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Farm-to-school education grants reach low-income children and encourage them to learn about fruits and vegetables

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Abstract

For children from low-income families, school meals are a significant portion of daily caloric intake and hence an opportunity to address food insecurity. For a variety of reasons, including children not eating school meals, participation in the National School Lunch Program remains below eligibility. Many states have pursued legislation to institutionalize programs such as farm to school that aim to improve the quality of school meals and acceptance of healthy foods (fruits and vegetables) to address the interconnected problems of food insecurity, hunger, and diet-related diseases. Oregon established its Farm to School Education Grant Program to increase knowledge of and preference for fruits and vegetables among children in low-income school districts. This article outlines the reach of the education grants and examines their influence on children's food choices and behaviors related to fruits and vegetables. We analyzed Oregon Department of Education Farm to School Baseline and Progress Reports from school year 2015–2016 and conducted interviews with education grantees. We conducted descriptive analyses for quantitative data. For qualitative data, we coded repeated concepts and identified themes using grounded theory approach. Education grants reached more than 20,000 students in 30 districts, including 25 low-income districts. The most reported activities were nutrition and food-based lessons, school gardens, and farm field trips. Thematic results included students eating fruits and vegetables, trying new foods because of gardens, and learning about growing produce. Oregon's Farm to School Education Grant Program reached the targeted low-income students, encouraged districts to implement educational activities, and allowed low-income children to learn about produce. Education is a core element of farm-to-school success and can help achieve the behavior change in youth needed for increased acceptance of school meals, better health outcomes, and improved food security.

Keywords

Farm to school, Food insecurity, State policy, Education, Low-income children

Implications

Practice: Providing designated funding for farm-to-school educational activities can allow low-income students to learn about fruits and vegetables which may encourage them to participate in school meals helping to address hunger and food insecurity.

Policy: Education is a core element of farm-to-school success, and policymakers should consider strengthening farm-to-school policies with more support and funding for educational activities to maximize the ability of the policies to decrease hunger, improve food security, and improve other diet-related health outcomes in students.

Research: Future research is needed to examine the long-term policy impacts of farm-to-school education on participation in the National School Lunch Program, health outcomes, and food security status, particularly among low-income students.

INTRODUCTION

For children from low-income families, school meals are a significant portion of daily caloric intake and hence an opportunity to address food insecurity [1]. Policies and programs implemented in the school environment are an effective way to reach students, including low-income children [2,3], and have the potential to improve students' knowledge of healthy eating and encourage healthy eating behaviors such as consuming fruits and vegetables [4,5].

Fruit and vegetable consumption is important to health promotion and chronic disease prevention [6], but multiple data sources indicate that children's fruit and vegetable intake is below recommended levels [4,7–9]. On average, Americans consumed 1.05 cups of fruits and 1.42 cups of vegetables per day during 2007–2010 (compared to the recommended 2 cups of fruits and 2.5 cups of vegetables) and individuals eligible for benefits through the Supplemental Nutrition Assistance Program (low-income consumers) ate even smaller amounts of fruits and vegetables—0.96 cup of fruits and 1.43 cups of vegetables [10,11]. Furthermore, youth consumed an average of 0.5 cup of fruit and 0.8 cup of vegetables per day, and an estimated 8.5% of high-school students in the United States met recommendations for fruit intake and 2.1% met recommendations for vegetable intake [12].

Fruit and vegetable intake is especially low in minority and low-income children [9,13,14] who are also more likely to be part of food-insecure households that lack money and other resources to provide

enough food for all members of the household [15]. Nationally, 11.8% of U.S. households were food insecure in 2017, and 4.5% of households were very food insecure, meaning that these households decreased their food intake and had unstable eating patterns at times throughout the year [15]. Households with children have higher food insecurity rates, and among households with children under the age of 18 years, 15.7% of households were food insecure in 2017 [15].

The National School Lunch Program (NSLP) provides balanced school meals at a free or reduced price to low-income children and is an opportunity to improve food security. However, among food-insecure households nationwide, only 30.5% participated in the NSLP and received free or reduced-price meals in 2017 [15]. For many low-income children, the school lunch is the major meal they consume all day and therefore has significant influence on children's eating habits and preferences. Support for policies and programs that improve the nutritional quality and acceptance of foods served through NSLP and facilitate children's preference for healthier options such as fruits and vegetables is of particular importance for ensuring food security and health for low-income populations.

Farm-to-school activities are known to influence positive attitudes toward healthy eating and increase student knowledge of and preference for fruits and vegetables. Although the implementation of farm-to-school programs can encompass a wide range of activities depending on location, time, and funding, these programs typically include at least one of the following core elements: (a) procurement: students receive local foods as part of lunches, as a snack, or as a taste test; (b) education: students participate in educational activities related to agriculture, food, health, or nutrition; and (c) school gardens: students engage in hands-on learning through gardening [16].

