Process Evaluation of a Policy, Systems, and Environmental Change Intervention in an Urban School District

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ABSTRACT

Objective: To conduct a comprehensive process evaluation of a policy, systems, and environmental (PSE) change intervention.

Design: Quasi-experimental, mixed methods.

Setting: Low-income urban school district.

Participants: Fifth-grade students in 4 schools assigned to 2 intervention and 2 comparison schools (intervention, $n = 142$; comparison, $n = 170$).

Intervention: Both groups received a nutrition curriculum delivered by classroom teachers. Intervention schools also received 10 PSE lessons taught by paraprofessional educators.

Main Outcome Measures: Quantitative data were obtained from fidelity and observation checklists, grading rubrics and self-reported student surveys. Focus group and interviews provided qualitative data. Quantitative measures included assessments of PSE and fruit and vegetable knowledge, as well as assessment of times fruits and vegetables (FV) were consumed yesterday.

Analyses: Qualitative data were analyzed using inductive content analysis. Quantitative data were analyzed using repeated measures analysis of variance and analysis of co-variance.

Results: Fidelity, dose, reach, and acceptance of PSE intervention were high; students felt more empowered, although PSE lessons were considered lengthy and complicated. Intervention PSE and FV knowledge scores were significantly higher than comparison scores ($F_{37.56}$, $P < .001$; and $F_{3.94}$, $P < .05$, respectively). However, issues in communication were identified between school staff and researchers.

Conclusions and Implications: Policy, systems, and environmental classroom interventions commented on the differences between quantitative and qualitative assessments, and this suggests the need for more sensitive quantitative assessments. Future research should look at long-term outcomes as this study only looked at short-term outcomes.

Key Words: food and nutrition policy, policy, school nutrition, student empowerment, systems and environment (*J Nutr Educ Behav* 2019; 51:307–317.)

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INTRODUCTION

Given the important role that environment has on food choice, public health interventions are increasingly implementing strategies involving policy, systems, and environmental (PSE) change.¹ Policy, systems, and environmental interventions focus on several circles of influence within the socioecological model to change and sustain healthy community

behaviors.² In contrast to individual or small-group interventions, PSE programs offer strategies with greater population impact than individual change strategies by making healthy choices easy and convenient.^{3–5}

Schools are viable locations for PSE interventions because they are existing infrastructures conducive to integrative coordination and collaboration among systems.⁶ In addition to classroom nutrition education,^{7,8}

interventions to improve eating behaviors appear to be more successful when they include policy change, input from multiple parties (students, parents, and school staff), and environmental change.^{9,10} These interventions within the school environment can be designed to empower children to be involved in changes that directly affect them, making them more likely to incorporate these changes into their daily routines^{11,12} and having a strong positive effect on their self-esteem and ability to drive change.¹³ Involvement in activities such as participating in wellness committee meetings or suggesting ways to improve the school cafeteria environment^{11,13} gives children a voice in enacting positive change to the school food environment.

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Because US children are not meeting recommended intakes for fruits and vegetables (FV)¹⁴ and school-based classroom nutrition education can have positive impacts on knowledge and behavior,^{7,8,11,15,16} FV classroom interventions incorporating PSE components seem warranted. However, there are a limited number of studies measuring outcomes of a PSE intervention on FV intake or on PSE and FV knowledge; and because PSE interventions are relatively new, there is a need for additional process evaluation research with these programs.^{11,15,17–19} The primary aim of this pilot study was to conduct a comprehensive process evaluation of a novel PSE intervention. It was hypothesized that process evaluation results would demonstrate that (1) intervention fidelity and dose, as well as student engagement, understanding, participation, and reach, would be $\geq 80\%$; and (2) students, school staff, and educators would evaluate the program positively. The secondary aim was to examine change in short-term outcomes, comparing the PSE intervention group with a group using a quasi-experimental design. It was hypothesized that students in the intervention group would increase FV intake and PSE and FV knowledge more than would students in the comparison group.

