



# Fuel for Fun Process Evaluation Reveals Strong Implementation and Approval with Varied Parent Engagement

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## ABSTRACT

**Objective:** To describe the implementation and process characteristics of *Fuel for Fun: Cooking with Kids Plus Parents and Play* (FFF).

**Design:** Mixed methods.

**Setting:** Elementary schools in 2 Northern Colorado school districts.

**Participants:** Fourth graders (aged 9–11 years), parents, school staff, and implementation researchers; measured over 2 consecutive years in 8 schools (851 students, 45 classrooms).

**Intervention(s):** Social Cognitive and active learning theory-based classroom cooking with tasting lessons, active recess games, cooking with tasting food promotion during school lunch, family nights, and take-home intervention reinforcements. A 7-month program delivered by a trained intervention team.

**Main Outcome Measure(s):** Implementation measures (observations and debriefings) assessed context, reach, dose delivered, fidelity, and dose received; process measures (surveys) assessed student and parent perceptions and intervention participation.

**Analysis:** Descriptive statistics for quantitative and themes for qualitative data.

**Results:** Minor adjustments in program delivery plans were required to accommodate changes in school schedules and policies. Process measures demonstrated > 90% achievement of goals for nearly all child-centered activities. One-quarter of eligible families participated in evening events, with strong parent and student approval. Fifty out of 116 parents (43%) completing an online survey reported preparing ≥ 1 of 5 recipes with their child. Fifty-nine percent of eligible students completed >1 of 10 take-home activity sheets with their parents.

**Conclusions and Implications:** Engagement and commitment of the intervention team and school staff supported strong implementation. Participant responses were positive, but improvement in parent engagement requires investigation.

**Key Words:** cooking, physical activity, process evaluation, children, school (*J Nutr Educ Behav.* 2023;55:16–29.)

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## INTRODUCTION

Community and after-school programs to improve dietary behaviors and promote physical activity often

include culinary and sensory lessons and active, noncompetitive games.<sup>1–3</sup> After-school and child/parent cooking programs have demonstrated improvements in cooking skills, interest, self-

efficacy, and vegetable intake.<sup>4,5</sup> After-school programs structured around informal games have been shown to build self-confidence and provide positive physical activity experiences for children, including those with limited access to or who do not enjoy organized sports.<sup>6</sup> However, these approaches reach only a small portion of school-age children and are often inconsistently delivered.<sup>2</sup>

Therefore, schools provide an important setting for reaching most children and the opportunity to integrate health promotion knowledge and activities into academic content in a structured way.<sup>7</sup> Multicomponent school-based interventions are recommended to improve children's dietary

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and physical activity behaviors and prevent childhood obesity.<sup>8–10</sup> Common components include classroom, cafeteria, recess, and family activities.<sup>11–13</sup> In a review by Mauger and colleagues,<sup>14</sup> school-based culinary programs yielded positive outcomes when they included hands-on cooking, skilled facilitators, and family engagement. However, these components require significant time and resources and are often challenging for schools to integrate into the schedule and provide without external support.<sup>15–18</sup> Physical activities beyond the limited hours of physical education are difficult for schools to offer for similar reasons.<sup>19,20</sup> In addition, despite the recommendation that 40% of recess time should be spent in physical activity (PA),<sup>21</sup> evidence suggests much lower rates.<sup>22,23</sup> Recess has the potential for increasing PA during the school day.<sup>24,25</sup>

Parent and family involvement is intended to provide home support and reinforcement for intervention activities.<sup>26,27</sup> Newsletters, homework, and attendance at school events are common components.<sup>28,29</sup> However, parent and family participation can be quite modest in school programs, often because of busy work schedules, competing family activities, and lack of transportation.<sup>5</sup>

Best practices also indicate that school-based health promotion interventions should be designed using a socioecological framework and incorporate behavior change theory to bring about intended effects.<sup>30–32</sup> Social Cognitive Theory (SCT)<sup>33</sup> is commonly applied in nutrition and PA programs because of its emphasis on internal and external influences of behavior change.<sup>34</sup> Experiential Learning Theory,<sup>35,36</sup> with its 4-phase cycle of experience, reflect, think, and act, is a powerful framework for interventions requiring skills to support behavior change. However, a review of reviews of school interventions to control obesity noted that few studies included any behavior change theory in their development.<sup>37</sup> In addition, recent reviews of children's cooking and PA interventions indicated mixed results, partly because of poor study designs, lack of standard measures, and differences in intervention

characteristics.<sup>13,38–40</sup> To determine the effectiveness of multicomponent school-based interventions, they must be framed with socioecological and behavior change theories and strong randomized study designs.