Farm-to-school education has been shown to improve students' knowledge of [17–19], preference for [17–20], and consumption of [5,20–23] fruits and vegetables. Results of a garden-enhanced nutrition curriculum (paired with nutrition education on healthy lifestyle habits) for elementary school students in California indicated that exposure to a nutrition education curriculum significantly improved students' nutrition knowledge, and exposure to gardening activities increased students' preferences for more vegetables than nutrition education alone [17,18]. Another study conducted in three elementary schools in Idaho found that students who participated in garden-based nutrition education consumed more fruits and vegetables than students who received no nutrition education and students who received nutrition education that was not paired with gardening activities [21]. A review of farm-to-school studies further demonstrates that educational activities can increase student knowledge of local agriculture and growing cycles [24].

Farm to school has also been cited as a strategy to improve dietary and health outcomes related to food insecurity [25]. By providing better quality food, it has been suggested that farm to school may encourage students to participate in the NSLP, thereby providing them with a more stable food supply and decreasing childhood food insecurity [26]. A review of farm-to-school evaluations found that this increase in school lunch participation is especially prominent when salad bars with local fruits and vegetables are introduced in school cafeterias [27].

The U.S. Department of Agriculture's (USDA's) January 2015 *Trends in U.S. Local and Regional Food Systems* indicates that the number of farm-to-school sites in the United States increased 430% between 2006 and 2012 [28]. The USDA Farm to School Census reports 5,254 school districts and 42,587 schools with 23.6 million students participating in farm-to-school activities in the 2013–2014 school year (SY) [28]. Many states have pursued legislation to institutionalize farm to school to address the interconnected problems of food insecurity, hunger, and diet-related diseases. As of 2018, 523 farm-to-school bills and resolutions had been introduced since 2002, with 261 passing [28]. At least 138 of the farm-to-school bills and resolutions passed support food-, agriculture-, and garden-based educational activities [28]. Despite this legislative support, research has not thoroughly examined the implementation and impact of state policies that support farm-to-school activities.

Oregon's state farm-to-school policy prioritizes and designates grant funding for farm-to-school education (in addition to grants for local procurement) to increase knowledge of and preference for fruits and vegetables among children in school districts serving at least 40% free or reduced-price school meals (i.e., a significant low-income student population according to Title I) [29]. In 2017, food insecurity rates in Oregon were similar to the national average: 12.9% of households were food insecure and 5.4% of households were very food insecure [15]. Estimates indicate that over 173,000 children were food insecure in Oregon in 2016 [30].

Initiated in 2011, Oregon's legislation has undergone several iterations, with the most recent House bill 2038 as of this analysis (passed in 2017) allocating $4.5 million for farm-to-school activities. The education portion of the bill expanded entities eligible for education grants to include education service districts, federally recognized Indian tribes, schools overseen by the Bureau of Indian Education, and soil and water conservation districts [31].

This article outlines the reach of Oregon's farm-to-school education grants through the RE-AIM framework which recently has been used to translate research into practice and improve program

implementation. The acronym stands for Reach, Effectiveness, Adoption, Implementation, and Maintenance [32]. This analysis focuses on the policy's reach into the target population and the policy's effectiveness, both of which are individual levels of impact. Organizational levels of impact examine whether a program or policy can be adopted, implemented, and maintained on a larger scale, resulting in a large public health impact.

Oregon's farm-to-school education grants are administered through Senate bill (SB) 501 (passed in 2015), which allocated $4.5 million in farm-to-school grant funding for SYs 2015–2017 and specified that 20% of grant funds be used for education grants with a priority for school districts that serve a high percentage of children who qualify for free or reduced-price school meals under USDA's NSLP [33]. This article measures the number of children reached by the educational grants, including the number of children reached attending schools in low-income districts. It further examines how the funded activities helped children learn about fruits and vegetables and changed their food choices and behaviors related to nutrition. We hypothesize that (a) Oregon's Farm to School Education Grant Program will reach the targeted children with educational programming that allows them to learn about fruits and vegetables in interactive ways and (b) participating in this interactive education will encourage children to express interest in and be willing to consume fruits and vegetables.

METHODS

We used quantitative and qualitative methods to explore whether the education funds allocated in Oregon's Farm to School Grant Program effectively reached low-income school districts across the state. Schools and districts are eligible for Title I funds if they enroll at least 40% of children from low-income families [29]; therefore, we defined districts as low income when 40% of children in the district qualified for free and reduced-price lunch. Data on free and reduced-price lunch eligibility came from reports collected by the Oregon Department of Education (ODE) in SY 2015–2016. We analyzed ODE Farm to School Baseline and Progress Reports submitted by all 24 education grantees in SY 2015–2016 under SB 501 and conducted 19 semistructured interviews with Oregon stakeholders.

