in meeting required policy components and weak language are prevalent.[22] Additional post HHFKA evaluations document improvements in the nutritional value of school meals and competitive food and beverage offerings as well as student purchasing of these items at school.[15 16 17 18] Connecting these improvements directly to reductions in childhood obesity or specific health outcomes is more challenging due to the complex interactions between biological and social determinants that can influence weight and health.[19 20] Nevertheless, there is broad agreement that physical and mental health impact learning,[21] and improving school food and activity environments plays a role in a comprehensive strategy to support child health and academic success.[10 21]

Interest in the quality of LSWPs persists because strong and comprehensive policy language indicates commitment and accountability and is associated with better policy implementation at the school level.[44] Two studies using the same validated LSWP scoring tool found the average policy comprehensiveness (scope of policy components) and strength (decisiveness of policy language) scores were below 50 out of a high score of 100.[45 46] A more recent analysis of a national sample using the HHFKA updated version of this scoring tool[23] reported an average comprehensiveness score of 53/100 and strength score of 33/100,[24] indicating that variability in LSWP quality and compliance persists. Some evaluations have found associations between LSWP quality and district characteristics. Others examined policy characteristics; specifically, the mirroring of a state or national-level LSWP model template. To date, studies have found stronger policies associated with district size, majority Hispanic/Latino and Black districts, presence of district high school(s), urban locale, and districts in states with additional state-level LSWP mandates.[22 24 45 46]

California (CA) is an excellent setting to study LSWPs due to the size and diversity of the more than 6 million K-12 students. Nearly 3.6 million CA students qualify for the federal free or reduced-price

meal (FRPM) program, a key poverty indicator.[47] (Children from families with incomes at or below 130% of the Federal poverty level quality for free meals, and those with incomes between 130 - 185% quality for reduced price meals.)[6] In addition, more than 60% of CA students represent racial/ethnic minorities and underserved demographic groups associated with the highest risk for both food insecurity and obesity.[35]

The purpose of this study is to describe the distribution of LSWP comprehensiveness and strength scores across low-income districts in CA, and to identify district characteristics that are associated with high scores. The study hypothesis is that factors such as large size, serving large numbers of low-income and/or racial/ethnic minority students, urban locale, having district high schools, use of a model LSWP template, and policy adoption after the passage of the USDA Final Rule LSWP update are associated with higher LSWP comprehensiveness and strength scores.

METHODS

Sample Selection and Demographic Data Sources

Stratified random sampling was used to select 200 public school districts for the study. Districts eligible for selection had to have at least one school with 50.0% or more FRPM-eligible students. Among California's 1028 school districts, 770 eligible school districts were stratified by county to ensure adequate representation from each California county in the final sample. Within each county, 25% of districts were randomly selected utilizing the SAS SurveySelect Procedure (METHOD=PPS). District demographic data were obtained from the California Department of Education (CDE).[40] The National Center for Education Statistics classifies district urbanicity as urban or rural.[48] [49]

Collecting and Scoring Wellness Policies

In spring 2018 the most recent LSWP was obtained from each of the 200 school districts' websites. Missing policies were requested from district administrators via phone and email contact. The Rudd Center's WellSAT 3.0 was used to score the policies because it captured both federal and state

nutrition requirements, had been validated, and has been used in other policy surveillance projects.[23 50] WellSAT 3.0 includes 67 questions organized into six sections: (1) Nutrition Education; (2) Standards for USDA Child Nutrition Programs and School Meals; (3) Nutrition Standards for Competitive and Other Foods and Beverages; (4) Physical Education and Activity; (5) Wellness Promotion and Marketing; and (6) Implementation, Evaluation and Communication.[51] WellSAT creators explain that the "comprehensiveness score captures the extent to which recommended content areas are covered in the policy. The strength score describes how strongly the content is stated. Both scores range from 0 to 100, with lower scores indicating less content and weaker language, and higher scores indicating more content and use of specific and directive language."[50] The WellSAT 3.0 assessment tool further clarifies that strong/directive policy language includes concrete plans, timelines and strategies for implementation using enforceable words such as "will, must, require and all," whereas weaker/less directive language includes vague statements with aspirational goals or recommendations using words such as "may, can, might, try and some."[51]

A Registered Dietitian Nutritionist with direct experience developing LSWPs scored all the policies. A third-year law student and MPH-trained public health researcher participated in a training session and scored 32 (16%) of the policies to determine interrater reliability. Most intraclass correlations (ICC) scores were 0.8 or higher indicating high levels of agreement between coders. Mean ICC was 0.89 for the total comprehensiveness score and 0.82 for the total strength score. The mean ICC for the six WellSat subsections sections was 0.78 for comprehensiveness and 0.72 for strength. Of note, these ICC results were consistent with and slightly higher than those reported by the WellSat creators, [50] indicating the interrater reliability was more than adequate.

LSWPs were also categorized by adoption date and mirroring of a model LSWP policy template. The most recent documented policy adoption date was used to determine if the policy was "compliant" with the USDA Final Rule enacted on July 26, 2016.[14] Policies adopted prior to July 26, 2016, were

considered “non-compliant.” LSWP template mirroring was determined by modifying a method employed by Smith et al.[52] using the following criteria: (1) the name of the template sponsor was listed on the policy; (2) the policy introduction and subheadings matched the original template, and (3) the number of pages and the organization of the text were similar to the original template. Template sponsors were identified as the California School Board Association (classified as a CA “state” template),[53] the Alliance for a Healthier Generation (classified as a “national” template),[54] and the National Alliance for Nutrition and Activity (classified as a “national” template).[55]

Covariates

The following covariates were included in the models because they were identified in the literature search as being associated with wellness policies: district size (small/large), geographic region (rural/urban), presence of a district high school (yes/no) since the competitive offerings at high schools require a higher degree or regulation, percent FRPM eligible students, policy template type (national/state/none), and policy adoption date (Compliant/Non-Compliant). The racial/ethnic makeup data for percent Latino/Hispanic students was highly correlated with percent FRPM eligibility and percent White students (correlation coefficients between 0.54 – 0.79) limiting inclusion of all three variables in the models. Therefore, we used the district race/ethnicity data to create a dichotomized variable (non-White majority) to include in the model. Results for small and medium district sizes were similar, so these categories were combined into the “small” category.

Analysis

The mean comprehensiveness and strength scores with 95% CI were calculated overall and for each covariate category using unadjusted general linear models (GLM) and Tukey’s test to evaluate significant differences in means scores. Two adjusted GLM models were used to examine associations between district factors and (1) comprehensiveness and (2) strength scores. For variables with >2 categories, the analysis was rerun by changing the referent within the category to ensure each grouping

was compared (not shown in data tables). Models were tested for interaction between template type and adoption date using an interaction term (template type*adoption date). Ten districts missing a policy adoption date were excluded from the final models. Statistical analyses were done using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

The sample of 200 low-income school districts represented a variety of sizes, locations, and types (Table 1.1). Mean enrollment was 10,474 students with a similar proportion of small, medium, and large districts. Almost 70% of districts were in urban areas. About 7% of the districts comprised only high schools (grades 9-12), with the rest as K-12 districts or elementary only (grades K-8).

Table 1.1. Characteristics of Low-Income School Districts.

Characteristics	Sample size†	Percent
District size [a] (mean, 95% CI)		10,474 (4,121-16,829)
Large (Enrollment ≥ 5000)	72	36.0%
Medium (Enrollment = 1000 - 4999)	66	33.0%
Small (Enrollment <1000)	62	31.0%
Non-White Majority [a]		
Yes	149	74.5
No	51	25.5
% FRPM Eligible students [a] (mean, 95% CI)		64.7 (62.0 – 67.3)
Urbanicity [b]		
Rural	61	30.5%
Urban	139	69.5%
District Grade Classification [a]		
Elementary only	76	38.0%
High School only	14	7.0%
K - 12	110	55.0%
Policy Template Type		
None	37	18.5%
State	137	68.5%
National	26	13.0%
Policy Adoption Date		
Compliant (after Final Rule enacted)	95	47.5%
Non-Compliant (prior to Final Rule)	95	47.5%
Missing	10	5.0%

[a] Source: California Department of Education.[40]

[b] Source: National Center for Education Statistics.[48] Urbanicity is based on standard urban/rural definitions developed by the U.S. Census Bureau. Urban Locales include designations: City, Large; City, Midsize; City, Small; Suburb, Large; Suburb, Midsize; Suburb, Small; Town, Fringe; Town, Distant; Town, Remote. Rural Locales include designations: Rural, Fringe; Rural, Distant; Rural, Remote.[49]

† n=200

Because the sample was selected for low-income school districts, the poverty indicators were high with a mean of nearly 65% of students FRPM-eligible. Districts represented a racially and ethnically diverse student population, with 75% having a Non-White majority. Half of the policies were adopted before the USDA final rule mandate on July 29, 2016. Ten policies were missing adoption dates. Most districts used a state model LSWP template from the California School Board Association. Another 13% used a national template by the National Alliance for Nutrition and Activity or the Alliance for a Healthier Generation, and 18.5% created their own policy.

Table 1.2 lists the average mean strength and comprehensive scores by district and policy characteristics. Total scores averaged 65 out of 100 for comprehensiveness and 37 out of 100 for strength (Table 1.2). There were no significant differences in mean comprehensiveness or strength scores by district size or geographic region. Having at least one district high school was not associated with mean comprehensiveness scores, but mean strength score was 4 points higher for districts with high schools ($p = 0.048$). Mean comprehensiveness scores for districts using a state template were 4.2 points higher ($p = 0.043$) and those using a national template were 18 points higher ($p = 0.001$) than districts not using a template. Strength scores also were affected by template use, with a 4.6-point higher mean score for districts using a state template than those not using a template ($p=0.046$) and a 22-point higher mean score for districts using a national template compared with no template ($p<0.001$). There was no difference in mean comprehensiveness score by policy adoption date, but the mean strength score for districts with date compliant policies was 9.4 points higher than for districts with non-compliant policies ($p<0.001$).

Table 1.2. Average Mean Strength and Comprehensiveness Scores by District and Policy Characteristics.

	Unadjusted Score Mean (95% CI), n = 200	
District Characteristics	**Comprehensiveness score**	**Strength score**
Overall Mean	64.95 (63.23 – 66.66)	37.29 (35.34 – 39.24)
District size		
Large	65.07 (62.20 – 67.94)	37.61 (34.36 - 40.87)
Medium	65.83 (62.83 - 68.83)	38.49 (35.09 - 41.89)
Small (ref)	63.86 (60.77 – 66.96)	35.63 (32.12 - 39.13)
Non-White Majority		
Yes	65.06 (63.06 – 67.05)	36.63 (34.37 – 38.89)
No	64.62 (61.21 – 68.03)	39.21 (35.36 – 43.07)
Geographic Region		
Rural	65.23 (62.18 – 68.35)	37.28 (33.74 – 40.81)
Urban	64.82 (62.76 – 66.89)	37.29 (34.95 - 39.64)
District has High School(s)		
No	63.60 (60.81 - 66.38)	34.80 (31.18 - 38.41)*
Yes	65.78 (63.60 - 67.95)	38.81 (36.58 - 41.05)
Policy Template Type		
National	77.80 (73.47 - 82.13)*	53.08 (48.24 – 57.92)*
State	63.92 (62.04 - 65.81)*+	35.92 (33.81 - 38.03)*+
None (ref)	59.70 (56.07 – 63.34)	31.26 (27.21 – 35.32)
Policy Adoption Date		
Compliant	66.11 (63.62 - 68.61)	41.83 (39.15 - 44.51)*
Non-Compliant	63.75 (61.26 - 66.25)	32.44 (29.76 – 35.13)

* p-value <0.05 using Tukey's test to evaluate differences in means.