Additional considerations when designing school-based interventions are to support sustainability once implementation has ended and disseminate to other populations and various contexts. Factors contributing to the sustainability of school-based healthy eating and PA programs include experiential components, ease of implementation, and integration into the course curriculum.<sup>41,42</sup>

Furthermore, detailing the intervention implementation process is important to understand what was done, how the activities can affect outcomes, and what factors can contribute to or impede program sustainability and dissemination. Process evaluation describes how an intervention is implemented and can include documenting program context, participants' involvement, the setting, materials used, activities conducted, and duration.<sup>43</sup> Without process evaluation measures, it is unclear whether the program was implemented as intended, whether outcomes are the result of the intervention or unrelated reasons, or whether the intervention was ineffective.<sup>44</sup> However, monitoring and assessing complex interventions calls for a cadre of process evaluation strategies.<sup>45,46</sup> School-based obesity prevention interventions have reported measuring implementation of the program components, responses from school staff, students, and parents, and/or environmental conditions which may influence the delivery or uptake of program components.<sup>47,48</sup> Factors enhancing program fidelity include adherence to study protocol, tools for monitoring quality, making adjustments to improve implementation, identifying and preparing champions, and tailoring implementation strategies to address barriers and leverage facilitators.<sup>49</sup> However, process measures, strategies, and results are often lacking or insufficiently described in the published literature,<sup>38</sup> resulting in limited information to thoroughly determine the causes of outcomes

and recommendations for application to future interventions.

Therefore, this article adds to the literature by describing and applying a comprehensive approach to documenting the implementation of a complex trial. *Fuel for Fun: Cooking with Kids Plus Parent and Play* (FFF) is a multicomponent school- and family-based program designed to improve fourth-grade students' culinary and PA skills and related attitudes and behaviors. Presented here are detailed descriptions of the FFF components, its implementation, and process evaluation results using data from intervention reports, observations, and parent surveys. Intervention results from student self report and measured height and weight are described in an article currently in press.<sup>50</sup>

## METHODS

### Research Design, Sampling, and Recruitment

The study was conducted in 8 schools located in 2 school districts over 4 academic years beginning the fall of 2012. The 2012 and 2015 cohorts did not receive the intervention (control); the 2013 and 2014 cohorts received FFF.<sup>51</sup> Half of the schools were randomized to receive a family component in addition to the school-based components described below. Intervention impact was evaluated using a randomized controlled design; results from student self-report and measured height and weight are described in a manuscript under review. No consent procedures were required for school-based process evaluation data collection activities of research staff. Parent consent and child assent were obtained in person. For data linked to children's names, trained research staff described study procedures in each classroom, and paper consent forms were sent home to be signed by parents. A week later, a second form was sent home if not previously returned. Research staff coordinated this process with classroom teachers. Parent consent procedures for an online parent survey are described below. The project was approved through an expedited review by the Colorado State University, Pennsylvania State University, and Rochester

**Table 1.** FFF Intervention Components, Frequency, and Length of Activities

Component	Frequency and Length	Activities
CWK-Colorado lesson series	1–2 per mo; cooking lessons 2 h each, tasting lessons 1 h each	October: Introductory lesson with melon tasting; Cooking lesson: Chinese American fried rice with sweet and sour cucumbers November: Tasting lesson: Apples; Cooking lesson: Minestrone and breadsticks December: Cooking lesson: Black bean tostadas with salsa fresca January: Tasting lesson: Citrus February: Cooking lesson: Llapingachos (Andean potato pancakes) with red chile sauce and green salad; Tasting lesson: Salad greens March: Cooking lesson: Vegetable paella with Mediterranean flatbread and green salad April: Tasting lesson: Peas
SPARK active recess	4 d/wk October-April; 15-20 min during lunch recess	Outdoor recess games: Tag games, cat & mice, SPUD, crows & cranes, straddle ball, all-run kickball, jump rope, hula hoop, frisbee golf, 4 square Games suitable for indoor recess: Rock paper scissors Olympics, group juggling, workout buddies, human knot, meet me in the middle, push-up hockey
FFF <i>Cafeteria Connections</i>	1–2 times/mo October-April, additive behavioral economic strategies during lunchtime to promote targeted FV	Training workshop with food service staff before the start of the school year Prominent placement of promotional signage and verbal encouragement from staff to try highlighted foods Staff wear FFF chef coats or aprons during FV promotions to increase students' awareness and connections to classroom activities Provided the wk when each cooking or tasting lesson was given Chip jar to encourage food service staff's continued involvement (ie, chip received for each strategy used earned funds for kitchen tool)
FFF family <sup>a</sup>	Family night, 1 each semester; 2 h Action packs and enhancements; sent home with recipes after each cooking and tasting lesson	Welcome, children lead families through the preparation of classroom recipes and SPARK games, dinner, prizes, and announcements Each pack includes several CWK-Colorado and SPARK activity assignments (eg, kitchen scavenger hunt, push-up hockey) modified for home use for children to do with family members, friends, or on their own Enhancements include a spice (eg, chili powder) or kitchen tool (eg, fruit sectioner) to support the home preparation of classroom recipes

CWK-Colorado indicates *Cooking with Kids-Colorado*; FFF, *Fuel for Fun*; FV, fruit and vegetable; SPARK, *Sports Physical Activity and Recreation for Kids*.

<sup>a</sup>Four of 8 schools were randomly assigned to this intervention component.

Institute of Technology Institutional Review Boards and committees that protect human subjects within both school districts.