METHODS

Study Overview

This quasi-experimental, mixed-methods pilot study was part of the University of Rhode Island (URI) Community Nutrition Education Program (*Supplemental Nutrition Assistance Program—Education* [SNAP-Ed] and *Expanded Food and Nutrition Education Program* [EFNEP]), entitled Empowering Urban School Children to Increase Fruit and Vegetable Consumption Through EFNEP-Enhanced PSE Interventions (EMPOWER). The EMPOWER consisted of 10 30-minute PSE lessons designed to be delivered every other week by trained EFNEP staff. It was designed to augment the 8-week URI SNAP-Ed *Fresh Fruit and Vegetable Program* (FFVP) Nutrition Education Curriculum that focused on increasing FV consumption by elementary school

students. In addition, the schools participated in the US Department of Agriculture FFVP,²⁰ which provides an additional serving of FV to children in low-income elementary schools as a snack, independent of school breakfast or lunch.¹⁶ Both intervention and comparison schools were to receive the FFVP Nutrition Education Curriculum delivered by school health teachers trained by SNAP-Ed staff. Intervention schools would receive the additional PSE education component delivered by 3 EFNEP paraprofessional educators who participated in 2 2-hour training sessions on the new PSE curriculum and received an in-depth orientation to process evaluation methodology. The study was composed of 2 concurrent phases: a process evaluation (September, 2015 to May, 2016) and an outcome evaluation (October, 2015 to May, 2016). The process evaluation followed the methodology of Saunders et al,²¹ starting with a detailed process evaluation plan identifying (1) process evaluation elements of program fidelity, dose delivered, dose received, reach, and perception of the program; (2) specific questions to evaluate achievements of these elements, eg, to what extent each of the program's lessons were implemented as planned; and (3) the instrument, such as educator and evaluator fidelity checklists, attendance, and assignment completion forms, or method of approach, such as focus groups and interviews. Outcome evaluation used a quasi-experimental pre-post design with schools assigned to intervention or control conditions.

Study Participants

Based on working relationships, a convenience sample of 4 schools was chosen by URI SNAP-Ed staff and researchers. Fifth-grade students ($n=142$) from 6 classrooms in 2 schools were assigned to the intervention arm; 170 from 6 classrooms in the 2 other schools were assigned to the comparison group. The target population was racially and ethnically diverse (35% white, 31% Hispanic, and 26% black or African American) from low-income households (72% received free or reduced-price meals).^{22–24}

As a part of process evaluation, 2 student focus groups were conducted, 1 per intervention school. The focus groups consisted of 5 intervention students per school, recruited at random by fifth-grade teachers. One additional focus group included the 3 EFNEP educators involved in the study. Key informant interviews included 1 intervention school principal, 1 foodservice representative for the district, one wellness committee member, and 2 health teachers (1 from each school). The study was part of URI Institutional Review Board's exempt status for SNAP-Ed and EFNEP.

Description of Intervention

The PSE lessons were designed to empower students to change their school environment and improve FV intake by participating in several different activities (Table 1). Like strategies used by other PSE initiatives,²⁵ the PSE lessons empowered students to make changes in their cafeteria environment through recipe and menu development as well as messaging and advertising changes.²⁵ In addition, students and parents were encouraged to attend wellness committee meetings. Parents received newsletters every other lesson (a total of 5) throughout the intervention to inform them about program activities. After the intervention, letters were written by the EFNEP director to the wellness committee, describing the intervention and results.

Evaluation

Process evaluation phase. The EFNEP educators documented delivery of PSE lessons. Elements evaluated included fidelity, dose delivered and received, reach, and program perceptions. The SNAP-Ed staff attended 3 lessons per educator and documented those elements. Finally, rubrics were created to evaluate whether students were successful in understanding lesson and/or activity objectives for each of the 3 take-home assignments. One SNAP-Ed staff member trained on the scoring process graded each submitted assignment by checking whether assignment criteria were met. The rubrics were created by the graduate

Table 1. Description of Policy, Systems, and Environment Lessons for the EMPOWER Intervention