+ Significantly different from the national template.

ref = reference group

Results from the adjusted linear regression for comprehensiveness score are presented in Table 1.3. The template x policy date interaction term was not significant (p=0.11) and was excluded from the final model. The R^2 was 0.21 meaning this model explained 21% of the variation in comprehensiveness scores. In the adjusted model, large districts had 5 points higher comprehensiveness scores than small districts (p = 0.024). Districts using a national model template scored 17.7 points higher than those not using a template (p < 0.0001). With state as the referent template, mean comprehensiveness for the national template was also higher than for the state template (Estimate = 15.28 [10.15, 20.41], p <0.0001).

Table 1.3. Linear Regression Results for Comprehensiveness Score.

District Characteristics	Adjusted estimate*†	95% CI	p-value
District Size			
Large (Enrollment ≥ 1,000)	5.12	0.69 – 9.57	**0.024**
Small (Enrollment < 1,000)	ref	---	---
Non-White Majority			
No	-2.31	-6.21 – 1.59	0.244
Yes	ref		
% Students Eligible for FRPM	-0.05	- 0.14 – 0.04	0.310
Urbanicity			
Rural	1.63	- 2.48 - 5.75	0.435
Urban	ref	---	---
District has High School(s)			
No	-0.89	- 4.22 – 2.44	0.601
Yes	ref	---	---
Policy Template Type			
National	17.66	11.58 – 23.75	**<0.0001**
State	2.38	- 1.74 – 6.50	0.255
None	ref	---	**---**
Policy Adoption Date			
Compliant	1.55	-1.55 – 4.67	0.325
Non-Compliant	ref		---

*Adjusted for district size, non-White majority, % students eligible for FRPM, geographic region, district has high school(s), template type, and adoption date.
† n=190

Results from the adjusted regression for strength scores are presented in Table 1.4. The template x date interaction term was statistically significant (p=0.024) therefore results are presented from districts by compliant and non-compliant dates. The R^2 of 0.36 for the compliant model means this model explained 36% of the variation in strength scores. The R^2 of 0.18 for the non-compliant model means this model explained 18% of the variation in strength scores.

For the date compliant policies, strength score was 7 points higher in large compared to small districts. However, district size was not associated with strength scores for non-compliant districts. Districts using a national model template with date compliant policies scored 27 points higher than those not using a template ($p < 0.001$). This estimate is more than double the estimate for districts using the national model template with non-compliant dates. Using state as reference for template type

for date compliant policies, the mean strength score for the national model template was also significantly higher than for the state template (Estimate = 22.82, [15.86, 29.79], p < 0.001). Using state as referent for non-compliant policies, the mean strength score for the national model template was also significantly higher than for the state template (Estimate = 11.30, [1.78, 20.83], p = 0.021).

Table 1.4. Linear Regression Results for Strength Score, Stratified by Policy Adoption Date.

District Characteristics	Adoption Date Compliant (n=95) †			Adoption Date Non-Compliant (n= 95) †		
	Adjusted* estimate	95% CI	p-value	Adjusted* estimate	95% CI	p-value
District Size						
Large (Enrollment ≥ 1,000)	7.22	0.69 - 13.75	**0.031**	6.13	-1.31 - 13.56	0.105
Small (Enrollment < 1,000)	ref	---	---	ref	---	---
Non-White Majority						
No	-1.32	-7.23 – 4.58	0.657	0.43	-5.81 – 6.68	0.890
Yes	ref					
% Students Eligible for FRPM	-0.03	-0.17 – 0.11	0.665	-0.13	-0.26 - 0.12	*0.073*
Urbanicity						
Rural	0.68	-5.54- 6.90	0.829	4.21	-2.29 – 10.71	0.202
Urban	ref	---	---	ref	---	---
District has High School(s)						
No	-0.42	-5.37 – 4.54	0.868	-4.22	-9.92 – 1.48	0.145
Yes	ref	---	---	ref	---	---
Policy Template Type						
National	26.99	17.64 – 36.35	**<0.0001**	11.73	1.59 – 21.88	**0.024**
State	4.17	- 3.12 – 11.46	0.259	0.43	-5.10 – 5.96	0.877
None	ref	---	---	ref	---	---

*Adjusted for district size, non-White majority, % students eligible for FRPM, geographic region, district has high school(s), template type, and adoption date.

DISCUSSION

Summary

All districts in this sample of low-income CA school districts adopted a LSWP by the 2018 study period. The study mean policy quality scores were similar to national scores; the mean comprehensiveness score was 65 (vs. 53), and the mean strength score was 37 (vs. 33). Model LSWP template use was common (by > 80% of districts), and those mirroring a national template had significantly higher comprehensiveness and strength scores than districts using the state template or no template. Strength scores were significantly higher for policies adopted after the USDA Final Rule, likely

reflecting the stronger LSWP assessment and oversight requirements stemming from this mandate. A small increase in policy quality was also associated with larger school districts (≥ 1,000 students), but there was no association with % FRPM eligible students, non-White majority districts, urbanicity or having high school(s). While some studies have found higher LSWP scores associated with districts serving large numbers of low-income and/or racial/ethnic minority students (likely because these districts often have higher school meal participation rates requiring more accountability to school food regulations), this study's focus on low-income districts plus the high prevalence of FRPM eligible and non-White majority districts in the sample may explain why no association was found for these variables.

While most districts mirrored a model policy template often verbatim, only 13% of the policies were tied to the more comprehensive national templates that incorporate a greater degree of directive language for both required policy components and elements outlining best practices. The less extensive CA state template was used by 68.5% of sample districts. This template incorporates strong language for required policy elements, but less directive language for the elements outlining best practices, which resulted in lower policy quality scores that were similar to the 18.5% of sample districts that developed a novel LSWP. This high use of model policy templates in this sample is comparable to findings from other states' evaluations showing model LSWP templates are often adopted without modifications, and depending on the template chosen, contribute to a high degree of variability in SWP quality scores.[52 56 57 58] The high use of the same CA state LSWP template by > 2/3 of the districts sampled may have limited the influence of other demographic characteristics on LSWP quality that were identified in studies conducted outside the state.

Sample LSWPs were collected in 2018, in order to evaluate policies after the 2016 USDA Final Ruling that required LSWPs to be updated to comply with HHFKA revisions by June 30, 2017. Yet half of the sample policies were adopted prior to the enactment of this 2016 mandate. While this finding is

similar to other states,[59] it is unclear whether this stems from lack of knowledge or lack of interest in LSWP updates. Higher strength scores among policies adopted after the Final Rule suggest districts may have spent some time reviewing updated LSWP expectations and made appropriate modifications, at least to ensure use of an updated model template that reflects Final Rule mandates. These findings also suggest that a strong template from a trusted source and regular revision of LSWPs are two strategies to improve scores and, ultimately, the school food and physical activity environment.

Several LSWP studies propose explanations for score variability and suggestions for managing template use. Lucarelli et al. proposed that districts may "intentionally keep written policies vague so that each building can tailor the policy to their specific needs or for fear of auditing of wellness practices," and that policies "may also be accompanied by a procedure manual (which may be deemed less restrictive for districts in which a lengthy and expensive process is required to change policy-related documents) outlining more specific requirements to implement the policy."[57] Szeszulski et al. also suggested that adding spaces in templates where districts can add details that align to specific local priorities may increase district engagement in LSWPs and improve quality when using model templates.[58] Studies on perspectives about LSWPs from focus groups and key informant interviews with school administrators consistently report that lack of time and resources due to significant, often competing high priority demands in the school environment coupled with higher accountability for academic outcomes limit further advances in LSWP commitment and implementation.[60] Allocating federal and state funding for dedicated district level personnel to coordinate health programs and policies is a common recommendation by school authorities to support further LSWP improvements.[60 61] Personal experience in this field corroborates these district challenges and suggests that some districts may choose weaker, less directive policy language to manage implementation accountability expectations within the highly fluctuating circumstances and resources common in school environments. In addition, local school boards often have a higher degree of trust and comfort with

guidance from local school-based organizations, which also may explain the high use of the CA state model LSWP template in this sample. The recent COVID-19 pandemic school closures which required schools to both educate and feed students regardless of whether they were on campus or at home indicate that changes may be needed in the management of LSWPs moving forward. The pandemic required frequent, sometimes daily updates to local, state, and national education and school meal practices to manage rapidly fluctuating circumstances. Future LSWP research should also consider contingencies for managing wellness policy implementation during local and national emergencies and/or school closures which are likely to persist.

Recommendations from the school health literature to improve LSWP quality and implementation within the context of competing priorities suggest that district adoption of the CDC's Whole School, Whole Community, Whole Child (WSCC) school health model could provide a useful framework that "keeps the whole child in mind" during LSWP policy development and evaluation.[62 63] The framework emphasizes collaboration between school departments and with community organizations to support the integration of student health with student learning objectives to broaden the focus of school improvements from "just academic goals to incorporate improvements that address barriers to learning such as health and well-being and provide a framework for collaboration among health and education sectors at the state and local level." [63] Many of the LSWP elements are shown to align directly with several of the WSCC domains. Murray et al.[61] also advocate for linking LSWP components to a district's local control funding formula (LCFF) and school climate framework. Such integration could broaden support and leverage resources to improve both student health and academic outcomes. For example, the San Diego Unified School District collaborated with the San Diego County Childhood Obesity Initiative using the WSCC approach to guide a district-wide LSWP review tied to the district's LCFF process to leverage funding for school wellness initiatives and to significantly improve both the strength and comprehensiveness of their LSWPs as well as wellness local policy

implementation.[64] Further research is needed including focus groups and key informant interviews with schools in districts that have successfully employed these methods, such as the San Diego Unified School District, in order to evaluate implementation of these practices into the LSWP process.

Strengths

Study strengths include: (1) use of a stratified, random selection process to ensure a sample of LSWPs that represents all counties within the state and (2) the focus on low-income districts with high need students who will benefit most from improvements tied to a strong LSWP.

Limitations

The high correlation between district racial/ethnic makeup and student poverty limits the examination of influences from individual racial/ethnic variables on LSWP scores. However, inclusion of both % FRPM eligibility and the proportion of districts with a non-White majority in the analysis shows no association with LSWP quality, indicating these variables are also not likely factors influencing policy quality among these districts. The focus on low-income CA public districts limits generalization of these findings to all CA districts and those outside the state. Another limitation is the single policy sampling period, as newer policies may have been adopted since this evaluation. Ten policies did not include an adoption date and could not be included in the analysis. However, half of the sample policies (95/190) scored were updated since the Final Rule mandate, but policy adoption date was not associated with policy quality.