### Fuel for Fun Intervention

*Fuel for Fun* was informed by the first 2 authors' experience with *Cooking with Kids* (CWK), a school-based culinary education program developed by colleagues in New Mexico.<sup>52,53</sup> These authors' involvement included developing and using evaluation instruments to measure the impact of

CWK cooking with tasting lessons and tasting-only lessons against a control condition,<sup>54,55</sup> and piloting an abbreviated version in Colorado.<sup>56</sup> An interdisciplinary team of scholars designed or adapted the FFF intervention components, integrating constructs from SCT<sup>33</sup> and Experiential Learning Theory.<sup>35,36</sup> *Fuel for Fun* classroom learning objectives were mapped to state academic standards, including mathematics, literacy, and social studies.

A description of the formative assessment and development of

the FFF intervention content is published,<sup>51</sup> and a video recording demonstrating the intervention components is available.<sup>57</sup> Table 1 details the content, frequency, and length of each intervention component. Table 2 provides intervention strategies and process evaluation measures targeting SCT and active learning theory constructs (self-efficacy, observational learning, behavioral capability, and reinforcement) to highlight how they are applied.

Schools were randomly assigned to receive either the 3 school-based

**Table 2.** *Fuel for Fun* Theoretical Constructs, Definitions, and Example Strategies and Measurement

Theory	Construct and Definition	Example Intervention Component, Strategy, and Aligned Measurement
SCT	Observational learning (environmental factor): Observing others perform the behavior	<i>Cooking with Kids-Colorado</i> Observe peers and food educators when they are preparing specific ingredients of lesson recipe measured by classroom observation (evaluator) and lesson debrief (food educator)
	Self-efficacy (individual factor): Confidence in one's own ability to perform the behavior	<i>Cooking with Kids-Colorado</i> Encouragement and guided mastery by food educator and classroom teacher when performing specific cooking activities Measured by cooking self-efficacy scale on student outcomes survey
	Behavioral capability (individual factor): Knowledge and skills to perform the behavior	SPARK active recess SPARK leader demonstrates and coaches students in the performance of active games Measured by recess observation (evaluator) and recess debrief (SPARK leader)
	Reinforcement (environmental factor): Responses to the behavior that increases or decreases its likelihood of occurrence	FFF <i>Cafeteria Connections</i> Fruits and vegetables students prepare in <i>Cooking with Kids</i> cooking and tasting lessons are promoted on the serving line via verbal prompting and signage Measured by observation (evaluator) FFF family nights Students teach/model to their parents and siblings the SPARK games they learned during active recess Measured by observation (intervention coordinator)
ELT	Concrete experience: Doing or having an experience	<i>Cooking with Kids-Colorado</i> Cooking and tasting activities in the classroom
	Reflective observation: Reviewing/reflecting on the experience	<i>Cooking with Kids-Colorado</i> Taste prepared recipes with peers to determine likes and dislikes
	Abstract conceptualization: concluding/learning from the experience	<i>Cooking with Kids-Colorado</i> In-class food writing activity, consider if the recipe is something the student wants to prepare with family at home
	Active experimentation: planning/trying out what was learned	<i>Cooking with Kids-Colorado</i> Plan and prepare recipes with family at home and/or during family night

FFF indicates *Fuel for Fun*; ELT, Experiential Learning Theory; SCT, Social Cognitive Theory; SPARK, *Sports Physical Activity and Recreation for Kids*.

components of the intervention (S.FFF; n = 4) or the school-based components plus a family component (S + F.FFF; n = 4). All components are described below:

1. *Cooking with Kids-Colorado* (CWK-CO) is a school-based culinary curriculum promoting fresh fruit and vegetable (FV) through five 2-hour cooking and five 1-hour tasting lessons delivered approximately every 3 weeks over 7 months. Adaptations from the original CWK curriculum<sup>53</sup> for FFF included formatting classroom lessons' structure to be consistent with the understanding by design format,<sup>58</sup> allowing clear

linkage of learning objectives and assessment strategies. Other changes included strengthening alignment with state academic standards, greater emphasis on in-depth nutrition and mathematics knowledge and skills, and letters from area farmers to promote interest in local fruits and vegetables. Recipes were developed with consideration for common food allergies. However, alternative ingredients were identified to accommodate any needed modifications; this allowed all students to be involved in food preparation and tasting. Lessons were delivered by trained food educators with classroom

teacher support. The food educator began each lesson with an introduction to the topic and activities, followed by reading and discussing workbook content (eg, food and nutrition, plants and growing food, farmer letter), preparing and tasting the recipe or in-season FV varietal samples, reflection on the foods consumed, and cleaning up.

2. A second school-based component of FFF was *Sports Physical Activity and Recreation for Kids* (SPARK) active recess, an evidence-based program that increased children's participation, confidence, and skills in PA through inclusive games.<sup>59</sup> Four

days each week, FFF's SPARK leaders set up the activity equipment (eg, hoops, cones, jump ropes, bean bags) before the fourth graders' lunchtime recess (approximately 15–20 minutes) and encourage students to join in the planned games as they came out to the playground. As children became more familiar with the SPARK games, they were often guided to lead other students in their favorite ones. Games suitable for indoor recess in anticipation of inclement weather are noted in Table 1.