ODE collected Farm to School Baseline Reports in September 2015 and Progress Reports in September 2016 from all 24 education grantees. Baseline reports included plans and a timeline for how grant funds would be used and the number of students the education program was expected to reach, whereas progress reports included grantee-reported information on farm-to-school activities completed and in progress, actual number of students benefitting from educational activities thus far, number of parents and producers participating in project activities, student motivation and ability to make responsible food choices, use of promotional materials, and project successes and setbacks.

Three study team members conducted 19 semistructured interviews with representatives from the following five stakeholder groups during March–May 2017: education grantees (two interviews), procurement grantees (two interviews), producers and distributors (six interviews), policy advocates and state partners (six interviews), and early care and education farm-to-school participants (three interviews). Fourteen of the interviews were conducted in person in Oregon, and three interviews were conducted via telephone. A list of potential participants was identified in discussion with an advisory panel and the National Farm to School Network, and we contacted these participants to schedule interviews. We were not able to schedule an interview with policymakers. We made several attempts to schedule a call with Representative Brian Clem, a champion of Oregon's farm-to-school policy, but were unsuccessful. All interviews were audio recorded, with one team member conducting the interviews using a guide with open-ended questions to lead the discussion and the other team member taking notes. The stakeholders described their experiences with the farm-to-school grant program and provided their perspective on implementation successes, implementation challenges, and the policy's impact.

RTI International's Committee for the Protection of Human Subjects, which operates as the RTI International Institutional Review Board, reviewed the study, which was exempted from Institutional Review Board approval.

Data analysis

Using ODE Farm to School Baseline and Progress Report data, we conducted a descriptive analysis on education grantee characteristics. Looking at reach of the education grant program, our outcome measures included the number of low-income children reached by the education grant funds, the number of school districts and low-income school districts reached by the education grants, and types of farm-to-school activities that grantees reported implementing.

Using ODE Farm to School Baseline and Progress Report data and stakeholder interview data, we identified themes to examine effectiveness of the education grant program following a grounded theory approach. We used this approach because grounded theory is a systematic methodology that begins with a research question and/or the collection of qualitative data [34]. It then allows researchers to develop theories based on the emerging patterns from the data. During the analysis, we tagged repeated ideas, concepts, or elements that emerged from the

data with codes. We then grouped the codes into concepts and themes. Outcome measures included produce acceptability, learning about produce, access to produce, and consumption of produce among children.

RESULTS

Reach of the education grant program, characteristics of grantees, and types of activities implemented

Table 1 provides descriptive statistics on the reach of the education grant program in SY 2015–2016, including the organization receiving the funding, the school district(s) served, the number of students participating, the amount of funding awarded, and the type of activity funded. Of 55 grant applications submitted to the ODE, 24 organizations, including school districts, nonprofit organizations, and commodity commissions, were awarded education grants (44% award rate). All 24 grantees completed Baseline and Progress Reports as part of the requirement for receiving grant funds. Education grants reached 20,024 students in 30 school districts across Oregon, including 25 (83%) low-income school districts (the grant's target population) and one nonprofit therapeutic school serving at-risk students. Approximately 69% of Oregon's school districts are low-income districts, and 51% of students in Oregon qualify for free and reduced-price lunch [35]; therefore, ODE has focused awarding its education grants to low-income districts. The number of students reached per education grantee ranged from 10 students to 4,920 students. Eight grantees reached fewer than 100 students; nine grantees reached 100–1,000 students, and seven grantees reached more than 1,000 students. The amount of funding awarded ranged from $3,725 to $78,597 with an average funding amount of $36,750 per education grantee. Overall, the farm-to-school education grants awarded $882,000 in funding over 2 years. Of the 24 education grantees, 19 grantees (79%) worked with at least one low-income school district. Of the 30 participating school districts (data not available from Serendipity Center), more than half (52%) of the total student population qualified for free and reduced-price meals. In addition, educational activities were often coupled with procurement activities: 19 grantees (79%) implemented activities in school districts that also received procurement funding in SY 2015–2016.

Education grantees reported a variety of educational activities (Table 1) such as nutrition and food-based lessons, school gardens, and farm field trips. Activities most commonly funded under this policy were designing, implementing, and working in school gardens; providing garden-based education; conducting field trips to learn about local agriculture; hiring garden educators; working with FoodCorps representatives; hosting community events about food and agriculture; providing take-home produce for families; having tasting tables; and building relationships with farmers and producers.