Policy, Systems, and Environment Lessons	Description
1. Fruits and Vegetables You Enjoy	Students discuss FV they enjoy and draft a letter to the wellness committee about adding these FV to the lunch menu.
2. Overcoming Barriers	Students discuss barriers to eating FV and how to communicate this with the wellness committee.
3. Let's Read a Recipe!	Students learn about all of the different components of a recipe in preparation for interviewing a parent at home for an FV-based recipe.
4. It's Time to Role-play!	Students learn how to interview their parents about an FV-based recipe they eat at home.
5. Making Requests	Students learn a constructive way to tell their parents which FV they like best.
6. Taste Testing	Students taste test FV-based recipes brought in from home and vote on the 1 they like best (the winning recipe).
7. Media and Food Ads	Students learn about advertising and slogans in preparation for advertising the winning recipe around the school.
8. Advertisements	Students create slogans and brainstorm ideas for posters to advertise the winning recipe around the school.
9. Persuasive Messages	Students brainstorm ideas for persuasive messages to promote the winning recipe during morning school announcements.
10. Taking a Poll	Students learn how to poll the rest of the student body about whether they like the winning recipe. The winning recipe was sampled by the entire student body.
Wrap-up	The winning recipe was added to the school menu. Students assisted in creating a letter to the wellness committee to disseminate intervention results. The <i>EAT MORE Fruits and Veggies Recipe Book</i> , which included all recipes submitted by fifth-graders, was printed and provided to all fifth-graders in participating schools.

EMPOWER indicates *Empowering Urban School Children to Increase Fruit and Vegetable Consumption Through Expanded Food and Nutrition Education Program—Enhanced Policy, Systems, and Environmental Interventions*; FV, fruits and vegetables.

student researcher and reviewed by SNAP-Ed staff and the EFNEP team. Student focus group guides were pilot-tested with nonparticipating fifth-grade students and revised for final use. The EFNEP focus group guide was based on previously tested items from earlier SNAP-Ed interventions (these items were also used for interviews). Focus groups (each 30 minutes long) and key informant interview responses, recorded by a notetaker, captured successes, barriers, and challenges regarding the intervention. All responses were

recorded as close to verbatim as possible. The moderator was a graduate student; the assistant moderator was the SNAP-Ed program manager. [Table 3](#) presents the tools used, collection details, and the evaluator category. All materials are available upon request from the corresponding author.

Outcome evaluation phase. Student demographics were collected at baseline using the SNAP-Ed Child/Youth Participant Survey Form.²⁶ Items assessed age, attendance at URI

SNAP-Ed workshops in the past year, gender, language spoken at home (to determine ethnicity), and race. Based on the validated SNAP-Ed FV Checklist,²⁷ the total number of times (from 0 to ≥ 5) a fruit and/or vegetable was consumed on the previous day was assessed. Students also completed a pre-post assessment to evaluate change in knowledge. The instrument, which was developed for the study, assessed PSE knowledge (7 items, scored 0 [incorrect] or 1 [correct]; in which 0=low and 7=high) and FV knowledge (9 items, scored 0 [incorrect] or 1 [correct]; in

which 0 = low and 9 = high). Face validity was determined by SNAP-Ed nutrition educators. One cognitive interview²⁸ conducted by the graduate student and SNAP-Ed program manager with 5 fifth-grade students from a different school district (a partner school with similar student demographics) indicated that students understood all knowledge items.

Analysis

Process evaluation phase. Quantitative data from the self-reported fidelity checklists, observation checklists, and grading rubrics were transferred into Microsoft Excel 2011 (Microsoft Corporation, Redmond, WA), which was used to analyze descriptive results. All handwritten comments from fidelity and observation checklists were typed into a structured template. Responses from focus groups and key informant interviews were typed and reviewed by the

researchers with the notetaker to discuss initial findings and impressions. All checklist comments, focus groups, interviews, and meeting minutes were entered into NVivo (version 11, QSR International, Melbourne Australia, 2017). Inductive content analysis²⁹ was used for qualitative assessment. The first author, who was trained by an expert committee member, generated codes through the process of open coding. Codes were then categorized to form higher-order categories which led to abstraction to determine the 4 main themes of analysis.²⁹ Emergent themes are illustrated by selected anonymous participant feedback.