3. The final school-based component was *FFF Cafeteria Connections*, which centered around a series of behavioral economic strategies to encourage lunchtime choice and consumption of the FV participants prepared and tasted in the 10 CWK-CO classrooms (Table 1). In close consultation with each district's school nutrition director, promotional activities were integrated with the lunch menu throughout the intervention period (October–April). Behavioral economic strategies were additive and included prominent placement of a fruit or vegetable as the main ingredient in that week's CWK-CO lesson. Other strategies included branded signage (such as a picture of cauliflower with the tag line superpower cauliflower) by the item on the tray line and verbal prompts from cafeteria staff (eg, Would you like to try some red peppers today?) to encourage students' selection of the highlighted FV.
4. *Fuel for Fun Family* (S+F.FFF) consisted of 2-hour family night events at school, offered once each semester, and Action Packs taken home after each cooking and tasting lesson, reinforcing FFF school-based components. Two of 4 schools in each district were randomly assigned to this component. Design and delivery were informed through interactions with parents, teachers, and youth at other schools in these districts and were pilot-tested before implementation. Two-

hour family nights were scheduled on the basis of dates and times recommended by the school's principal and participating teachers; these were usually held in the cafeteria. Food service staff were involved in dinner preparation on the basis of a selected classroom cooking recipe, such as Chinese American fried rice with sweet and sour cucumbers (Table 1). *Sports Physical Activity and Recreation for Kids* leaders arranged game stations and equipment in a section of the cafeteria or gymnasium, and food educators arranged cooking stations on cafeteria tables. *Cooking with Kids-Colorado* recipes and SPARK activities were adapted from classroom cooking and active recess activities. Students were encouraged to guide their families through the cooking and game stations.

Action Packs (ie, fun homework) and enhancements were sent home with students after each cooking and tasting lesson (10 total) to reinforce the theme of the lesson (Table 1). Action Packs allowed students to set cooking and PA goals and share their FFF experiences with their families by modeling CWK-CO cooking and SPARK game activities. Classroom recipes were adapted for family size, and Action Pack content included food and game activities that students could complete with family members and friends or by themselves. Enhancements were an ingredient or kitchen tools that supported that day's cooking or tasting activity. Examples included a key spice for the CWK-CO recipes, such as turmeric for vegetable paella, or a tool for tasting samples, such as a citrus peeler for citrus tasting. Completed Action Packs, signed by a parent, were returned to the classroom and retrieved by the food educator.

Parents in schools randomly assigned to the *About Eating* online program were invited to participate in program content from 6 lessons, including text, graphics, quizzes, web links, and printable handouts to address how to enjoy eating, increase food variety, plan for meals, address

weight management and bias, and introduction of exercise into a healthful lifestyle.<sup>60</sup> This randomization process was independent of schools randomly assigned to the family component; thus, 2 of the 4 S+F.FFF schools and 2 of the S.FFF schools received the *About Eating* program. Implementation information and results of this component are not included here.

### Intervention Training and Implementation

The intervention coordinator and university students delivered FFF from October through April, adhering to detailed protocols. The CWK-CO component was delivered by food educators (nutrition graduate students) who received 2 days of intensive, experiential training by the CWK program developers. Food educators were each assigned to 2 schools (4 educators in total). These educators led the lessons and were assisted by 2–3 college nutrition students and the classroom teacher. Teachers were allowed to participate in a 2-day training program on the content of the classroom component for which they would receive continuing education credit. Weekly check-in meetings addressed delivery challenges, such as changes in school schedules or unavailability of recipe ingredients. *Sports Physical Activity and Recreation for Kids* recess leaders (exercise science students) were trained for 8 hours using online and in-person SPARK resources; physical education teachers were also invited to participate in this training. Once the SPARK recess intervention began, weekly check-in meetings were held, including status updates and troubleshooting strategies. Cafeteria staff was trained through a 2-hour workshop and brief school-level reinforcement meetings to implement FFF *Cafeteria Connections*. They were given chef coats or aprons with the FFF logo and encouraged to wear them during CWK-CO lesson weeks. *Fuel for Fun* family night events were led by the project coordinator with assistance from trained university students.

**Table 3.** Process Evaluation Assessments for each *Fuel for Fun* Intervention Component

Component	How Measured	Frequency; Completed By	Context	Reach	Dose Delivered	Fidelity	Dose Received
School Classroom cooking and tasting	School environment scan Lesson debrief Observation	Annually; intervention team After each lesson; food educator Unannounced 4 x per intervention year; coordinator	✓ ✓ ✓	✓ ✓	✓	✓ ✓	✓ ✓
SPARK active recess	Intervention tracking Recess debrief Observation	Monthly; coordinator After each instance; SPARK leader Unannounced 2 x per semester; evaluator	✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓
Cafeteria Family	SPARK summary form Observation	Weekly; SPARK leader Monthly; evaluator	✓ ✓	✓ ✓	✓ ✓	✓	✓ ✓
Cooking and tasting enhancements	Lesson debrief	After each lesson; food educator		✓	✓	✓	
Action Packs	Lesson debrief Score sheet	After each lesson; food educator 3 x per semester; coordinator		✓	✓	✓	✓
Family nights	Attendance Intervention tracking	With each event; coordinator Each semester; coordinator		✓ ✓			

SPARK indicates *Sports Physical Activity and Recreation for Kids*.