In addition to the funded activities listed in Table 1, grantees reported conducting activities that promote local food, sharing educational materials with families and the community, educating students about food heritage and local agriculture, and including families and producers in project and educational activities. Table 2 provides information on the number of grantees that reported conducting these specific activities. Eighteen grantees (75%) reported using materials from ODE to feature different local fruits or vegetables each month and using additional promotional materials related to local foods. Seventeen grantees (71%) reported including parents or caregivers in project activities such as field trips and cooking classes, and 16 grantees (67%) reported sharing food-, agriculture-, or garden-based learning materials with families and the community. In addition, 16 grantees (67%) reported educating students, families, or the community about Oregon agriculture, and 13 grantees (54%) reported promoting specific Oregon agricultural products through educational activities.

Thematic results on the effectiveness of the education grant program

We identified seven thematic results from the ODE Baseline and Progress Reports and two interviews with education grantees. Table 3 provides illustrative quotes for each theme. We also discuss findings from stakeholder interviews with individuals other than education grantees.

Students' acceptance of fruits and vegetables

Eighteen grantees (75%) reported that students showed enthusiasm for the fruits and vegetables they were exposed to in school gardens, school cafeterias, and classrooms. Through engaging activities such as growing produce in gardens, participating in tasting tables, and preparing recipes using garden produce, these grantees reported that students demonstrated a preference for and liking of many types of fruits and vegetables, including blueberries, strawberries, marionberries, corn, kale, beets, squash, and carrots. By allowing students to become directly involved in the growing process, these grantees reported that they took greater ownership of the gardens and thus were more interested in and accepting of the produce.

Students consuming fruits and vegetables

In addition to a demonstrated acceptance of fruits and vegetables, 16 grantees (67%) reported that students consumed new fruits and vegetables. Ten grantees (42%) observed or heard directly from students that they were motivated to make healthy

Table 1 | Characteristics of Oregon farm-to-school education grantees in school year 2015–2016 ($n = 24$)

Education grantee	School district(s) served	Number of students participating	Amount of education grantee funding awarded	Number (%) of students in district qualifying for free/reduced-price lunch	Type of activity funded
Jason Lee Elementary	Portland Public Schools[b]	10	$12,274	18,228 (38.5)	Implement a comprehensive farm-to-school education program
Klamath County School District	Klamath County[a,b]	16	$10,000	3,943 (61.3)	Construct a 30' × 56' hoop house to grow produce during the school year
Oak Grove Academy	Forest Grove[a,b]	30	$3,725	3,529 (57.1)	Build a soil corral
Philomath School District	Philomath[a,b]	60	$35,098	639 (40.1)	Add an outreach and service component to the Philomath High botany program
Food Roots	Tillamook #9[a,b] and Nestucca Valley[a]	61	$26,014	1,500 (59.0)	Enhance farm-to-school programming
Oregon Human Development Corporation	Tigard-Tualatin[b]	74	$72,385	4,275 (33.4)	Implement a comprehensive farm-to-school education program
Oregon Albacore Commission	Seaside[a,b]	75	$15,411	929 (60.3)	Expose students to seafood
Reedsport School District #105	Reedsport #105[a]	76	$59,011	306 (56.7)	Expand the school garden and implement an outdoor education program
Gilliam East John Day Watershed Council	Condon 25J[a]	126	$31,359	74 (58.7)	Incorporate agricultural-based learning experiences into schools
Serendipity Center	Serendipity Center[c]	134	$24,585	N/A	Design and implement an outdoor garden
Curry Soil & Water Conservation District/ NeighborWorks Umpqua	Central Curry,[a,b] 2CJ (Port Orford Langlois),[a,b] and Bandon[a]	147	$40,000	1,024 (70.4)	Expand the school garden and implement a comprehensive farm-to-school education program
Pine Eagle Charter School	Pine Eagle[a]	187	$34,829	118 (66.7)	Incorporate agricultural-based learning experiences in schools
Planting Communities	Woodburn 103[a,b]	250	$26,289	4,362 (76.3)	Expand three school gardens
Schoolyard Farms	North Clackamas[b] and Oregon City[b]	350	$40,607	9,504 (37.5)	Implement a comprehensive farm-to-school education program
Lake County School District #7	Lake County #7[a]	400	$39,718	378 (50.3)	Design and implement an outdoor garden
South Fork John Day Watershed Council	Grant County #3 (AKA John Day SD)[a,b]	615	$9,475	320 (52.0)	Implement outdoor education program
Glide School District	Glide[a,b]	750	$23,262	401 (56.8)	Set up a buying program with distributors that provide Oregon-grown/processed foods
OSU Klamath Basin Research & Extension Center	Klamath County[a, b] and Klamath City[a,b]	1,100	$28,374	5,899 (61.0)	Implement a comprehensive farm-to-school education program