Outcome evaluation phase. All data were analyzed using SPSS (version 24 for Windows, IBM, Armonk, NY, 2017). Demographic information was analyzed using independent-sample *t* tests or Pearson chi-square tests of independence. The FV variables were normally distributed with no

differences in baseline FV consumption; fruits and vegetables were combined for analysis. Between-group change in FV consumption was analyzed using repeated-measures ANOVA (dependent variable $\times$ 2 groups $\times$ 2 occasions). To account for baseline differences between groups, ANCOVA was run for between-group changes for the 2 knowledge variables with baseline variable as a covariate. Within-group differences for FV intake, PSE knowledge, and FV knowledge were measured using paired *t* tests.

RESULTS

Table 2 provides a description of the sample population. On average, the children were aged 10.19 ± 0.45 years, relatively evenly split by gender; 36% reported speaking Spanish at home. Hence, intervention materials such as newsletters were provided in both English and Spanish.

Table 2. Study Sample Demographics of Fifth-Grade Students (Potential of 142 Intervention and 170 Comparison Students) in 4 Schools in Pawtucket, RI, School District

	Intervention		Comparison		Total			
Continuous Variables	Mean ± SD	n	Mean ± SD	n	Mean ± SD	n	<i>t</i> ^a	<i>P</i>
Age, y	10.16 ± 0.44	140	10.22 ± 0.45	166	10.19 ± 0.45	306	−1.02	.31
Baseline fruit ^b	2.38 ± 1.45	138	2.40 ± 1.53	168	2.40 ± 1.49	306	−.121	.90
Baseline vegetables ^b	1.86 ± 1.38	138	2.01 ± 1.43	160	1.94 ± 1.40	298	−.926	.36
Baseline policy, systems, and environmental knowledge ^c	3.85 ± 1.66	142	3.24 ± 1.67	167	3.52 ± 1.69	309	3.217	.001
Baseline fruit and vegetable knowledge ^c	4.21 ± 1.60	142	3.70 ± 1.70	167	3.94 ± 1.67	309	2.713	.007
Categorical Variables	n (%)		n (%)		n (%)		<i>χ</i> ^{2d}	<i>P</i>
Gender								
Male	71 (51)		88 (52)		159 (51)		.001	.10
Female	68 (49)		82 (48)		150 (49)			
Total	139 (45)		170 (55)		309 (100)			
Language spoken ^e								
Spanish	44 (31)		68 (41)		112 (36)		2.59	.11
Other	97 (69)		99 (59)		196 (64)			
Total	141 (46)		167 (54)		308 (100)			

^aIndependent-samples *t* test; ^bBaseline values are for the number of times fruit was eaten the previous day or the number of times vegetables were eaten the previous day, on a scale of 0–5; ^cPolicy, systems, and environment knowledge on a scale of 0–7 (in which 0 = low and 7 = high), and fruit and vegetable knowledge on a scale of 0–9 (in which 0 = low and 9 = high);

^dPearson chi-square (continuity correction); ^eBased on the question, *Do you speak Spanish at home?*

Process evaluation qualitative results. Four themes emerged from the qualitative assessments. The first was that students, school staff, and EFNEP educators enthusiastically endorsed the PSE activities, as evidenced from the following participant feedback:

If this is the first school in Pawtucket, RI, to do this program, you guys did a really, really good job. (Student)

I would do it again because I liked having a choice in cafeteria. (Student)

Students were willing to participate and showed a lot of enthusiasm. They had many ideas. (Educator)

The students really enjoyed taste testing the recipes. It was nice to see a different program that the students really enjoyed getting involved in. (Health Teacher)

Both cafeterias were very excited and looked like the kids really enjoyed Recipe Day. (Foodservice manager)

Students were excited about the whole event, especially having the recipe on the lunch menu. (Educator)

I think this was a great program and I would like to see it again. (Teacher)

The recipe contest was awesome and the kids really enjoyed the lessons. (Principal)

The cafeteria was in a buzz and really excited. (Wellness Committee member)

The second and most commonly mentioned theme that school staff voiced as a result of this intervention was student empowerment. Most agreed that the lessons and activities increased the students' self-confidence in requesting the FV they

wanted to see offered more in school and at home:

The program made them realize they had a voice in their school and were being heard. They realized they had power to make changes in their school. (Teacher)

It definitely empowered the students and it's always good to get a different perspective from different speakers. (Teacher)

I have had parents come up to me saying their kids are asking them to try new fruits and vegetables. (Principal)