CONCLUSION

LSWP mandates have resulted in significant improvements in school food and physical activity environments, which both are shown to support student health and academic success. While strong and comprehensive LSWPs show commitment and support implementation and accountability, study findings that most sample district policies simply mirrored the less extensive state model LSWP template may indicate that districts do not have the interest or bandwidth to focus on improving LSWP quality

beyond meeting basic requirements. The recent COVID pandemic demonstrated that while schools are an important partner in addressing child health and ensuring access to nutritious food, poor nutrition is not the only child health threat that our nation's schools must manage daily. As education moves forward in the post-COVID era, more streamlined and flexible LSWP processes and expectations may be necessary. Further research is needed including focus groups and key informant interviews with school administrators and school food authorities to improve understanding about how to more effectively use LSWPs to support student wellness, and to evaluate and guide future efforts aimed at improving alignment and integration of LSWPs within other priority school health and education frameworks such as WSCC and LSFFs to leverage limited district resources more efficiently to support both student health and academic success.

Chapter 2: District Characteristics Associated with Farm to School Engagement among California Public School Districts during the 2018-19 School Year

ABSTRACT

Importance: The USDA promotes farm to school (F2S) as an evidence-based approach to help schools meet updated school nutrition standards that promote good health. California (CA) is a key agricultural state that also serves large numbers of at-risk low-income and racial/ethnic minority students. There is strong state-wide support for F2S yet published literature on factors influencing F2S adoption in the state is limited.

Objective(s): Examine the influence of district demographics on F2S engagement among CA public districts during the 2018-19 school year to evaluate for potential adoption disparities by district size, student racial/ethnic makeup, student poverty and district urbanicity.

Design, Setting, and Participants: Data from the 2019 USDA F2S Census were used in the analysis. The study sample included 572 public districts responding to the 2019 F2S Census.

Variables Measured: Study outcome is reported engagement in F2S practices in 2018-19. District demographic data for 2018-19 were collected from the California Department of Education.

Analysis: Descriptive statistics (unweighted frequency, weighted percent) were reported for district characteristics. Weighted, multiple logistic regression was used to assess associations between district characteristics and F2S engagement, reported as OR [95% CI].

Results: Nearly 78% of districts reported F2S engagement. The top F2S activities were serving local food in school lunch (73%) and breakfast (65%) programs followed by local food promotion. The odds of F2S engagement among districts with enrollment $\geq$ 1,000 were nearly double that of small districts and were 1.5 times higher in districts in the lower two terciles of per-pupil spending than the highest tercile. There were no differences by district racial/ethnic make-up, % FRPM eligibility, or urbanicity.

Conclusions and Implications: F2S engagement continues to grow in CA districts. Challenges exist for small districts and those in the highest per-pupil spending tercile often lacking the advantage of economies of scale of larger districts. Focused support for these groups and administration of a brief annual state F2S Census would support more definitive and timely monitoring and accountability for state food security and equity goals and increase opportunities for data sharing, community engagement and research.

INTRODUCTION

Farm to school (F2S) is an evidence-based approach to school meals promoted by the U.S. Department of Agriculture (USDA) that connects local and regional farmers with school meal programs to promote the intake of farm-fresh foods at school.[65] [66] The F2S approach encompasses a range of strategies to increase servings of fresh food through school meals along with activities that increase knowledge about and consumption of these nutritious foods through classroom food and agriculture education and/or hands-on participation in school gardens.[66] Studies show programs that employ a multi-component framework that connects both environmental and behavioral strategies are effective at supporting dietary behavior changes.[67] This approach also aligns with the Centers for Disease Control and Prevention's (CDC) Whole School, Whole Community, Whole Child (WSCC) model for school health promotion by integrating classroom education with food services and local community farms to support increased access and consumption of nutritious foods that promote health.[62]

Passage of the bipartisan 2010 Healthy Hunger-Free Kids Act (HHFKA) gave the USDA the authority to establish nutrition standards for all foods sold on school campuses and strengthened school meal nutrition standards to align with the U.S. Dietary Guidelines to ensure that all children have access to nutritious food needed for good health.[12] [14] The HHFKA also created a national Farm to School (F2S) Program within the USDA to help school food authorities (SFAs) meet the updated guidelines by providing competitive grants and technical assistance to support adoption and expansion of practices

that increase the procurement and promotion of locally and regionally grown foods at school.[68] In addition, the USDA was charged with periodically administering a F2S Census to monitor progress and set goals for F2S funding and policy priorities.[13] While F2S adoption is not mandated, support for F2S policies and programs has increased across the country,[25] bolstered by growing evidence of co-benefits from local food procurement on health and educational outcomes, local agricultural economies, and the potential for reduced food processing and transportation to lower the carbon footprint of school meals.[26 27 28] Despite this growing support, challenges remain for universal adoption of F2S programs in all districts.

Peer-reviewed F2S research is sparse because F2S has not been an interest of scholarly activity until relatively recently, and many of the studies to date focus on the effectiveness of F2S practices on increasing fruit and vegetable consumption in the school setting.[26 28] The first two USDA F2S Censuses in 2013 and 2015 were administered to all school districts across the country and several follow-up evaluations using these data identified national and regional F2S adoption disparities among small school districts, districts with high numbers of low-income and minority students, low per-pupil spending, and those located in more rural communities.[26 31 32 33] In response, both the USDA and the National Farm to School Network prioritized race/ethnicity and income equity criteria into program goals and grant funding criteria.[41] The USDA administered the third Farm to School Census in 2019, sent by email to all SFAs participating in the National School Lunch Program (NSLP), including public, private, and charter schools as well as residential childcare institutions.[13] Expansion of the 2019 Census population and modifications to various metrics limit direct comparisons with prior Census findings. However, results from a small longitudinal analysis of districts that completed all three Censuses show a national trend of increasing F2S engagement among respondents (42% in 2013, 45% in 2015, and 72% in 2019).[29] Growing evidence from school meals studies following the HHFKA mandate documents overall improved nutritional quality of school meals and increasing adoption of F2S practices.[18 28] However, it is

not known whether disparities continue to influence F2S adoption or if barriers are more common in specific regions of the country. The recent availability of data from the 2019 F2S Census provides an opportunity for further analysis of these factors.

California (CA) provides an important setting to evaluate F2S engagement. The state is a primary agricultural producer, contributing a third of the nation's vegetables and two-thirds of the nation's fruits and nuts,[36] and was among the first to promote F2S.[37] The number of F2S programs has steadily grown in the state from a few pilot districts in the mid-1990s to 55% of the CA districts responding to the 2015 F2S Census.[43] CA schools serve more than 6 million children,[35] the highest among U.S. states.[34] In 2018-19 more than 60% of these students qualified for the federal free or reduced-price meal (FRPM) program which is a key poverty indicator associated with the highest risk for both food insecurity and obesity.[35] Investment in F2S expansion in CA provides an important access point to address childhood food insecurity, while also providing support for the state's agricultural economic sector. A statewide F2S program is now administered by the CA Office of Farm to Fork (COFF) within the Department of Food and Agriculture (CDFA).[38] COFF works with an array of state and local agricultural, education, and health partners on a range of initiatives to "promote and protect CA's agriculture, lessen the impact of food insecurity, foster healthy environments and improve market access–through coordination, education, and outreach."[39]

Analysis of CA-specific F2S data has been limited. The recent availability of the 2019 F2S Census provides the opportunity to assess progress up to 2018-19, the last "normal" academic year prior to COVID-19 pandemic-related disruptions. The goal of this study is to examine associations between district demographic characteristics and F2S participation among CA public districts to determine if F2S adoption barriers that are similar to national findings are present in the state. The study hypothesis is that factors such as small size, serving large numbers of low-income and/or racial/ethnic minority students, rural locale, and limited per-pupil spending result in additional financial and/or geographic F2S

barriers for these districts and are associated with lower F2S engagement. Study outcomes will fill gaps in knowledge and inform equity priorities as districts transition back to more stable environments.

METHODS

Sample

This evaluation used data from two data sets: the 2019 USDA F2S Census[43] (F2S data) and the CA Department of Education (CDE) (district level demographic data).[40] The Census is a nationwide web-based survey administered by email to all U.S. school food authorities (SFAs) between September 9 and December 31, 2019.[43] The Census invited SFAs to self-report engagement in 30 different F2S activities during the 2018-19 and 2019-20 school years. (See Figure 1 for a list of these F2S activities.) Supplemental questions asked about policies and practices around school meals and food procurement. However, not all SFAs responded to these supplemental questions which limited comparisons.

The 2019 data set includes responses from 795 CA SFAs from which 576 were identified as serving public school districts. The Census collected a small amount of demographic data. However, other than "urbanicity" which was calculated and reported directly by the USDA, most variables were gathered through self-report by each SFA, and the exact source or corresponding timeframe is unclear. For data consistency, each SFA was matched by name to demographic profiles for CA public districts obtained from CDE for the 2018-19 school year. Merging the Census and CDE data resulted in 572 of the CA SFAs matching to a specific public district which were included in the final study sample. The remaining 4 SFAs served multiple school districts and were excluded since they could not be matched to a single district.

Covariates

The model demographic covariates were identified from published literature and USDA F2S reports from prior Censuses (2013 and 2015) indicating associations with F2S engagement at the national and regional levels. Urbanicity was reported directly by the USDA Census Team. The

racial/ethnic makeup of district students, district size, student poverty level, and per-pupil spending data were obtained from matched CDE profiles. Student poverty level for each district was determined using the % FRPM eligible students. Children from families with incomes at or below 130% of the Federal poverty level qualify for free meals, and those with incomes between 130 - 185% qualify for reduced price meals.[6] Per-pupil spending is a measure of the district cost of education per average daily attendance which includes teacher and staff salaries, classroom spending, and administrative costs. Per-pupil spending reflects overall availability of school funds, and lower spending is associated with districts serving large populations of low-income and racial/ethnic minority students.[69] See Table 2.1 for variable classifications, measurements, and sources.

Table 2.1. Variable Classifications, Measurements, and Sources.

Variable	Measurement	Source
Dependent		
F2S Engagement	Reported participation in $\geq$ 1 of 30 F2S activities	USDA Farm to School Census 2019
Independent		
Racial/Ethnic Makeup	% Student racial/ethnic makeup	CDE Ed-Data Partnership
District Size	Common student enrollment classification (small, medium, large)[26]	CDE Ed-Data Partnership
Student Poverty Level	% FRPM-eligible students grouped by USDA Community Eligibility Provision guidelines (Low < 40%, High = 40 – 62.4%, Very High $\geq$ 62.5%)[70]	CDE Ed-Data Partnership
Per-pupil Spending	Current cost of education per average daily attendance classified at data terciles	CDE Ed-Data Partnership
Urbanicity	Determined by the USDA F2S Census Team[a]	USDA Farm to School Census 2019

[a] Urbanicity is based on locale codes, which describe the type of area in which schools in a district are located. The USDA study team grouped SFAs located in towns with rural SFAs. Classifications of these areas are mostly based on information from the U.S. Census Bureau. [29] [49]

Analysis

The study outcome is reported engagement in F2S practices among CA public school districts during the 2018-19 school year. SFAs who reported engaging in at least one of the 30 F2S activities listed in the Census were considered by the USDA definition to have participated in F2S activities during that year.[29] Districts with no F2S engagement in 2018-19 were considered as non-participants for that year.