(Continued)

Table 1 | Continued

Education grantee	School district(s) served	Number of students participating	Amount of education grantee funding awarded	Number (%) of students in district qualifying for free/reduced-price lunch	Type of activity funded
Growing Gardens	Portland Public Schools[b]	1,190	$78,597	18,228 (38.5)	Implement outdoor education program
Willamette Farm and Food Coalition	Eugene 4J,[a,b] Bethel,[a,b] Springfield[a,b]	1,407	$75,842	6,947 (40.7)	Implement a comprehensive farm-to-school education program
Salem Keizer Education Foundation	Salem Keizer[a,b]	1,500	$63,548	26,352 (64.1)	Incorporate agricultural-based learning experiences in schools and community activities
South Lane School District	South Lane[a,b]	2,791	$37,275	1,774 (63.6)	Implement a comprehensive farm-to-school education program
Lebanon Community Schools	Lebanon Community 9[a,b]	3,755	$44,594	2,534 (58.4)	Expand the school garden program
Outgrowing Hunger	David Douglas,[a,b] Centennial,[a] and Portland Public Schools[b]	4,920	$49,728	30,873 (47.9)	Offer in-class and after-school programming in each on-site school garden
Total	30 school districts served	20,024	$882,000		

Source: 2015–2016 Farm to School Education Grantee Progress Reports.
[a]School district is low income, defined as 40% of children in the district qualify for free and reduced-price lunch.
[b]School district also received procurement funding.
[c]Serendipity Center is a nonprofit therapeutic school serving at-risk students.

Table 2 | Activities reported by Oregon farm-to-school education grantees in school year 2015–2016 (n = 24)

Activity	Grantees conducting activity % (n)
Used Oregon Harvest for Schools Materials[a]	75 (18)
Used promotional activities related to local foods in the school environment	75 (18)
Used promotional activities related to local foods in the community outside school	63 (15)
Shared food-, agriculture-, or garden-based learning materials with families and/or the community	67 (16)
Promoted specific Oregon agricultural products through educational activities	54 (13)
Educated students about food heritage or food culture, including historical or native significance of food	58 (14)
Educated students, families, or the community about Oregon agriculture (e.g., agricultural regions, jobs in agriculture and food processing, history)	67 (16)
Included parents or caregivers in project activities (e.g., after-school activities, field trips, cooking classes)	71 (17)
Included producers in project activities (e.g., after-school activities, field trips, cooking classes)	46 (11)

Source: 2015–2016 Farm to School Education Grantee Progress Reports.
[a]Oregon Harvest materials promote Oregon foods and can be used to feature a different local fruit or vegetable using resources available from Oregon Department of Education. Materials include posters, classroom activities, a newsletter to send home to families, and recipes.

food choices and were excited about activities integrating healthy, local foods. These grantees reported that students consumed a greater amount of fresh fruits and vegetables in school cafeteria salad bars and expressed preferences for fresh foods over processed foods. In addition, these grantees reported that students were willing to try new vegetables, especially those harvested from school gardens. Three education grantees (13%) reported that students expressed interest in consuming fruits and vegetables at home and in creating their own gardens outside of school.

Increased food access for students and families

The effects of farm-to-school education funding extended past the immediate school environment. Education funding provided students and families with opportunities for increased access to local produce. Five grantees (21%) reported providing food-insecure families with produce from school gardens. Six grantees (25%) reported organizing food pantries and community-supported agriculture, providing coupons for local produce at farmers markets, and providing families with information about using the Supplemental Nutrition Assistance Program.

Family and community involvement

Education funding provided opportunities to include students' families and the community at large in farm-to-school activities. The 24 grantees reported engaging 1,060 parents or caregivers in activities such as cooking classes, community events, and volunteering in gardens and providing educational materials such as informational brochures and literature. In addition to direct involvement, grantees reported that these activities reached community members through local media coverage of school gardens and other educational activities.

Students' knowledge of agriculture, produce, and sources of food

Twelve education grantees (50%) reported that students involved in the education grant activities effectively demonstrated knowledge of agriculture, could identify produce, and understood the source of their food. These grantees reported that students gained this knowledge through educational activities such as reviewing maps to show where different produce is grown throughout Oregon, field trips to local farms, hands-on garden activities, and lessons about food heritage.

Integrating garden activities into school curriculum

Education funding encouraged the integration of garden activities into the school curriculum. Seven grantees (29%) reported that teachers used school gardens in core subject areas and connected the lessons to standards, including conducting science experiments using garden produce and growing conditions. These grantees reported teachers being enthusiastic about using school gardens in innovative ways for instruction and students expressing pride and ownership of the garden and gardening activities.