### Process Evaluation and Participant Satisfaction Instruments and Data Collection

Process evaluation measures addressed implementation context (eg, assessment of school environment), and reach, dose delivered, fidelity, and dose received for each intervention component (Table 3).<sup>44–46</sup> Measures were recorded using paper and pencil during or directly after intervention activities. They included those completed by personnel implementing the intervention, such as debriefing summaries of delivery of activities, and were developed by the research team specifically for each type of event. They also included those completed by the evaluation team led by the project coordinator with assistance from trained university students, such as observations to assess adherence to protocol. Observation forms for the CWK-CO and SPARK were modified from validated forms by CWK and SPARK program developers. Feedback to the intervention implementers was given shortly after the observed event. Collection, management, and database entry protocols were followed for each data source, with research personnel trained and supervised in their specific assignments.

Food educators completed a debriefing form after each CWK-CO classroom lesson to record the number of students present, student and teacher recollections of the previous lesson, a descriptive assessment of student and teacher engagement, and rating of the recipe (would they try this dish again), and any issues encountered or changes that were made during the lesson. Research team members observed each food educator 4 times during the year to assess fidelity to the lesson plans, food educator, student and teacher engagement, and unexpected delivery issues. Similar debriefing and observation strategies were used for the SPARK active recess component, with SPARK leaders completing the debriefing forms after each SPARK event and evaluators completing the observations. Additional debriefing notes were written by the implementation

team and archived after *Cafeteria Connections* observations and family night events.

After each family night, parents and students were allowed to complete an anonymous paper and pencil survey to provide their opinions about the event. Student surveys included 6 items (eg, I liked cooking with my family at this event, the games were fun), measured on a 5-point scale (from strongly disagree to strongly agree), with 5 being the most positive rating. There was also an open-ended prompt to describe what they liked best about the event. The parent survey contained 7 items measured on the same scale as the students and similarly addressed their attitude about the event (eg, this event was worthwhile, I enjoyed the cooking activities, I enjoyed the SPARK activities). It also included 4 items about their participation in other aspects of the intervention, such as *About Eating* lessons and Action Packs, and the grades of all their children attending the event.

In addition, parents who consented for their child to complete an outcome measures survey that included the child's name were invited to complete an online survey (Qualtrics, Qualtrics.com, 2018) directly after the FFF intervention ended. This survey included parent demographic information, cooking and FV modeling items, and involvement and satisfaction with the breadth of school- and family-based FFF activities.<sup>51</sup> Parents received \$25 for completing the survey.

Finally, we maintained regular communication with the participating schools' classroom and physical education teachers, cafeteria managers, and administrators throughout FFF implementation. During the second implementation year, we began conversations about opportunities to sustain all or parts of the intervention. An advisory committee comprised University Cooperative Extension and local programs' health educators was active throughout the study period and addressed considerations and informed decisions for disseminating the intervention once it was completed.

## Analyses

Process evaluation collection forms described in Table 3 included quantitative and qualitative information, as recommended by Oakley et al.<sup>61</sup> All process evaluation and parent and student survey forms' quantitative content was entered into SPSS (version 23.0, IBM Corp, 2015) to generate descriptive analyses, such as the total number of SPARK recesses or percentage of CWK-CO lessons completed compared with planned. Twenty percent of entries for each data source were randomly checked for accuracy by the research coordinator; any incorrect entries resulted in double-entry for all data. The brief qualitative content from open-ended sections of data collection forms (debriefings and observations) and surveys was entered into ATLAS.ti (ATLAS.ti Scientific Software Development GmbH, ATLAS.ti 18 Windows, 2018) by a single trained coder, with 20% of the content independently entered and confirmed by the research coordinator. Any inconsistencies were discussed, and a consensus was achieved. Thematic analysis of content<sup>61</sup> was used to determine key themes such as barriers and facilitators for activity implementation.

## RESULTS

### School Characteristics

Eight elementary schools located in 2 neighboring school districts received the FFF intervention; 851 students enrolled in 45 classrooms. Forty teachers returned to the same grade level and participated for the second intervention year, likely contributing to continuity in implementation. Five teachers were new in the second intervention year. Thirty-eight percent of kindergarten to fifth-grade students qualified for free or reduced-price meals, ranging from 25% to 66% by the school. Seventy-five percent of students were White, with 17% Hispanic. District lunch and recess practices were similar but not identical. For example, all schools in one district offered a salad bar during lunch, whereas none of the schools in the second district did. The first district held recess after lunch, but

most schools in the second district had recess before lunch. All schools reported 15–20 minutes for this recess. Most schools provided physical education classes 1 or 2 d/wk; minutes per class ranged from 30 to 45 minutes.