District characteristics were compared for SFAs with and without F2S engagement. Study estimates were weighted using inverse propensity scores provided by the USDA for each SFA to account for potential non-response bias. Weighted means, 95% confidence intervals, and p-values from t-test comparisons were reported for continuous variables. Frequencies, with weighted percentages, and p-values from chi-square tests were reported for categorical variables. Weighted, adjusted logistic regression was used to examine associations between district characteristics and F2S engagement. Weighted adjusted odds ratios and 95% CI were calculated for each covariate category with a p-value cut-off of 0.05. The model strategy began with large gradations of variable categories. However, in the final model, the categories for student poverty (high/very high) and urbanicity (urban/suburban) were combined due to small sample sizes, which did not change the results. For variables with >2 categories, the analysis was rerun by changing the referent to ensure each category group was compared (not shown in data tables). Variables were kept in the final model if they changed effect estimates by more than 10%. Some studies suggest that high student poverty may affect F2S participation differently by district size and urbanicity because larger districts and those in more urban locations may be able to compensate for F2S cost challenges through economies of scale. Therefore, a cross-product interaction term was used to test whether student poverty effects differ by district size or urbanicity. Models were also run including and excluding the Los Angeles Unified School District (with > 600,000 students) as a potential size outlier with no difference in results, so this district was included in the final analysis. Statistical analyses were done using SAS 9.4 (SAS Institute Inc., Cary, NC, USA.)

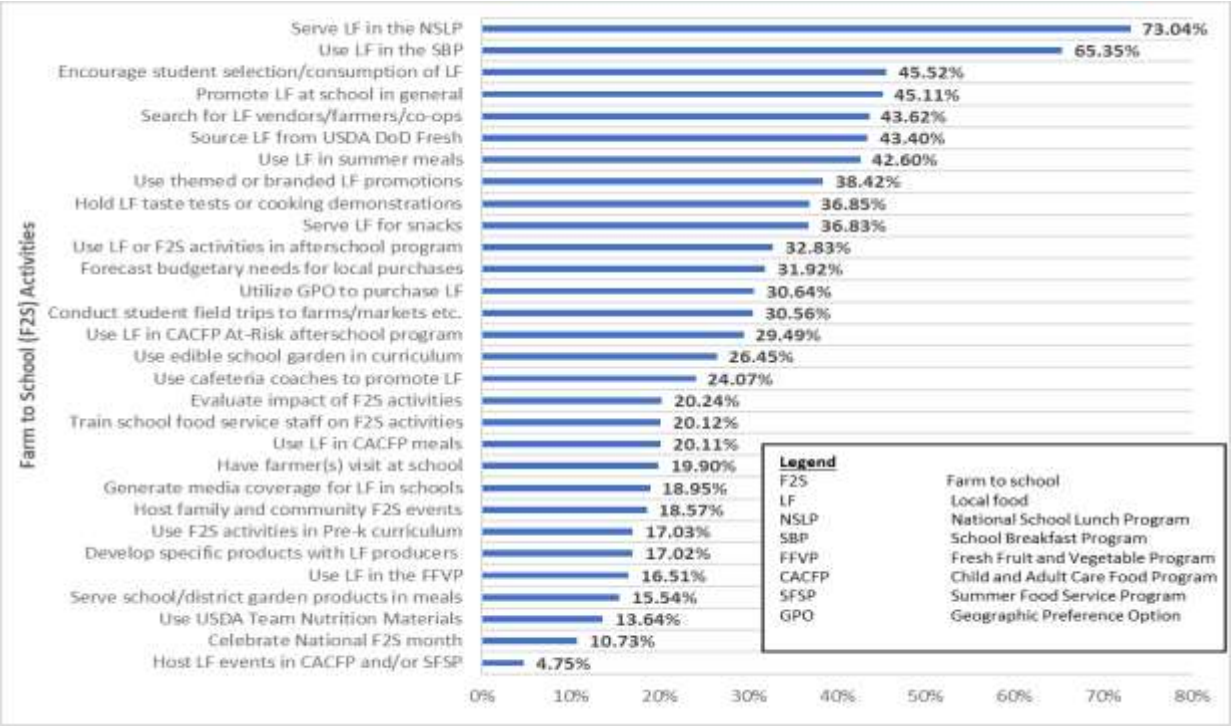
The racial/ethnic data for % Latino/Hispanic students were highly correlated with % FRPM eligible and % White students (correlation coefficients between 0.65 – 0.84), limiting inclusion in the model. Therefore, additional models were run with the largest (> 2%) racial/ethnic minority groups (% Hispanic/Latino, % Black/African American, % Asian) stratified by the student poverty categories (Low < 40% FRPM eligible, High $\geq$ 40 FRPM eligible.) As a sensitivity check, the race/ethnicity variables were

tested in the model as either continuous variables or categories dichotomized at the median. However, it made no difference, so the continuous variable results are presented.

RESULTS

Figure 2.1 shows the percent of CA public districts engaging in each of the 30 F2S activities listed in the 2019 Census. Serving local food in the school lunch (73%) and breakfast (65%) programs were the top F2S activities, followed by local food promotion.

Figure 2.1. Farm to School Participation among CA Public Districts in 2018-19.



A comparison of demographic characteristics among districts engaging in F2S activities in 2018-19 with districts that did not is reported in Table 2.2. Nearly 78% reported F2S engagement with significant differences between the groups by district size, per-pupil spending terciles, and urbanicity, but not by student poverty level. Engagement by most student racial/ethnic categories is similar except for % White students which was 5% lower in districts that did not participate in F2S.

Table 2.2. Characteristics of CA Public Districts with and without F2S Engagement in 2018-19.

District Characteristics	**Engaging in F2S** 447 (77.9)	**No F2S** 125 (22.1)	p-value[a]
Racial/Ethnic Makeup	Weighted Mean† (95% CI)	Weighted Mean† (95% CI)	
% White	33.6 (31.4 – 35.9)	38.7 (34.1 – 43.4)	0.04
% Hispanic/Latino	48.8 (46.3 – 51.4)	44.7 (39.5 – 49.8)	0.14
% Black/African American	3.2 (2.7 – 3.6)	2.4 (1.7 – 3.2)	0.14
% Asian	5.8 (4.8 – 6.8)	5.3 (3.4 – 7.3)	0.65
	Unweighted sample size† (Weighted percent)	Unweighted sample size† (Weighted percent)	
Student Poverty Level			0.48
Low < 40 % FRPM eligible	105 (76.0)	33 (24.0)	
High ≥ 40 % FRPM eligible	342 (78.5)	92 (21.5)	
Per-pupil Spending			0.003
Tercile 1 (< $11,913)	151 (79.2)	39 (20.8)	
Tercile 2 ($11,913 - $13,707)	175 (82.9)	36 (17.2)	
Tercile 3 (≥ $13,708)	121 (70.6)	50 (29.4)	
District Size			<0.0001
Small (enrollment < 1,000)	111 (66.6)	56 (33.5)	
Medium (enrollment 1,000 – 4,999)	156 (81.8)	35 (18.2)	
Large (enrollment ≥ 5,000)	180 (84.1)	34 (16.0)	
Urbanicity			0.0001
Rural	187 (71.8)	73 (28.2)	
Urban	260 (83.4)	52 (16.7)	

[a] p-values from t-tests are given for continuous variables and from chi-square tests for categorical data.
† Unweighted n=572

Results from the adjusted, weighted logistic regression models for F2S engagement in 2018-19 are presented in Table 2.3. The student poverty x district size (p =0.98) and student poverty x urbanicity (p=0.32) interaction terms were not significant and therefore not included in the final model. The odds of F2S engagement were higher among CA districts with high student poverty but the difference was not significant. The odds of F2S engagement were also more than 1.5 times higher in districts in the lower

two terciles of per-pupil spending than districts at the highest tercile of per-pupil spending. The analysis was rerun with T1 as the reference group for per-pupil spending and large as the reference group for district size. The T1 and T2 per-pupil spending categories were similar (OR 1.04 [0.65, 1.65], p = 0.88), so T1 and T2 were combined in the final model which did not change the results. The odds of F2S engagement were nearly 2 times higher among medium and large districts compared to small districts. The difference was significant for medium but not for large districts. The analysis was rerun with large as the reference group for district size. The odds ratio for medium districts was not different from large districts (OR 1.01 [0.61, 1.67], p= 0.97), so the medium and large categories were combined in the model for district size (≥ 1,000 students) which did not change the results.

Table 2.3. Associations between District Characteristics and F2S Engagement Final Model.

District Characteristic Variables	Weighted† Unadjusted OR (95% CI)	p-value	Weighted† Adjusted* OR (95% CI)	p-value
Student Poverty Level				
High ≥ 40% FRPM	1.15 (0.78, 1.71)	0.48	1.40 (0.92, 2.14)	0.12
Low < 40 % FRPM	ref		ref	
Per-pupil Spending				
T1 + T2	1.79 (1.26, 2.56)	0.001	1.57 (1.08, 2.28)	0.02
T3	ref		ref	
District Size				
≥ 1,000 students	2.44 (1.72, 3.47)	<0.0001	1.79 (1.15, 2.79)	0.01
< 1,000 students	ref		ref	
Urbanicity				
Urban	1.96 (1.39, 2.78)	0.001	1.46 (0.94, 2.28)	0.09
Rural	ref		ref	

* Adjusted for student poverty level, per-pupil spending, district size, and urbanicity.
† Unweighted n=572

Results from the adjusted, weighted logistic regression models for F2S engagement in 2018-19 including the race/ethnicity variables stratified by student poverty levels are presented in Table 2.4. Racial/ethnic makeup was not associated with F2S engagement for either student poverty category. The odds of F2S engagement were significantly higher in urban high poverty districts, nearly twice that of rural districts, and in districts with per-pupil spending in tercile 1 and 2 compared with the highest tercile. In high poverty districts, large and medium districts were more than 1.5 times more likely to

engage in F2S activities than small districts, but the difference between large and small districts was not significant. The analysis was rerun with T1 as the referent for per-pupil spending and large for the referent for district size. The T1 and T2 per-pupil spending categories were similar (OR 1.3 [0.74, 2.28], p = 0.36) and combined in the final model, which did not change the results. Medium and large districts participated at similar rates (OR 0.92 [0.49, 1.71], p= 0.79), and were combined as district size ≥ 1,000 students in the final model with no change in results.

F2S engagement was higher in Low poverty districts with ≥ 1,000 students, but the difference was not significant. There were no differences by urbanicity or per-pupil spending for these districts.

Table 2.4. Associations between District Characteristics and F2S Engagement Stratified by Student Poverty.