Challenges

Eight grantees (33%) reported that they did not experience challenges or unexpected setbacks that they were unable to address. However, among the 16 grantees (67%) who reported experiencing problems, they cited challenges with completing time-consuming administrative tasks and paperwork (four grantees, 25% of those with challenges), school garden growing conditions and climate (seven grantees, 44% of those with challenges), and school staff finding time for educational activities given competing priorities (eight grantees, 50% of those with challenges). Four grantees (25% of those

Table 3 | Sample of quotes related to outcomes of Oregon farm-to-school educational activities reported by education grantees in school year 2015–2016

Theme	Quote
Students' acceptance of fruits and vegetables	"The head cook at our elementary school told me that on Wednesday the first-grade classes had harvested tomatoes from the school garden. On salad Thursday, a young student came up to get his tray and wanted to make sure that he was getting the tomatoes he picked the day before because his were the 'biggest and reddest.' He also wanted the seeds to take home and plant so he could have them all summer long." "During several of our tasting tables we were able to capture several great quotes from excited students . . . 'If I had to rate [the radish slaw] one to five I would rate it a ten!' 'I love radishes; once I start I can't stop eating them!'" "There are so many examples of the impact of [the grant program] on students. From the kids who now list salad as their favorite food, to those who discover their favorite garden vegetable and excitedly devour it whole, each time they visit the garden, be it kohlrabi, lemon cucumbers, or heirloom tomatoes." "Making smoothies in the garden seems like a small thing, but the children wanted to do it every day! They were inventive with the different choices of plants they could add and they told their parents they were being healthy! This inspired several families to start making them at home."
Students consuming fruits and vegetables	"Through the garden education program at the elementary school, our salad and fresh fruit consumption has [gone] up by 25%." "I opened up the extra produce share today in my 2nd and 3rd periods and the kids went wild. Handfuls of green beans straight into mouths, pictures taken with carrots (and then promptly shoved into mouths), tomatoes eaten like apples, cilantro neatly stored in a backpack." "With support from cafeteria staff we were able to harvest over 15 pounds of fresh radishes, 10 pounds of salad greens, and 5 pounds of snap peas that were served on the salad bar in May. Cafeteria staff said they ran out quickly and wanted more!" "During every garden class, students eagerly tried bok choy flowers, baby kale, snap peas, and edible flowers. At every school, almost every single student was willing to try a new vegetable."
Increased food access for students and families	"[We] provided families with resources and coupons to increase their access to locally grown foods and . . . provided coupons for use at farmers markets/farm stands and information about using Supplemental Nutrition Assistance Program benefits." "[One student] was able to bring home produce from the farm and access food and other resources through the onsite food pantry, while also being proud that he grew some of the food that he received from the pantry during his work at the farm." "A community food pantry was organized in the spring. Over the summer a project was piloted compiling weekly food bags, including garden produce, which were then sent home with students whose families were identified as food insecure."
Family and community involvement	"[The grant program] has helped us fund community events to bring the neighborhood together. One of our goals is to better educate families, so the grant has helped us have events to do that." "The garden teacher called the local newspaper and asked them to come see us. We had an article printed in the local paper that was really well received and inspired several people to come volunteer." "The garden has become a key platform for community-building, where recipes are shared between staff, students, and community members." "We get good feedback from local community groups and businesses here that want to see [farm to school] succeed. For example, we did a taste testing to teach kids the difference between certain fruits, and a local ice-cream shop featured one of the flavor combinations."
Students' knowledge of agriculture, produce, and sources of food	"Going through the garden at the end of the year, most students in 2nd through 5th grade were able to successfully identify the majority of edible plants growing in the garden." "Kids have become more educated. At the high school level, they didn't know the difference between a beet and a radish—educating kids on what fruit and vegetables look like is a big thing. It's surprising how many kids don't know." "Students attended a field trip to the farm . . . to plant their squash and cucumber crops. The students received a tour of the farm, learned about their business and how they process their produce for sale . . . Staff coordinated with farmers and made plans to come back over the summer and again in the fall to harvest the crops they planted and learn more about the farm business." "Guest speakers discussed agriculture and careers as well by sharing their education and experiences. Students in the botany class, our visitors, and students who benefitted from the free lunch program were all familiarized to crops grown in Oregon because they ate them straight from the farm. Some students had never seen a lemon cucumber or a yellow tomato and our program introduced them to new agricultural crops."