One school, randomized to the school-based and family components, declined to continue as an intervention school in the second intervention year. This was because of significant school-wide concerns in academic performance and resulted in increased school time devoted to primary academic content at the expense of outside programs. Thus, there were no process evaluation data collected in the second intervention year for this school.

### Fuel for Fun Implementation

Each fourth-grade class received the intervention from October through April; it was delivered with few deviations from the protocol, as detailed in Table 4. Reach, fidelity, dose delivered, and dose received > 90% for most activities. In addition, 203 of the planned 210 cooking lessons (96.7%) and 199 of 210 tasting lessons (94.8%) were taught. The fidelity of tasting lesson delivery was at 84.1%; deviations from the protocol were only owing to a lack of time to complete the final activity (graphing favorite tasting samples). Students were actively engaged in classroom and SPARK activities as documented on implementer debriefing and evaluator observation forms. For the classroom lessons, the percentages reflect the number of instances of the total possible instances, in which  $\geq 76\%$  of students were engaged in the cooking or tasting activities. Of the 468 days of SPARK active recess planned, 448 (95.7%) were held. Although cafeteria staff was involved in posting signs and prompting students to choose FV highlighted in the CWK-CO lessons, *Cafeteria Connection* activities were not sufficiently documented by the evaluation team to affirm the dose and fidelity.

Action Packs were distributed in the 4 S+F.FFF schools after cooking and tasting lessons, but the return of completed activity sheets was modest; 59% of students completed > 1

**Table 4.** Fuel For Fun Intervention Process Evaluation Results by Component and Measurement Source

Component	Reach	Dose Delivered	Fidelity	Dose Received
Cooking with Kids Classroom	94.7% attendance (overall) <sup>a</sup>	402 lessons completed out of 420 planned overall (95.7%) <sup>a</sup>	Average completion 87.3% of procedures followed overall <sup>d</sup>	Average engagement: 96.2% (overall) <sup>a</sup> Average engagement: 95.0% (overall) <sup>d</sup>
Cooking lessons	94.0% attendance <sup>a</sup>	203 lessons completed out of 210 planned (96.7%) <sup>a</sup>	Average completion of 90.5% of procedures followed <sup>d</sup>	Average engagement: 97.5% <sup>a</sup> Average engagement: 97.5% <sup>d</sup>
Tasting lessons	95.4% attendance <sup>a</sup>	199 lessons completed out of 210 planned (94.8%) <sup>a</sup>	Average completion of 84.1% of procedures followed <sup>d</sup>	Average engagement: 95.0% <sup>a</sup> Average engagement: 92.5% <sup>d</sup>
SPARK active recess	Average 15 students <sup>b</sup>	448 SPARK days completed out of 468 planned (95.7%) <sup>b</sup>	Average completion of 93.7% of procedures followed <sup>e</sup>	Leaders answered yes to the following questions (100% of the time): <sup>e</sup> 1. Participants were active at least 50% of the session time (achieved goal). 2. Participants appeared to enjoy the activities
Family Family fun nights	24.9% attendance <sup>c</sup>	10 events completed out of 14 planned (71.4%) <sup>c</sup>	2 schools (50%) consistently followed procedures <sup>f</sup> The remaining 2 schools noted the following changes: 1. Shortened time for activities because of inclement weather delaying attendance 2. Skipping an activity station	Overall, student participants were reported as engaged throughout the activities. At some events, parents were listed as less engaged than their students, standing off to the side watching their children participate <sup>f</sup>
Action Packs	94.7% <sup>a</sup>	Not specifically assessed	Not specifically assessed	59% of students attempted $\geq 1$ <sup>g</sup> 21% indicated parent awareness/participation across all lessons <sup>h</sup>

SPARK indicates *Sports Physical Activity and Recreation for Kids*.

<sup>a</sup>Classroom lesson debrief form (completed by food educator): Reach for classroom lessons is calculated as the mean attendance over both cohorts but broken down by cooking and tasting lessons; classroom attendance was calculated as the no. of students present for lesson/total the no. of students in class  $\times 100$ . Reach for Action Packs was calculated as the reach for the overall classroom lessons. The dose delivered for classroom lessons was calculated by summing the total no. of forms completed for the classroom lessons; a missing form was treated as the lesson was not delivered. The dose received for classroom lessons was assessed with the following question: On a scale of 1–4, with 4 being actively involved ( $> 76\%$  participation) and 1 being uninterested ( $< 25\%$  participation), how engaged were fourth-grade students? The reported dose received was treated categorically, and the percentage of instances of recording a 4 ( $> 76\%$  active participation) was reported as the percentage of classrooms in which the dose was received; <sup>b</sup>SPARK summary reports (represents fall months for both cohorts): Reach for SPARK is the mean number of students who participated in the SPARK activities; SPARK reach is an average because the total no. eligible to participate at each school was not available; the total no. eligible could be estimated from fourth-grade classroom rosters; however, in many cases, multiple grades shared the same recess period, and it was possible that students from other grades participated in the SPARK activities and thus were included in these numbers. The dose delivered for SPARK was calculated as the average of (days SPARK occurred/days SPARK was planned)  $\times 100$ ; <sup>c</sup>Family night sign-in sheets: Reach for family fun nights is calculated as total no. attending 1 or both family nights/total eligible from consented students on classroom rosters  $\times 100$ . The dose delivered for family fun nights was calculated by summing the no. of sign-in sheets present for each event; a missing sign-in sheet indicated that the family night did not occur; <sup>d</sup>Classroom cooking and tasting observation forms: Cooking and tasting observation forms were tailored forms completed by research staff. Fidelity for cooking and tasting lessons was calculated from an observer checklist of procedures followed during the lesson. There were 21 check marks possible for cooking observations, and 17 check marks possible for tasting observations. The dose received was calculated as described in footnote a; <sup>e</sup>SPARK observation form: SPARK observations were completed by