District Characteristic Variables	High Poverty ≥ 40% Weighted† Adjusted* OR (95% CI) n=434	p-value	Low Poverty <40% Weighted† Adjusted* OR (95% CI) n=138	p-value
Race/Ethnicity Type				
% Hispanic/Latino	0.99 (0.99, 1.01)	0.45	1.00 (0.97, 1.03)	0.84
% Black/African American	0.99 (0.95, 1.04)	0.68	1.14 (0.92, 1.43)	0.24
% Asian	0.99 (0.96, 1.03)	0.59	0.99 (0.97, 1.02)	0.58
Per-pupil Spending Tercile				
T1 +T2	1.70 (1.11, 2.59)	0.02	1.15 (0.49, 2.67)	0.75
T3	ref		ref	
District Size				
≥ 1,000 students	1.73 (1.03, 2.93)	0.04	2.56 (0.90, 7.30)	0.08
< 1,000 students	ref		ref	
Urbanicity				
Urban	1.90 (1.08, 3.36)	0.03	0.78 (0.27, 2.22)	0.64
Rural	ref		ref	

* Adjusted for % Hispanic/Latino, % Black/African American, % Asian, district size, urbanicity and per-pupil spending.
† Unweighted n = 572

DISCUSSION

Summary

This analysis shows that F2S engagement is increasing among CA public districts with 78% of sample districts reporting F2S engagement in 2018-19 compared with 55% of CA districts reporting engagement in the 2015 F2S Census. This number is also higher than the current national average of 65% reported for all SFAs nationwide responding to the 2019 F2S Census.[29]

Interestingly, F2S engagement was not associated with districts serving large numbers of racial/ethnic minority or for low-income students. These results are similar to recent national findings[29] and may indicate that the race/ethnicity and income equity priorities built into the F2S granting process since the report of lower engagement among these districts in the 2013 Census are helping to reduce disparities for these groups. However, repeated evaluation of the degree to which F2S activities are implemented and sustained are needed to assess the full impact on disparity reductions.

Another significant study outcome showed district size was associated with F2S engagement. The odds among larger districts ($\geq$ 1,000 students) were nearly double that of small districts (< 1000 students). These results are also consistent with recent national findings.[29] A common explanation for this disparity is that small districts cannot take advantage of the economies of scale available to larger districts for staffing and large bulk purchases to balance any increased costs associated with adoption and maintenance of F2S practices.[29] In addition to size, the odds of engagement among districts in the lower two-thirds of per-pupil education spending in this sample was almost 60% higher than those in the highest spending tercile. Per-pupil spending is a measure of the district cost of education per average daily attendance which includes teacher and staff salaries, classroom spending, and administrative costs.[40] Districts in the highest spending tercile may appear to be wealthier districts that would likely also have the resources to invest in programs like F2S; however, the opposite is commonly found to be true.[71] Many districts in the highest per-pupil spending groups are small and often located in rural and/or low-income areas without the advantages of economies of scale of larger districts and/or the geographic advantages of more urban districts, resulting in the high per-pupil cost just to deliver basic education services.[71] These cost challenges limit funding available for other priorities and could contribute to higher implementation costs for new programs like F2S. Additional analysis of the highest spending group in the study sample indicated many match this profile (83% are high poverty, >50% are rural, and nearly 50% are small < 1,000 students with 74% having < 5,000 students).

Study models stratified by district poverty also showed that larger district size and lower per-pupil spending were associated with higher F2S engagement in the high poverty stratum but not the low poverty stratum, likely due to the small sample size. Engagement was also significantly higher in urban districts in the high poverty stratum, nearly double that of rural districts. The opposite outcome for urbanicity was found in the low poverty stratum although not significant (lower engagement in urban compared with rural districts), likely due to the small sample size. These findings also may indicate that urbanicity affects F2S engagement differently for high and low poverty districts in CA. The small number of low poverty districts in the sample limited further comparisons and indicates more research is needed including focus groups and key informant interviews in rural districts to clarify these relationships.

Limitations

The study has several limitations. (1) The cross-sectional design precludes causal inferences. (2) Limiting this analysis to CA public districts provides important data for school food and F2S decision makers in the state, but limits generalization of study findings to all types of CA SFAs. In addition, the reduced sample size may have limited the power to detect differences between smaller categories such as for district sizes "large (5,000 – 25,000 students)" and "very large (> 25,000 students)" or for very small racial/ethnic groups such as American Indian/Alaska Native, Filipino or Pacific Islander which make up less than 2% of all CA students. (3) Some results may reflect sample bias. The USDA F2S Census is sent to all SFAs nationwide that participate in national school meal programs and relies on voluntary participation rather than a randomly selected sample chosen to represent all districts. Some SFAs such as those not engaging in F2S may have less motivation to complete the Census, adding to bias. To address these concerns, the Census team provided inverse propensity non-response weights for participating SFAs which were used in all analyses of this dataset. However, systemic differences between respondents and non-respondents likely are not fully accounted for in these weights. (4) Finally, the Census relies on self-report by an SFA member responding for the whole district, causing

concerns about response bias. The Census Report[29] provides the following statement about potential bias for data users:

> *Reports of expenditures and school-level activities found in this dataset should be considered approximations. The information used in both the 2019 Farm to School Census Report and this website is based on self-reporting by SFA-level respondents. They may not have been familiar with farm to school activities that occurred at the school-level or in prior years or may not have had access to exact expenditure data for local purchases.*

The potential for response bias was minimized in these analyses by limiting study variables to factors most likely under the purview of school meal programs and excluded variables with large numbers of missing data or responses such as "Don't Know," or data indicating it was derived through estimation. The district demographic data used were validated data from CDE, and the district urbanicity data used were calculated and reported directly by the USDA Census Team rather than SFA self-report.

CONCLUSION

The key study finding is that F2S engagement is significantly lower among small CA public districts and districts with high education costs. State F2S leadership may be able to address this issue with targeted policy and funding initiatives that increase F2S funding available to these districts and organize support networks or cooperatives to help these districts manage F2S related costs and program coordination. Further research is needed including focus groups and key informant interviews with SFA leadership in these districts to determine the most effective strategies to limit barriers and facilitate engagement in F2S. Study limitations related to the use of USDA Census data could be addressed by administering a brief annual state F2S Census that aligns with state food equity goals. A state census would support more definitive and timelier F2S monitoring and expand opportunities for data sharing, community engagement, and research. The "Farm to School Counts" program developed by the state of Oregon may serve as a useful model in these efforts.[72]

Chapter 3: District Factors Associated with Serving Local Food in the School Lunch Program among CA Public School Districts Engaging in Farm to School during the 2018-19 School Year

ABSTRACT

Importance: The USDA promotes farm to school (F2S) as an evidence-based approach to help schools meet updated school nutrition standards that promote good health. Serving local food (LF) is a core F2S activity to increase access to farm-fresh food on school campuses. California (CA) public schools serve nearly 6 million students with > 60% in at-risk, low-income and racial/ethnic minority groups who would benefit most from access to fresh food at school. As a key agricultural state, support for F2S and LF procurement is strong and aligns with state food security, agricultural and climate goals, yet not all districts engaging in F2S serve LF in school meals. Research is needed to evaluate factors that influence whether districts serve LF in the school meal program.

Objective(s): Assess how district demographic and school meal practices influence serving LF in the school lunch program among CA public districts during the 2018-19 school year. School meal variables include use of salad bars, having a LF procurement policy, use of the geographic preference procurement option, years of F2S engagement, type of "local" food definition, having district-operated school meal programs, and members with a F2S leadership role.

Design, Setting, and Participants: The study sample includes 477 CA public districts reporting engagement in F2S activities in the 2019 F2S Census.

Variables Measured: The study outcome is report of serving local food in the school lunch program in 2018-19. District demographic data for 2018-19 were collected from the California Department of Education. School meal practices were reported in the 2019 F2S Census.

Analysis: Descriptive statistics (unweighted frequency, weighted percent) were reported for district demographic and school meal factors. Weighted, multiple logistic regression assessed associations between district factors and serving local food in school lunches, reported as OR (95% CI).

Results: Among CA districts engaging in F2S, 73% served local food in the school lunch program in 2018-19, which was significantly higher among urban districts, districts with low student poverty (< 40% FRPM eligible), and those that used salad bars.

Conclusions and Implications: Study factors associated with serving LF in school lunches appear to impact school meal reimbursement and budgets. State F2S leadership can address these issues with targeted policy and funding initiatives to support LF procurement among low-income and rural districts. Tying LF procurement with salad bar resources also may be an effective strategy. Administering a brief annual state F2S Census would allow more definitive and timely monitoring and accountability of F2S toward state food security and climate smart agricultural goals and increase opportunities for data sharing, community engagement and research.

INTRODUCTION

The Dietary Guidelines for Americans (DGA) continue to report that intake of fruit, vegetables, and dairy among school age children is about half of what is recommended to meet nutritional needs for growth, development and good health.[9] It is estimated that many U.S. children consume nearly half of their daily calories at school, positioning the nation's schools as important partners in promoting access to nutritious food.[8] This is especially important for low-income and racial/ethnic minority children who are more likely to live in areas known as "food deserts," with reduced access to fresh, nutrient dense foods.[42]

In response, Congress passed the bipartisan 2010 Healthy Hunger-Free Kids Act (HHFKA) which strengthened nutrition standards for school meals to align with the DGA recommendations and created a Farm to School (F2S) Program within the U.S Department of Agriculture (USDA) to help schools meet the updated standards by improving access to and promoting consumption of farm-fresh food at school.[12] The USDA F2S Program provides competitive grants and technical assistance to school food authorities (SFAs) and local farmers to support adoption and expansion of F2S practices through school

meal programs.[68] F2S activities are defined by three core practices (1) procurement of local/regional fresh, nutrient-dense foods; (2) integration of food- and agriculture-related education into classrooms, and (3) hands-on food activities through school gardens. [66] Under the HHFKA, the USDA must also periodically administer a F2S Census to monitor progress and set goals for F2S funding and policy priorities. Expanding F2S through school meal programs holds the potential to make schools a strategic access point to support the consumption of nutritious food for all children.

Local food (LF) procurement is a core F2S strategy and the most frequently reported F2S activity. [29] Improving opportunities to source food locally has wide appeal in many communities supported by growing evidence that sourcing food locally is considered a more equitable and environmentally sustainable method of food procurement by providing consistent economic support to marginalized small and medium sized farmers using a smaller carbon footprint than large national distribution systems due to reduced transportation, storage, and processing inputs.[26] [27] [28] Recently, the growing network of local F2S producers has played an important role in filling COVID-19 pandemic-induced gaps in the national food chain and supplying essential fresh food to U.S. schools during and following COVID-19 school closures.[73] [74] The National School Lunch Program (NSLP) is the second largest government feeding program in the U.S. behind food stamps, and the National School Breakfast Program is the third largest.[6] Strategies such as increasing LF procurement through F2S programs provide a substantial opportunity to address health, economic, and climate goals simultaneously through the federal school meal program while also building a food system that is more resilient to supply chain disruptions.