(Continued)

Table 3 | Continued

Theme	Quote
Integrating garden activities into school curriculum	"The language arts teacher uses the school garden as the instructional center for persuasive writing, turning their assignments into relevant and real world case studies for nutrition, agriculture and school garden topics." "We are fully integrating the garden into the core subject areas and connecting the lessons to standards. In this way, we hope to transform garden-based education from a nice afterschool "add-on" to something institutionalized and the educational experience of every child at a school." "The kids planted radishes in different "micro-climates." Each week the kids ran outside to check the rain gauge and thermometers and compare how their plants were growing. They are counting how many seeds germinate in each environment and will measure the height of the plants before finally eating the radishes on the final day of the unit." "When we started the school year there were some teachers who were reticent about giving up some of their classroom time for outdoor education. But once they participated in the first lesson, they were all very excited about it . . . One lesson that was especially well-received was a science lesson in which kids measured the temperature of the air, the temperature of the soil and precipitation in a rain gauge."
Challenges	"Our other large setback was the process of getting our large item shipped to us in [a] timely fashion. Greenhouse specifics have been challenging due to our particular climate and cold winters. This has definitely been a process for our community and school district to learn." "One school withdrew from our program after two months of programming. This was attributed to a combination of poor site preparation, misunderstandings between our staff and teachers, and difficult behavioral issues among some of the students . . . In retrospect, we realized that we had not invested enough time in building the relationship with that school, getting to understand each other's organizational cultures, and that beginning programming at a new school mid-year is very difficult in the best of circumstances." "Setting up the acceptance and administration of the grant was very confusing and delayed the start of the grant. Communication was problematic."

Source: 2015–2016 Farm to School Education Grantee Progress Reports and stakeholder interviews conducted with education grantees in 2017.

with challenges) also noted that further relationship building with the school, volunteers, and/or the community was necessary to foster mutual understanding of shared program goals and lead to better program outcomes.

Findings from other stakeholder interviews

On the basis of interviews with stakeholders other than education grantees (procurement grantees, producers and distributors, policy advocates and state partners, and early care and education farm-to-school participants), the procurement funding from SB 501 allowed school districts to increase purchases and availability of local fruits and vegetables, in addition to other locally grown and processed products. The themes of increased student learning about or interest in fruits and vegetables did not emerge from these interviews.

DISCUSSION

Although studies have demonstrated the positive influence of farm-to-school garden activities and farm-to-school educational activities in improving health behaviors of children including low-income children [5,17–24], limited research has explored the impact of designating state funding to provide farm-to-school education. Using ODE Farm to School Baseline and Progress Reports and stakeholder interview data to examine reach and effectiveness (the individual-level impacts of the RE-AIM framework), this study shows that Oregon's Farm to School Education Grant Program is achieving its goal of reaching low-income students and enabling low-income districts to incorporate farm-to-school educational activities into the curriculum, which is encouraging low-income children to learn about and become more interested in produce.

More than 20,000 students in 30 school districts across Oregon, 25 of which were low-income school districts, were involved in educational activities supported by the SB 501 education grants. Education grantees implemented a diverse range of activities, including increasing the number and quality of school gardens, using school gardens for nutrition education and education in other subject areas, promoting Oregon agricultural products through hands-on activities, using Harvest of the Month materials, and conducting taste tests. The interactive delivery and format of these activities facilitate learning and encourage positive attitudes and behaviors toward healthy foods.

Education grants enabled students to learn about fruits and vegetables. Grantees reported that students expressed knowledge of produce grown in school gardens and about agriculture, enthusiastically consumed fruits and vegetables served in the school environment, and were willing to try new fruits and vegetables.

Education grants also had an impact on the community. Through educational activities, grantees

were able to involve parents in project activities, hosted community events, engaged with volunteers, generated awareness of farm to school through local media, and built connections with local producers. These activities increased opportunities for resources intended to stabilize household food supply and provided families with food assistance that they might not have received outside of the farm-to-school grants program.

In interviews conducted with procurement grantees, producers and distributors, policy advocates and state partners, and early care education farm-to-school participants, stakeholders reported that the procurement funding from SB 501 primarily resulted in increased district participation in the farm-to-school program and increased purchases of local produce. From this analysis of the education component of the farm-to-school program, grantees reported that students were able to learn about fruits and vegetables through the education grants. This demonstrates that the education component of the legislation (and not local procurement alone), which funds interactive and innovative activities, can have a positive impact on students' ability to learn about fruits and vegetables.

Students learning more about and being interested in fruits and vegetables could result in them being more willing to try new foods served through the NSLP. Receiving free or reduced-price meals has been found to improve student health outcomes [36]. However, many eligible students do not participate in the free or reduced-price meals program through the NSLP because, for one reason, parents or children or both express dissatisfaction with the foods served [37]. Students' increased connections with and liking of new fruits and vegetables could encourage more satisfaction with and participation in school meals (serving local fruits and vegetables through farm-to-school procurement). Food-insecure households would then have more resources and money available for other meals, potentially helping to stabilize child eating patterns and increase food intake both inside and outside of the school environment.