In addition, a third theme identified by this project was that all students from both schools attributed making positive dietary changes to being the result of this intervention:

I asked Mom to buy more carrots when I had a recipe. I like them now. (Student)

Before, I didn't eat lots of fruits and vegetables; now I eat tomatoes, lettuce, apples, banana, grapes. (Student)

I asked Mom to put fruits and vegetables in [the] refrigerator where I can see them. (Student)

I didn't want to try new foods; now I ask Mom to buy new fruits and vegetables so I can try them. (Student)

Whereas fidelity, dose, and reach were high throughout the PSE intervention (Table 3), qualitative results revealed a fourth theme of barriers to the project. A major barrier throughout the intervention was miscommunication between EFNEP educators and classroom health teachers, and between these teachers and other school staff involved in the activities, such as the art teacher. In addition, there were scheduling problems in teaching the FFVP Nutrition Education Curriculum during the intervention; health teachers reported that in the intervention

group only 1 FFVP Nutrition Education Curriculum lesson was taught at 1 school and 5 of 8 lessons were taught at the other school. In the comparison group, 3 lessons were taught at 1 school and 6 were taught at the other school:

Teachers seemed confused about what is happening after being originally excited about it. (Educator)

There was miscommunication with the art teacher and there was confusion as to who was teaching what. (Teacher)

Respondents indicated that lessons were too long (lasting 24–40 minutes instead of the intended 20 minutes) and too wordy and that the 2-week delivery approach was a major struggle:

I may have to summarize lessons more to ensure more time is available to complete group work. (Educator)

I realized I needed to explain words when mentioning the list of barriers categories. (Educator)

The program was delivered every 2 weeks and a lot of students forgot what they had learned on the previous lesson. Timing was the hardest. (Teacher)

Outcome evaluation quantitative results. The intervention group scored significantly higher than the comparison group on baseline PSE knowledge assessment ($t=3.22$; $P=.001$) and FV knowledge ($t=2.71$; $P=.007$). Whereas there were no significant changes in FV consumption between or within groups from pre- to postintervention, the intervention group scored significantly higher after adjusted for before as a covariate for PSE knowledge and FV knowledge (Table 4). Intervention PSE knowledge scores were significantly higher than were scores from comparison schools after the intervention ($F_{37.56}$; $P<.001$) as were FV knowledge scores ($F_{3.94}$; $P=.04$); PSE knowledge increased within both groups and FV

Table 3. Details and Outcomes of the Process Evaluation of EMPOWER

Evaluation Element	Instrument	Details Collected	Evaluator	Overall Findings
Fidelity and dose delivered	Fidelity checklist	Lesson objectives met for lessons 1–10	EFNEP educators	About 97% lesson fidelity
	Observation checklist	Lesson objectives met for lessons 2, 6, and 8	SNAP-Ed staff	100% of lessons delivered
Dose received	Fidelity checklists	Attentiveness: 1 = not at all to 5 = very Understanding: 1 = nothing to 5 = everything	EFNEP educators	Student attentiveness = 92% Student understanding = 90%
	Handwritten notes	Observations	EFNEP educators	Students actively participated and were engaged in all lessons, particularly in games and group activities. Lessons 4 and 9 activities were most confusing for students. Objectives in lessons 1, 4, and 9 were not always met owing to lesson length. Some educators struggled to keep student discourse and classroom order. Overall, educators agreed students were excited about the intervention.
	Returned take-home assignments	Completion of assignment	EFNEP educators	75% assignment completion
	Graded rubrics	Whether students understood lesson and/or activity objectives	SNAP-Ed staff	Lesson 5: Writing Recipes 100% lesson taught 58% recipes were submitted 21% met all rubric guidelines 70% were fruit/vegetables based Average score = 4.7/7 Lesson 6: Making Requests 93% lessons taught 39% submitted 71% met all rubric guidelines Average score = 5.5/6 Lesson 8: Persuasive Messages 94% lessons taught 97% submitted 69% met all rubric guidelines Average score = 1.5/2
Estimated reach	Lesson attendance	Number of students/lesson	EFNEP educators	Each lesson exposed about 135 students to lesson content

(continued)

Table 3. (Continued)