The USDA has administered three F2S Censuses to date (2013, 2015, and 2019). The expansion of census metrics and types of SFAs surveyed with each new Census limits direct comparison, but a small longitudinal analysis among SFAs completing all three Censuses shows increasing F2S engagement among these respondents over time (42% in 2013, 45% in 2015, and 72% in 2019).[29] National trends reported by the 2019 Census Report show the majority of respondents served LFs through some type of

school venue, with 72% of SFAs participating in the NSLP serving some type of LFs in school meals, most commonly, fruits and vegetables followed by fluid milk.[29]

School food procurement involves sourcing, purchasing, and serving food, and is influenced by similar factors regardless of the food's origins.[31] SFAs generally operate on tight budgets and under significant federal and often state regulations requiring certain purchases from vendors providing products at the best value.[75] Food procurement can be impacted by many factors such as organizational budgets, food availability and supplier access for SFA size, and procurement regulations. Additional factors may include whether an SFA is operated within the district or through an outside management company, and the ability to store, prepare and serve fresh foods.[75] The most common LF procurement challenges reported by SFAs nationally are higher direct costs and inconsistent availability of local or regional foods.[29] [31] National trends also indicate higher LF procurement among SFAs with salad bars (a primary site to serve LF), and among SFAs serving small and medium size districts compared to large and very large districts.[29]

As a primary agricultural producer of the nation's fruits, vegetables and nuts,[36] California (CA) was among the first states to pilot a F2S program in the late 1990s.[37] CA public schools serve more than 6 million children, with more than 60% coming from racial/ethnic minority and underserved demographic groups associated with the highest risk for both food insecurity and obesity.[35] F2S participation has grown steadily from the original handful of pilot programs to 55% of the CA districts that responded to the 2015 F2S Census.[43] CA does not have specific LF procurement mandates;[31] however, a state-wide taskforce has promoted F2S advocacy, grant funding, and technical assistance since 2004.[37] In 2016 the CA-grown Fresh School Meal Grant was appropriated to encourage procurement of CA-grown foods for school meals to support agriculture in the state.[76] In 2017 a statewide F2S program was formally established through the California Office of Farm to Fork (COFF) within the California Department of Food and Agriculture (CDFA).[38] COFF now provides F2S leadership,

training, and grants to an array of state and local agricultural, education, and health partners on a range of initiatives to "promote and protect CA's agriculture, lessen the impact of food insecurity, foster healthy environments and improve market access – through coordination, education and outreach."[39]

To date, analysis of CA-specific F2S data has been limited. The recent availability of the 2019 USDA F2S Census data provides the opportunity for states like CA to assess progress and barriers associated with serving LF during the 2018-19 school year, the last "normal" academic year prior to COVID-19 pandemic-related disruptions. The goal of this study is to examine district level demographic characteristics and SFA meal practices that may influence whether LF is served in the NSLP among CA public school districts. The study hypothesis is that districts with smaller school meal budgets such as small districts, those serving large numbers of low-income and/or racial/ethnic minority students, districts with lower per-pupil spending and rural districts will have lower odds of serving LF in the school lunch program, whereas school meal programs that are self-operated by the district, have salad bars, a LF procurement policy, use the geographic preference option, have engaged in F2S for $\geq$ 3 years, have a more liberal "local" food definition, and have members with a F2S leadership role will have higher odds of serving LF in the school lunch program. Study outcomes will fill gaps in knowledge about LF procurement in F2S programs to inform funding and technical assistance priorities and can serve as a baseline for measuring progress as SFAs transition back to more stable school food environments.

METHODS

Sample

This evaluation merges data from two data sets: the 2019 USDA Farm to School Census[43] and demographic data for CA public districts from the CA Department of Education (CDE).[40] The 2019 Census is a nationwide web-based survey administered by email to all U.S. school food authorities (SFAs) between September 9 and December 31, 2019.[43] The Census invited SFAs to self-report engagement in a range of F2S activities during the 2018-19 and 2019-20 school years.

The 2019 Census data set includes responses from 795 CA SFAs from which we identified 576 as serving public school districts. A small amount of demographic data was collected in the Census. However, other than "urbanicity" which was calculated and reported directly by the USDA, the rest was collected by SFA self-report and the exact source or corresponding timeframe for this data are unclear. For data consistency we matched each SFA by name to demographic profiles for CA public districts obtained from CDE for the 2018-19 school year. Merging the Census and CDE data resulted in 572 of the CA SFAs matching a specific public district which were included in the final study sample. The remaining 4 SFAs served multiple school districts and were excluded since they could not be matched to a single district. Only SFAs reporting F2S engagement in 2018 or 2019 were asked to complete all sections of the Census including questions about SFA-related policies and practices around school meals and food procurement. Within the sample of 572 CA SFA respondents, 447 reported engaging in F2S activities during the 2018-19 school year. Therefore, the study sample was limited to the 447 SFAs with complete Census responses to allow consideration of more Census questions in this analysis.

Covariates

The district demographic factors and SFA meal practices used as covariates in study models are described in Table 3.1. These variables were identified from published research and national reports based on prior F2S Censuses (2013 and 2015), indicating potential associations with LF procurement.

The model demographic covariates included: racial/ethnic make-up, district size, student poverty level, per-pupil spending and urbanicity. The racial/ethnic make-up of district students, district size, student poverty level, and per-pupil spending data were obtained from the CDE profile for each SFA. District urbanicity classifications for each SFA were reported directly by the USDA Census Team. The racial/ethnic makeup data for percent Latino/Hispanic students were highly correlated with the percent of Free and Reduced-Price Meal (FRPM) eligible and percent White students (correlation coefficients between 0.66 – 0.83), limiting inclusion in the model. Therefore, we used the district race/ethnicity data

to create a dichotomized variable (non-White racial/ethnic majority) to include in the model. The student FRPM eligibility data were grouped by the USDA Community Eligibility Provision guidelines for student poverty designations that are tied to federal SFA school meal reimbursement rates since these rates may affect SFA budget priorities.[70] Per-pupil spending is a measure of the district cost of education per average daily attendance which includes teacher and staff salaries, classroom spending, and administrative costs. Per-pupil spending reflects overall availability of school funds, and lower spending is associated with districts serving large populations of low-income and racial/ethnic minority students.[68]

Table 3.1. Study Variables, Measurements, and Data Sources.

Dependent Variable	**Measurement**	**Source**
Serving LF in NSLP	Positive Census responses for 2018-19	USDA Farm to School Census 2019
Independent variables		
Non-White Majority District (>50% students)	Calculated from district-reported % student racial/ethnic makeup (Yes/No)	CDE Ed-Data Partnership
District Size	Common student enrollment classification (small, medium, large, very large).[26]	CDE Ed-Data Partnership
Student Poverty Level	% FRPM-eligible students grouped by USDA Community Eligibility Provision poverty guidelines (Low < 40%, High = 40 - 62.4%, Very High ≥ 62.5%).[70]	CDE Ed-Data Partnership
Per-Pupil Spending	Current cost of education per average daily attendance classified at data terciles	CDE Ed-Data Partnership
Urbanicity	Determined by the USDA F2S Census Team[a]	USDA Farm to School Census 2019
≥ 1 Salad Bar	Calculated from Census response (Yes/No)	USDA Farm to School Census 2019
Used Geographic Preference Option (GPO)	Calculated from Census response (Yes/No)	USDA Farm to School Census 2019
Has LF Procurement Policy (LFPP)	Calculated from Census response (Yes/No)	USDA Farm to School Census 2019
≥ 3 Years F2S Engagement	Calculated from Census response (Yes/No)	USDA Farm to School Census 2019
Type of LF Definition	Calculated from Census response ("None" = None/don't know, "Strict", within county or < 50-mile radius, "Liberal"= within state/region or > 100-mile radius)	USDA Farm to School Census 2019
District Self-Operated SFA	Calculated from Census response (Self-operated = "Yes," Management Company, Vended Meal, Other = "No")	USDA Farm to School Census 2019
F2S Leadership Role	Calculated from Census response (Yes/No/Don't Know)	USDA Farm to School Census 2019

[a] Urbanicity is based on locale codes, which describe the type of area in which schools in a district are located. The USDA study team grouped SFAs located in towns with rural SFAs. Classifications of these areas are mostly based on information from the U.S. Census Bureau.[2949]

LF = local food; SFA = school food authority; CDE = CA Dept. of Education; FRPM = free & reduced-price meal

The school meal practice covariates included: having salad bars, use of the geographic preference option (GPO) in food procurement, having a LF procurement policy (LFPP) for the SFA, type of LF definition, having a district self-operated SFA, and having an SFA member with an active F2S leadership role. Data about SFA meal practices were obtained from SFA self-report responses in the Census. The variable "number of school salad bars" was highly correlated with district enrollment (correlation coefficient 0.65), with small districts having less than 2 salad bars on average and with 87 in the largest district. We tested this variable in the model at various cut points and were able to dichotomize the salad bar category (Yes = $\geq$1, No = 0) without changing the results.

Analysis

District demographic and SFA characteristics for SFAs that engaged in F2S practices were compared by whether they served local food in the NSLP during 2018-19. Study estimates were weighted using Census-derived inverse propensity scores to account for potential non-response bias. Frequencies, weighted percentages, and p-values from chi-square tests were reported for covariates.

Weighted adjusted logistic regression models were used to examine associations between covariates and serving LF in the NSLP in 2018-19. Weighted odds ratios and 95% CI were calculated for covariate categories with a p-value cut-off of 0.05. The model strategy began with testing large gradations of variable categories. In the final model, the student poverty (high/very high) and urbanicity (urban/suburban) groups were combined due to small sample sizes, which did not change the results. Model variables were removed one by one but were kept in the final model if they changed the size of the effect estimates by more than 10%. For variables with >2 categories, the analysis was rerun by changing the referent within the category to ensure each grouping was compared (not shown in data tables). We also ran the models including and excluding the Los Angeles Unified School District as a potential size outlier (with > 600,000 students) and saw no difference in results, so this district was kept in the final analysis. Statistical analyses were done using SAS 9.4 (SAS Institute Inc., Cary, NC, USA.)

RESULTS

Table 3.2 shows the covariate frequencies among these districts. An estimated 73% of the districts engaging in F2S activities during 2018-19 served LF in the NSLP. Chi square comparisons with districts engaging in F2S that served LF in the NSLP show demographic differences between the groups by district size, student poverty, and urbanicity, and differences in SFA characteristics by use of salad bars, the geographic preference option, a LF procurement policy, and years of F2S engagement.

Table 3.2. Comparison of CA Public Districts Serving LF in the NSLP in 2018-19.

District Characteristics	**Served LF** Unweighted sample size† (Weighted percent) 328 (73.0)	**Did not Serve LF** Unweighted sample size† (Weighted percent) 119 (27)	**^p-value**
Non-White Majority			0.45
Yes	233 (74.0)	81 (26.0)	
No	95 (71.0)	38 (29.0)	
District Size			0.02
Small (enrollment < 1,000)	72 (64.7)	39 (35.3)	
Medium (enrollment 1,000 – 4,999)	118 (75.2)	38 (24.8)	
Large (enrollment ≥ 5,000)	138 (76.7)	42 (23.3)	
Student Poverty			0.02
Low (< 40 % FRPM)	85 (81.0)	20 (19.0)	
High (≥ 40 % FRPM)	243 (70.7)	99 (29.3)	
Per-Pupil Spending			0.14
Tercile 1 (< $11,913)	108 (71.4)	43 (28.6)	
Tercile 2 ($11,913 - $13,707)	136 (77.4)	39 (22.6)	
Tercile 3 (≥ $13,708)	84 (68.9)	37 (31.1)	
Urbanicity			0.0001
Rural	121 (64.8)	66 (35.3)	
Urban	207 (79.5)	53 (20.5)	

^P values from chi square tests.
†Unweighted n=447

LF = local food; NSLP = National School Lunch Program

Table 3.2. (cont.) Comparison of CA Public Districts Serving LF in the NSLP in 2018-19.