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out of 10 packs, with most completing only 1 or 2. The best return rates for Action Packs were when teachers assigned them as graded homework (data not shown). Approximately 25% of eligible families participated in 1 or both family night events as determined by sign-in sheets; teacher and parent informal feedback indicated the low participation was often because of inclement weather or competing family activities.

### Challenges Documented by Process Evaluation Activities

Implementation debriefing notes and evaluation team observations affirmed situations that supported or detracted from expected delivery. For example, they revealed that classroom teacher involvement was important for classroom management and assistance during cooking and tasting lessons. However, in several schools, the 2-hour cooking lessons were scheduled during special classes (art, music, physical education). Teachers of these classes appeared less engaged, perhaps because they were less aware of the lesson content and instruction. Most students opted to try the recipes and samples with their peers, and one student's willingness to try a new food often led to other students' willingness. Based on informal teacher feedback after lessons and study personnel observation, educator enthusiasm was critical to engaging the children. Reinforcement of behavioral expectations (classroom and recess rules) and involving students in hands-on activities were crucial for the successful and timely completion of culinary lessons and SPARK recess games.

The intervention team occasionally needed to modify the planned schedule because of other classroom or school events, such as district-wide testing and assemblies. Foods for classroom cooking and tasting lessons were originally planned to be purchased by the school districts as part of the sub-award they received, but the amounts of ingredients needed were too small to be obtained through the districts' usual vendors. University staff was tasked with making these purchases and bringing the food items to schools for classroom lessons. In most instances, the school foodservice staff prepared modified recipes from classroom cooking lessons for family night events. However, substitute foods were used several times because planned ingredients were not delivered on time or available.

Despite the opportunity to receive continuing education credits, only 3 of 27 classroom teachers (9%) participated in receiving in-depth CWK-CO training. Physical education teachers were invited to participate in SPARK training and were given access to the equipment after the intervention was completed. However, none participated in the training nor wanted the responsibility for maintaining the equipment. Principals were asked if recess monitors could be trained in SPARK active recess, but they declined because monitors (parent volunteers and teachers) were responsible for maintaining the safety of all children during recess and would not be able to focus on leading the games.

### Parent and Student Surveys

One-hundred-sixty parents completed an anonymous evaluation

survey at the close of family night events. The mean score (with 5 being the most affirmative) for parent responses were as follows: I liked this family event ( $4.6 \pm 0.6$ ), this event was worthwhile ( $4.6 \pm 0.6$ ), I learned a cooking tip ( $3.8 \pm 1.0$ ), I learned a new way to involve my kids in cooking at home ( $4.1 \pm 0.8$ ), I enjoyed the cooking activities ( $4.5 \pm 0.6$ ), I enjoyed the SPARK activities ( $4.3 \pm 0.7$ ), and if another event were planned I would try to attend ( $4.6 \pm 0.6$ ). Sixty-four percent reported participating in the Action Pack activity with their child. Of the 69 parents who answered the question, What could be done to improve this *Fuel for Fun* event?, 33 (49%) provided only positive feedback (eg, great event, cannot think of anything), and 44 (64%) suggested ways to improve the logistics of the event such as providing more space, lengthening the time for activity stations, providing more food (including adding meat and dessert) to the dinner, and starting the event earlier (or later). Some parents provided multiple responses.

Of the 188 students who completed a survey at the end of family nights, 122 (65%) were in the fourth grade, with the remaining siblings from other grades. The mean score (with 5 being the most affirmative) for all student responses were as follows:  $4.7 \pm 0.5$  liked this event ( $4.7 \pm 0.5$ ), I liked cooking with my family at this event ( $4.5 \pm 0.7$ ), I liked tasting food that I helped make ( $4.5 \pm 0.8$ ), the cooking activities were fun ( $4.6 \pm 0.6$ ), the games were fun ( $4.6 \pm 0.7$ ), and I want to come to another event like this ( $4.6 \pm 0.7$ ). Seventy-nine (42%) responded to the question, What did you like best