Evaluation Element	Instrument	Details Collected	Evaluator	Overall Findings
Perception of program	Student focus groups guide	Successes, barriers, challenges captured with 5 students from each intervention school (2) Script pilot-tested with 5 fifth-grade students in nonparticipatory school	Researcher	Enjoyed creating posters Particularly recall discussing barriers to eating fruits and vegetables Liked recipe taste testing the most All would repeat the project if given the chance All attributed making dietary changes to intervention
	Key informant semistructured interview scripts	Successes, barriers, challenges captured with 1 principal, 1 foodservice representative, 2 health teachers, and 1 wellness committee member Questions reviewed and edited by SNAP-Ed staff member with previous interviewing experience	Researcher	Student struggled with lessons delivered every other week Miscommunication between educators and school staff Wordiness of lessons Recipe taste testing most successful activity Student empowerment most perceived effect of intervention
	EFNEP focus group script	Successes, barriers, challenges captured by 3 study-involved EFNEP staff members Previously tested questions from other SNAP-Ed interventions	Researcher	Lessons were lengthy and wordy and some were difficult for students Miscommunication between researchers and school staff University of Rhode Island <i>Fresh Fruit and Vegetable Program</i> not being taught in classrooms Timing of lessons every other week
	Wellness committee meeting minutes	Pawtucket Wellness Committee meetings recorded to track policy changes	Researcher	Overall, pleased with outcome of the intervention.

EFNEP indicates *Expanded Food and Nutrition Education Program*; EMPOWER, *Empowering Urban School Children to Increase Fruit and Vegetable Consumption Through EFNEP—Enhanced PSE Interventions*; SNAP-Ed, *Supplemental Nutrition Assistance Program—Education*.

knowledge increased within the comparison group ($P < .05$).

DISCUSSION

The purpose of this study was to conduct a comprehensive process evaluation of a school-based PSE change intervention called EMPOWER, as well as a short-term outcome evaluation. The primary aim was to assess the intervention's fidelity, dose, and reach as well as its perception by

various key informants and staff; the secondary aim was to assess pre-post outcomes compared with a no-PSE treatment school. The process evaluation followed the comprehensive guide described by Saunders et al²¹ and its results were used to fine-tune the intervention.

Overall, both students and school staff reported liking the intervention and reported that students felt more empowered. Similar to other school-based interventions,^{30,31} hands-on,

engaging activities (which in this study included recipe taste testing, creation of promotional posters, polling on Recipe Day, and lesson games) proved to be the most popular aspects of the intervention. The end result of these activities was that the recipes developed were added to the foodservice cycle menu. The qualitative results indicated that students reported increased self-confidence and empowerment in having a voice in both their school community and

Table 4. Change in Students' Behavior and Knowledge From Pre- to Postintervention, by Group

Variables	Pre (Mean ± SD)	Post (Mean ± SD)	Within-Group Change (<i>t</i> / <i>P</i>) ^a	Adjusted Post ^b (Mean ± SE) (95% CI)	Between-Group Difference ^c (F)	<i>P</i> ^c
Number of times child ate fruits and vegetables the previous day						
Intervention (n = 129) ^d	4.21 ± 2.38	4.16 ± 2.36	.282/ <i>P</i> = .78	NA	0.001	.97
Comparison (n = 139) ^d	4.37 ± 2.53	4.32 ± 2.78	.226/ <i>P</i> = .23	NA		
Policy, systems, and environment knowledge ^e						
Intervention (n = 133)	3.90 ± 1.66	5.01 ± 1.57	6.55/ <i>P</i> < .001	4.92 ± 0.136 (4.66–5.19)	37.56	.001
Comparison (n = 145)	3.30 ± 1.65	3.68 ± 1.65	2.30/ <i>P</i> = .02	3.76 ± 0.130 (3.50–4.02)		
Fruit and vegetable knowledge ^e						
Intervention (n = 133)	4.20 ± 1.56	4.58 ± 1.93	1.96/ <i>P</i> = .05	4.52 ± 0.151 (4.22–4.82)	3.94	.05
Comparison (n = 145)	3.71 ± 1.67	4.05 ± 1.60	2.03/ <i>P</i> = .04	4.10 ± 0.144 (3.82–4.39)		

CI indicates confidence interval; NA, not available.