School Meal Practices	Served LF Unweighted sample size† (Weighted percent)	Did not Serve LF Unweighted sample size† (Weighted percent)	^p-value
Salad Bar (>1)			0.002
Yes	266 (76.1)	83 (23.9)	
No	62 (62.4)	36 (37.6)	
Uses Geographic Preference Option			0.04
Yes	55 (82.0)	12 (18.0)	
No	273 (71.5)	107 (28.5)	
LF Procurement Policy			0.003
Yes	153 (79.4)	39 (20.6)	
No	175 (68.4)	80 (31.6)	
Years of F2S Engagement			0.013
< 3 years	145 (68.3)	66 (31.7)	
≥ 3 years	183 (77.4)	53 (22.7)	
Local Food Definition Type			0.73
Strict	36 (72.3)	14 (27.7)	
Liberal	151 (74.6)	51 (25.4)	
None	141 (71.6)	54 (28.4)	
Self-Operated SFA			0.80
Yes	292 (72.9)	107 (27.1)	
No	36 (74.4)	12 (25.6)	
F2S Leadership Role			0.28
Don't know	61 (68.9)	27 (31.2)	
No	211 (73.0)	77 (27.0)	
Yes	56 (78.6)	15 (21.4)	

^P values from chi square tests.
†Unweighted n=447

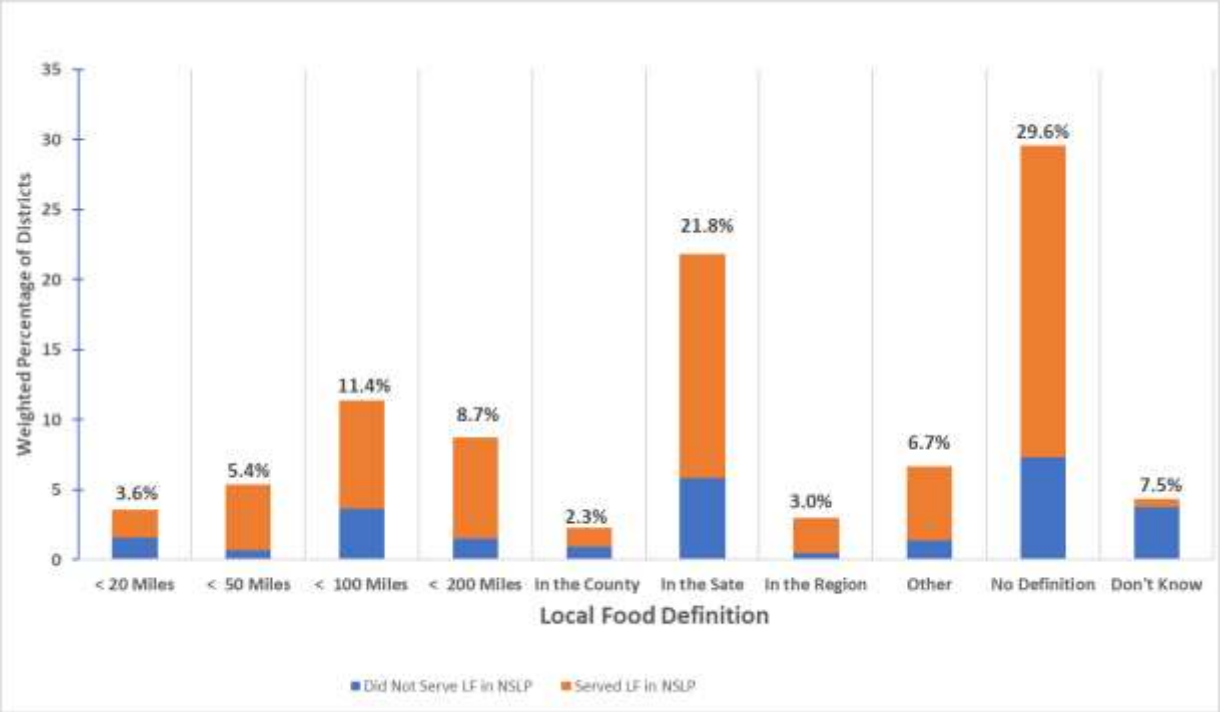
LF = local food; NSLP = National School Lunch Program; F2S = farm to school; SFA = school food authority

Results from the weighted logistic regression analyzing district characteristics associated with serving LF in the NSLP are presented in Table 3.3. Significant associations were found for student poverty level, urbanicity, and per-pupil spending. The odds of serving LF in the NSLP were 1.8 times higher in districts with low student poverty than high poverty districts, and 2.1 times higher in urban than rural districts. The odds of serving LF were 1.6 times higher in districts with per-pupil spending in Tercile 2 than those in the lowest spending tercile. The difference between Tercile 1 and Tercile 3 was not significant. Using Tercile 3 as the referent for per-pupil spending also showed no difference between Terciles 2 and 3 (OR 1.43 [0.88, 2.33], p =0.154). While medium and small districts were more likely than

large districts to serve LF, the differences were not significant. Using small as the reference group showed the odds for medium and small districts were similar (OR 0.90 [0.53, 1.54], p = 0.71).

Figure 3.1 describes the percentages of LF definitions type reported among CA districts that engaged in F2S during the 2018-19 school year. Different colors represent comparison between SFAs serving LF in the NSLP with those that did not. The figure shows wide variation in definition types with the highest proportion indicating "No Definition," and "In the State" the most frequent actual definition.

Figure 3.1. Percentage of Sample Districts Using Each LF Definition Described in the 2019 F2S Census



Salad bars were significantly associated with serving LF at lunch with the odds ratio 1.6 times higher for districts with salad bars than those without. SFAs using the GPO in food procurement, with LFPPs and those with $\geq$ 3 years of F2S engagement, were more likely to serve LF, but these differences were not significant. The type of LF definition was not associated with serving LF in the NSLP. Testing "strict" as the LF definition reference showed no difference between the liberal and strict LF definitions (OR 0.95 [0.50, 1.80], p = 0.881), and these categories were combined to evaluate the effect of having a

LF definition (Yes/No), which showed no association (OR 0.91 [0.61, 1.36], p=0.647) and was removed from the final model without changing the results.

Table 3.3 Weighted Associations between District Characteristics and LF Served in the NSLP.

District Factors Full Model	Weighted† Adjusted* OR (95% CI)	p-value	District Factors Final Model	Weighted† Adjusted* OR (95% CI)	p-value
Non-White Majority					
Yes (Ref)	1.04 (0.65, 1.66)	0.880			
No					
District Size			**District Size**		
Small	1.55 (0.78, 3.09)	0.214	Small	1.60 (0.82, 3.11)	0.171
Medium	1.43 (0.83, 2.46)	0.193	Medium	1.44 (0.85, 2.45)	0.178
Large (ref)			Large (ref)		
Student Poverty			**Student Poverty**		
Low < 40 % FRPM	1.80 (1.02, 3.12)	0.041	Low <40% FRPM	1.86 (1.11, 3.12)	0.020
High ≥ 40% FRPM (ref)			High ≥40% FRPM (ref)		
Per-Pupil Spending			**Per-Pupil Spending**		
Tercile 3	1.13 (0.69, 1.85)	0.634	Tercile 3	1.14 (0.70 1.54)	0.606
Tercile 2	1.61 (0.99, 2.60)	0.053	Tercile 2	1.62 (1.01 2.61)	0.046
Tercile 1 (ref)			Tercile 1 (ref)		
Urbanicity			**Urbanicity**		
Urban	2.14 (1.25, 3.68)	0.006	Urban	2.15 (1.27, 3.65)	0.004
Rural(ref)			Rural(ref)		
Have Salad Bar(s)			**Have Salad Bar(s)**		
Yes	1.64 (1.04, 2.60)	0.035	Yes	1.60 (1.02, 2.52)	0.040
No (Ref)			No (Ref)		
Used GPO			**Used GPO**		
Yes	1.39 (0.76, 2.56)	0.292	Yes	1.38 (0.76 2.54)	0.293
No (Ref)			No (Ref)		
LF Procurement Policy			**Have LFPP**		
Yes	1.38 (0.89, 2.12)	0.148	Yes	1.35 (0.89 2.04)	0.161
No (Ref)			No (Ref)		
F2S Program Years			**F2S Program Years**		
≥ 3 years	1.41 (0.94, 2.09)	0.096	≥ 3 years	1.41 (0.96, 2.08)	0.079
< 3 years (Ref)			< 3 years (Ref)		
LF Definition Type					
Strict	0.95 (0.50, 1.79)	0.863			
Liberal	0.91 (0.59, 1.38)	0.631			
None					
Self-Operated SFA					
Yes	0.91 (0.48, 1.75)	0.770			
No (Ref)					
F2S Leadership Role					
Don't know	0.91 (0.45, 1.82)	0.780			
No	0.94 (0.52, 1.69)	0.827			
Yes (Ref)					

* Adjusted for non-White majority, student poverty level, per-pupil spending, district size, urbanicity, have salad bar(s), used GPO, have LFPP, F2S program years, LF definition type, self-operated SFA, and F2S leadership role.
† Unweighted n=447

LF = local food; NSLP = National School Lunch Program; F2S = farm to school; SFA = school food authority; GPO = geographic preference option

DISCUSSION

Summary

This analysis shows LF procurement is high among CA F2S Census respondents, with an estimated 73% of the districts that engaged in F2S activities during 2018-19 serving LF in the NSLP. This frequency is similar to national trends.[29] Our analysis also shows that serving LF was significantly higher among districts with low student poverty, mid-tercile per-pupil spending, districts located in more urban settings, and those that used salad bars. Many of these factors appear to impact SFA food budgets and/or school meal reimbursement, which may indicate that increased costs associated with LF procurement may be prohibitive for districts with high student poverty and/or challenges procuring LF. Policies that offer tiered funding reimbursement for LF purchases based on % FRPM eligibility could be a pathway to reverse this trend. The odds of serving LF at lunch were also higher in districts that had engaged in F2S activities for $\geq$ 3 years, those that used the GPO in LF procurement and those that had a LF procurement policy, but these differences were not significant. Having a district self-operated SFA, an SFA member serving in a F2S leadership role, and the types of definitions for "local" food were not associated with LF procurement.

An interesting paradox in CA is the lower odds of serving LF among rural districts which may be in closer proximity to farms than the urban districts in CA. Lack of access points for fresh food purchases in the Central Valley, the main farm belt in the state, is a known challenge[77] that the state Office of Farm to Fork (COFF) has been strategically working to address.[39] Other factors that may contribute to LF food procurement challenges for rural districts include different financial pressures due to smaller district size which reduces the ability to leverage economies of scale[71] and/or more conservative views that may not place a high priority on public health or climate-focused initiatives.[78] Promoting F2S with a stronger emphasis on the economic benefits of local food procurement to local communities may be a more effective strategy to increase interest in LF in these communities.

It is important to note the high overall use of salad bars among SFAs engaging in F2S with 76% reporting use of LF in district salad bars. This finding is similar to national trends which also indicate that salad bars are the primary venue for serving LF.[29] The popularity of salad bars likely results from the myriad of both national and state resources and funding opportunities [79] to support salad bars in school meals. Leveraging salad bar funds to offset the increased cost of preparing and serving fresh local food may be an important F2S promotion tool to increase LF procurement.