The legislation's requirement that low-income school districts have preference for receiving education grants ensured that the students in Oregon most at risk of food insecurity were targeted. This approach allowed resources for educational activities to be directed to districts that had the greatest opportunities to address food insecurity in their student populations.

Multicomponent policies and programs that integrate education, availability of healthful foods, family involvement, and community resources can have meaningful impact on student health outcomes [38]. Oregon's Farm to School Grant Program, combining funding for education and procurement activities, is an example of a multicomponent policy. The coupling of farm-to-school education with procurement likely leads to the policy having a greater impact on student attitudes and behaviors related to health than just procurement activities alone because the policy not only increases the availability of local fruits and vegetables in schools, but also increases students' ability to learn about these products.

The policy provided funding for and set expectations to encourage complementary partnerships with education grantees, including community-based organizations, cooperative extension centers, commodity commissions, and school districts. Involving diverse stakeholders from inside and outside the school district has been suggested as a factor that contributes to farm-to-school success [24]. The policy also involved parents and the community in school gardens and other farm-to-school educational activities. This involvement is important, especially for schools with limited resources and other competing priorities to foster a commitment to the program [39]. Their involvement can help ensure sustainability and institutionalization for continued program success. By offering farm-to-school education; involving families; engaging with the community; and providing local, healthful foods, schools can become proactive in promoting healthy behaviors and move beyond their standard academic role, helping to improve child health and increase acceptability of resources that can reduce food insecurity in low-income students [40].

Translational implications

This study demonstrates that the Oregon Farm to School Education Grant Program is making progress toward the behavior change in youth needed to achieve better health outcomes through the reach of the program and students learning about and showing interest in fruits and vegetables. Education is an essential component of farm-to-school success; to continue to build on the progress made in Oregon, it is necessary to strengthen policies that support the educational aspects of farm to school to achieve the intended long-term goals. This finding can help guide the development of effective state and local farm-to-school policies and programming in Oregon and elsewhere.

To build on the results of this study and encourage the scaling up of effective approaches in farm-to-school efforts, future research is needed to examine the long-term policy impacts on participation in NSLP, health outcomes, and food security status, particularly among low-income students and in low-income districts. In addition, more robust measurement of low-income student satisfaction and consumption of fruits and vegetables in the school environment using methods such as dietary recalls, surveys, or plate waste would provide useful insight into the effects of coupling farm-to-school education

with procurement. However, these more robust methods can be costly.

In addition to future research on this topic, attention should be given to ways to adapt and replicate similar programs across diverse locations and environments [41]. When implementing farm-to-school education programs, it would be useful to have a better understanding of local, specific needs by using methods such as community-based and participatory research to ensure the program fits the community [42], particularly when implementing the program in low-income and underserved communities.

Limitations

Several study limitations must be considered. First, we cannot draw any conclusions about a causal relationship between the farm-to-school education grants and reported outcomes. This study did not use a randomized controlled trial design, limiting the ability to determine if a cause-and-effect relationship is present. Second, we did not conduct dietary recall interviews or surveys to gather data directly on student acceptance and consumption of foods at school, and grantees did not collect rigorous monitoring or evaluation data as part of this grant. Instead, we used qualitative data from individuals working with the students and implementing educational activities in the school environment as a method to measure change. Third, we were constrained by time and availability of the stakeholders in conducting interviews. Additional interviews with education grantees would have provided more in-depth information about the policy's implementation successes and challenges that was not otherwise reported in progress reports. Finally, our results are specific to Oregon's Farm to School Grant Program; as a result of political, geographical, or other factors, results may not be generalizable to other states.

CONCLUSION

Research about the education component of farm-to-school programs and policies is limited. This study provides insights into the effects of farm-to-school education in support of the other core elements of farm to school. Evidence suggests that Oregon's funding for farm-to-school education grants reached many low-income students, encouraged districts to incorporate farm-to-school educational activities into curricula, and allowed children to learn about local produce. This evidence is promising for similar programs and policies because more states are passing legislation supporting farm-to-school programs. Research needs to continue to explore the reach and effectiveness and eventually the adoption, implementation, and maintenance of these programs and the impacts on food security. These results also underscore the importance of education as a core element of farm-to-school success (often overlooked in funding and policy decisions) and the need to strengthen support for the educational aspects of farm to school to achieve the intended long-term goals.

Compliance with Ethical Standards

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Conflict of Interest: Caroline Rains, Kristen Giombi, and Anupama Joshi declare that they have no conflicts of interest.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. RTI International Institutional Review Board reviewed the study, which was exempted from Institutional Review Board approval.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Welfare of Animals: This article does not contain any studies with animals performed by any of the authors.

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