^aPaired *t* test; ^bPost value adjusted for pre as a covariate for knowledge items owing to baseline differences between groups; ^cBetween-group difference for fruit and vegetable intake repeated-measures ANOVA; between-group differences for knowledge ANOVA, post adjusted for pre as covariate; ^dValues are for the number of times fruit was eaten the previous day or the number of times vegetables were eaten the previous day, on a scale of 0–5; ^eNo baseline difference between groups (no adjustment necessary).

family environment as a result of these activities. Increasing student engagement is an integral piece in ensuring an intervention's success.^{32–34}

Fidelity, dose, and reach were high. The high degree of fidelity of the PSE intervention seen in this study compares favorably with those that also used self-reported curriculum fidelity measurements and observations,^{35,36} as does that of dose.^{30,32,36} However, the dose of the health teacher who taught the FFVP Nutrition Education Curriculum was low; this was similar to finding by Helitzer et al,³⁷ who reported that some school teachers were not following lessons entirely. In studies that had low implementation rates, lessons were delivered by school staff rather than research staff, which may explain their outcomes. Studies such as *It's Your Move*³⁴ and *High 5*,³¹ in which intervention curricula were delivered by research staff, reported implementation rates similar to the PSE curriculum in the current study.

As hypothesized, postintervention PSE knowledge scores were significantly higher than those from comparison schools, which indicated that the intervention was effective in increasing PSE knowledge. This increase in PSE knowledge was consistent with qualitative results indicating greater empowerment. To the authors' knowledge, no other study looked at an increase in PSE knowledge or empowerment in fifth-graders. Although both the intervention and comparison schools increased their FV knowledge scores, the intervention group had a significantly higher increase in scores compared with the comparison group. This finding is similar to that in other studies.³⁵ However, the current study found no change in the intake of FV. This is in contrast to other elementary school-based PSE interventions that found significant increases in FV as well as increases in nutrition knowledge.^{15,18,19} It is possible that the lack of change in FV intake found in the current study was related to the insensitivity of the survey instrument, because qualitative results found perceived FV behavior change

by the students. It is equally possible that intervention activities were insufficient to change FV intake. Future research is needed to explore what behavioral effects, if any, were associated with the intervention.

Although there were several strengths to this study, there were limitations. Schools in this study were not randomly selected and baseline differences (although accounted for) were observed, which limits generalizability. Although the researchers observed 3 lessons, the majority of fidelity information was supplied by the EFNEP educators, which may have introduced respondent bias. Furthermore, teachers and students might have been inclined to give socially desirable answers. In addition, although responses were recorded as accurately as possible by a notetaker, interviews and focus group responses were not audio recorded. This decision was made to encourage student participation. According to Gibson,³⁸ at-risk minority students have low confidence in verbal group participation, and "choosing the least intrusive [approach] might be preferred for young children." In addition, a single researcher coded and analyzed qualitative data. These limitations may have led to overestimation of intervention effects and perceptions. Schools were not measured on the same day of the week and different foods were available at different schools, which may have affected outcomes. Finally, dietary assessments with children are challenging and the accuracy of the FV assessment instrument is questionable.³⁹ The FV Checklist used in this study may not have been sensitive enough to assess change.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Results from this pilot study can be used to design future school-based PSE change interventions. Focusing on student empowerment may lead to longer-term changes in FV intake and knowledge. Future PSE FV interventions might explore delivering key concepts in simpler language, more interactively with

lessons of shorter duration with increased frequency. There also needs to be better communication between intervention and school staff. Future interventions could consider incorporating preimplementation meetings with classroom teachers, regular check-ins to avoid confusion of teaching roles, and integration of the FFVP Nutrition Education Curriculum into the PSE curriculum, which would reduce the need for coordination between intervention and school staff. All of these changes have been incorporated into an expansion of the program entitled *SNAP-Ed Students Take Charge*, which is currently provided in 2 inner-city school systems in Central Falls and Providence, RI. Future research needs more sensitive assessment tools and incorporation of full-scale observations of curriculum delivery to determine fidelity as well as assess long-term outcomes of PSE interventions in schoolchildren.

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