Other findings of interest are the overall low use of the GPO in LF procurement by < 15% of all districts engaging in F2S activities, and the high number of districts that did not have a specific definition for "local" food. The GPO provision is an important exception that allows higher spending for qualified LF procurements. While this finding is similar to national trends (only 20% report GPO use),[29] it is unclear whether the low use among study districts stems from a lack of need for this provision in CA or a lack of understanding about how to use the GPO, warranting further investigation. The high frequency of no specific definition for "local" food is also similar to national trends,[29] and makes accountability for LF procurement more tenuous. An explanation for this finding comes from personal experience in this field indicating that many SFAs purchase LF from school food vendors rather than directly from local farmers. These purchases are designated as "local" by the vendors, and some SFAs simply may not know the exact definition used by their vendor leading to the high number of "No Definition" and "Don't Know" responses. A firm state requirement for at least a minimum definition such as "within the state" to qualify as LF procurement would improve accountability and tracking of LF procurements.

Limitations

The study has several limitations. (1) The cross-sectional design precludes causal inferences. (2) Limiting this analysis to CA public districts provides important data for school food and F2S decision makers in the state, but limits generalization of study findings to all types of CA SFAs. In addition, the reduced sample size may have limited the power to detect differences between smaller categories such

as for district sizes “large (5,000 – 25,000 students)” and “very large (> 25,000 students)” or for very small racial/ethnic groups such as American Indian/Alaska Native, Filipino or Pacific Islander which make up less than 2% of all CA students. (3) Some results may reflect sample bias. The USDA F2S Census is sent to all SFAs nationwide that participate in national school meal programs and relies on voluntary participation rather than on a randomly selected sample chosen to represent all districts. Some SFAs such as those not engaging in F2S may have less motivation to complete the Census, adding to bias. To address these concerns, the Census team provided inverse propensity non-response weights for participating SFAs which were used in all analyses of this dataset. However, systemic differences between respondents and non-respondents likely are not fully accounted for in these weights. 4) Finally, the USDA Census relies on self-report by an SFA member responding for the whole district, causing concerns about response bias. The Census Report[29] provides the following statement about potential bias for data users:

> *Reports of expenditures and school-level activities found in this dataset should be considered approximations. The information used in both the 2019 Farm to School Census Report and this website is based on self-reporting by SFA-level respondents. They may not have been familiar with farm to school activities that occurred at the school-level or in prior years or may not have had access to exact expenditure data for local purchases.*

The potential for response bias was minimized in these analyses by limiting study variables to factors most likely under the purview of school meal programs and excluding variables with large numbers of missing data or responses such as “Don’t Know,” or data indicating it was derived through estimation. We also used matched validated demographic data from CDE and the urbanicity data calculated and reported directly by the USDA Census Team.

CONCLUSION

The key study finding is that LF procurement for the NSLP is significantly lower among districts with high student poverty and those located in rural settings. These districts are also more likely to serve the large numbers of at-risk students who would benefit most from improving access to farm-fresh nutritious foods at school. Further research is needed including focus groups and key informant interviews with SFA leadership in these districts to determine the most effective strategies to limit barriers and facilitate LF procurement for school meals. Tying LF procurement with salad bar initiatives and resources also may be an effective strategy to leverage LF costs. In addition, F2S promotion strategies that emphasize the benefits of LF procurement on local economies may be a practical strategy to increase interest in LF access in rural districts.

Study limitations related to the use of USDA Census data could be addressed by adding a simplified accounting of LF procurement activities as part of the required annual SFA school meal state tracking system. A more frequent, standardized tracking system would support more definitive and timelier monitoring of LF procurement for school meals in order to inform state food equity and agriculture-related climate goals as well as expanded opportunities for data sharing, community engagement, and research.

SUMMARY AND CONCLUSION

The National School Lunch and School Breakfast Program has played a long-standing role in the nation's food assistance safety net.[6] The epidemic of childhood obesity renewed interest in improving the nutritional value of school meals and led to several significant federal legislative actions aimed at improving school food and physical activity environments to support child health and educational success. The first mandate in 2004 required districts participating in the national school meal program to adopt a local school wellness policy (LSWP) that sets standards for all food served and sold on school campuses.[11] The 2010 Healthy Hunger Free Kids Act (HHFKA) strengthened LSWP and school meals requirements by mandating school nutrition standards to align with the Dietary Guidelines for Americans (DGA).[12] The HHFKA also created a National Farm to School (F2S) Program within the U.S. Department of Agriculture (USDA) to help districts meet the updated nutrition standards by increasing access to and consumption of farm-fresh food on school campuses.

National evaluations of school food environments following enactment of these mandates repeatedly show improvements in the nutritional value of school meals and competitive food and beverage offerings,[18] and show that dietary intakes from school foods now achieve a higher nutrition quality score than non-school sourced foods for all students regardless of income or food security status.[7] F2S evaluations show steady nationwide increases in F2S engagement, but not all districts participate in F2S activities.[29] Studies evaluating LSWP show most districts nationwide have adopted a LSWP; however, overall policy quality remains low[22] and near exact mirroring of model LSWP templates is common.[56] [57] [58] As the key agricultural producer and the nation’s most populous state serving a large and diverse student population, [35] CA provides an important setting to study engagement in LSWP and F2S activities. There have been no published CA-specific analyses of factors influencing LSWP and F2S practices to date. The purpose of this dissertation was to assess the quality of LSWP and engagement in F2S activities following full enactment of these federal mandates and to evaluate district level factors

associated with adoption of these practices to fill gaps in knowledge and assist school food and child health advocates to promote healthy school food environments more effectively for all CA students.

Dissertation Chapter 1 evaluated the quality (comprehensiveness and strength) of a county-stratified randomly selected sample of 200 LSWPs from low-income CA public school districts using the WellSAT 3.0[23] LSWP scoring tool. Linear regression was used to assess whether district demographic factors, use of a model LSWP template, or the policy adoption date were associated with policy comprehensiveness or strength scores. On a scale of 0−100, the mean comprehensiveness score was 65.0 (63.2-66.7) and mean strength score was 37.3 (35.3-39.2). District enrollment $\geq$ 1,000 students and modeling a national template were associated with higher comprehensiveness and strength scores. Overall template use among districts was high (> 80%), with only 13% of the sample modeling a more extensive national template. Half the policies had not been updated following the USDA Final Ruling which clarified the updated school nutrition standards. Although these study findings are similar to national outcomes, they indicate that overall district engagement in LSWP is limited in CA. While the LSWP mandate was successful in improving the nutritional value of school food environments, more research is needed including focus groups and key informant interviews with school administrators to better understand the low engagement in the LSWP process and how wellness policies can be used more effectively to support further improvements to school meals and school food environments.

Dissertation Chapter 2 evaluated F2S engagement among CA public districts during the 2018-19 school year using data from the 2019 USDA F2S Census. Logistic regression was used to assess associations between district demographic factors and F2S engagement to evaluate whether F2S adoption is influenced by district size, student racial/ethnic makeup, student poverty or district urbanicity in the state. Nearly 78% of the study sample respondents reported engagement in F2S activities. Serving local food in the school lunch (73%) and breakfast (65%) programs were the top activities, followed by local food promotion. The odds of F2S engagement among districts with

enrollment ≥ 1,000 students were nearly double that of smaller districts, and the odds were 1.5 times higher in districts in the lower two terciles of per-pupil spending than the highest tercile. There were no differences by district racial/ethnic make-up, % FRPM eligibility, or urbanicity. While F2S engagement continues to grow among CA districts, adoption challenges appear to be higher for small districts and those with the highest per-pupil spending. One explanation is that these districts often lack the advantage of economies of scale of larger districts, which limits funds available for programs beyond the direct cost of education. The design of the F2S Census and the voluntary, self-report structure limit deeper analyses of these factors. More research is needed including focus groups and key informant interviews with small and high spending districts to understand the unique needs of these districts in order to inform funding and technical assistance needs that are better targeted toward these districts. Administering a brief, mandatory annual state F2S Census would allow more definitive and timely monitoring of F2S engagement to support accountability for state F2S food security and equity goals and increase opportunities for data sharing, community engagement, and research.

Serving local food (LF) is a core F2S activity to increase access to farm-fresh food at school. Dissertation Chapter 3 examined how district demographic and school meal practices influenced serving LF in the school lunch program during the 2018-19 school year among the 477 CA public districts reporting engagement in F2S activities in the 2019 F2S Census. School meal practices analyzed include use of salad bars, having a LF procurement policy, use of the geographic preference procurement option, years of F2S engagement, type of "local" food definition, having a district-operated school meal program, and school food members with a F2S leadership role. Serving LF in the school lunch program was significantly higher among urban districts, districts with low student poverty (< 40% FRPM eligible) and those that use salad bars. Further research is needed including focus groups and key informant interviews with low-income and rural districts to improve understanding about how to effectively support these districts with LF procurement for school meals. Tying LF procurement with salad bar

funding and resources may also be an effective strategy. Requiring a brief, simplified accounting of LF procurement activities within the traditional state school meal accounting process would allow more definitive and timely monitoring of LF procurement to support accountability for state food security and climate-smart agricultural goals and increase opportunities for data sharing, community engagement, and research.

The analyses described in this dissertation have several limitations. All three studies evaluated observational data so causation cannot be inferred from these analyses. The focus on CA public districts limits generalization of findings beyond this population. In addition, the analyses using data from the USDA F2S Census, which is a voluntary, self-report electronic survey emailed to all U.S. school food authorities that participate in the national school meal programs, may be prone to both sampling and response biases.

Taken together, insights gained from this dissertation suggest that interest in promoting healthy school food environments is strong in CA. However, promoting more extensive development of LSWP may not be the most effective tool to advocate for further school food improvements. Small districts with < 1,000 students are associated with both lower LSWP quality (policy comprehensiveness and strength) and lower engagement in F2S activities, which indicates the need for further research to understand the unique needs of small districts in promoting healthy school food environments. High student poverty and the racial/ethnic make-up of students were not associated with overall F2S engagement in this sample. This finding may indicate that the race/ethnicity and income-based equity criteria built into the USDA F2S grant funding structure are helping to reduce disparities in overall F2S adoption for these groups. However, a more in-depth evaluation of the longevity of F2S engagement and the degree to which these activities are implemented on the ground is needed to assess the full impact of F2S equity criteria and equity goals. To this point, the study described in Chapter 3 found that high student poverty and rural locale are associated with lower odds of serving LF in the school lunch

program which is a core F2S activity that is important for increasing asses to fresh, nutritious food. Further research is needed including focus groups and key informant interviews to identify strategies to support LF procurement among these districts. Finally, results from this CA-specific analysis can serve as a baseline accounting of LSWP quality F2S engagement among CA public districts as schools transition back to more stable school food environments following the recent COVID-19 pandemic-related school closures. Lessons learned from the analyses of data from the USDA F2S Census (including study limitations due to the periodic, voluntary, self-report nature of the USDA Census design) can be used to shape the development of a state F2S monitoring system. What is needed is a more frequent reporting and analysis process that is aligned with the state's local food, food security, agriculture, economic, and climate goals.

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