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research staff. The observer completed a checklist of procedures to be followed during SPARK, with a total no. of 8 check marks possible. The dose received for SPARK was based on the no. of observation forms in which leaders answered yes to the 2 questions related to participant engagement; <sup>f</sup>Family night debrief forms: The debrief forms were completed by the intervention coordinator, with assistance from other research staff and Colorado State University students in attendance. Fidelity was assessed using the following question: To what extent the family night was implemented consistently with the outlined procedures? The dose received was assessed using the following 2 questions: (1) To what extent were participants at the family night engaged in the activities? and (2) How did participants react to certain aspects of the family night?; <sup>g</sup>Action Pack flowchart: Dose received for Action Packs is defined as an attempted Action Pack: a consented student turned in at least 1 Action Pack with  $\geq 1$  component attempted. The dose received was calculated as the (no. of students attempting  $\geq 1$  Action Pack/no. students eligible)  $\times 100$ ; <sup>h</sup>Action Pack rubrics: An additional measure of the dose received for Action Packs was the number of Action Packs for all lessons that indicated parent awareness/participation (via signature). Parent Action Pack dose received was calculated as the (no. Action Packs with parent signature or participation indicated/ no. Action Packs that could be completed by students [ie, 10 per student])  $\times 100$ .

about this event? Common themes were cooking and eating ( $n=51$ ; 65%), the games ( $n=29$ ; 37%) and everything ( $n=12$ ; 15%). In addition, being there with my family ( $n=8$ ; 10%). Some children provided multiple responses.

Of the 646 youth completing 1 or 2 follow-up surveys, 117 parents (18%) described their experience and satisfaction with FFF through an online survey. Ninety-six percent of these parents ( $n=112$ ) reported that their child spoke with them a few times or often about the FFF cooking classes. Forty-three percent ( $n=50$ ) prepared > 1 out of 5 CWK-CO recipes with their child. The most common recipes used were Chinese American fried rice, black bean tostadas, and minestrone soup (data not shown). In addition, 44% of parents ( $n=51$ ) reported that their child talked with them often about the tasting lessons, with another 44% ( $n=52$ ) reporting talking with them a few times.

In the family schools, in addition to the in-school activities, students took home bagged spices for CWK-CO recipes, FV samples from tasting lessons, Action Packs to reinforce classroom activities and active recess games, and invitations to family night events. Of S+F.FFF parents who completed the survey ( $n=68$ ) reported receiving the recipe spices (60% to 78% receipt depending on the spice; frequency decreased over time). Few parents (6% to 18%) used the individual spices with the intervention recipe, but more (9% to 26%) prepared other dishes with them (data by recipe not shown). Approximately 70% to 80% of S+F.FFF parents reported receiving specific FV tasting samples; frequencies varied by type of FV. Thirty-five percent reported using a variety of apples in a meal or snack ( $n=24$  of 69), with 31% ( $n=21$  of 68 responding) for salad greens, 30% ( $n=20$  of 67 responding) for citrus, and 27% ( $n=18$  of 67) for the pea varieties. An additional 15% to 18% reported sampling these items.

Most of these parents (77%,  $n=52$ ) completed 1–6 of the 10 Action Packs with their child, and another 11 (16%) indicated they did not. Content analysis of open-ended responses

( $n=42$ ) to the best things about the Action Packs included that it was something to do as a family and that the SPARK games were a fun way for their child to be active. Forty-one parents (60%) who completed the survey reported attending 1 or both family night events. Parent responses ( $n=16$ ) to an open-ended question about their or their child's overall experience with FFF were positive toward the benefits of their child's exposure to new varieties of foods and trying foods with their classmates that they would not try home.

### Sustainability and Dissemination Efforts

Some activity occurred in response to our efforts to sustain FFF in participating schools and to disseminate it more broadly within these districts. One district provided health education curriculum funding for the FFF team to modify cooking and tasting lessons to 1 hour to fit more easily within the school schedule and to address academic standards for all elementary grades. This modified version of CWK-CO was a popular course during that district's summer institute and provided training for 23 prekindergarten to fifth-grade teachers. After the training, the district could fund the purchase of perishable food items, and the FFF team provided cooking equipment and curricular materials such as lesson plans, worksheets, and recipes. However, it took the district nearly 2 years to develop a process for teachers to be reimbursed for the perishable items and a checkout system for the cooking kits. One of the FFF schools used these kits most frequently, suggesting familiarity with the contents may have supported their use.

In addition, dissemination efforts were made by engaging the Cooperative Extension network of County Family and Consumer Science and 4-H agents and AmeriCorps volunteers. Training sessions were tailored to these groups and focused on the cooking and tasting activities as those were of most interest to the agents. Curricula and equipment were provided as well. However, the use has been limited because of other program priorities.

## DISCUSSION

*Fuel for Fun: Cooking with Kids Plus Parents and Play* was a multicomponent school-based intervention designed to expand fourth-grade students' cooking experiences, widen their exposure to different FV, and provide unique opportunities for PA through active games. Process evaluation results indicated high dose program delivery with excellent fidelity and reach. The dose received was > 90% for classroom and active recess components but low for the family activities.

Fidelity in the classroom cooking and active recess components was higher than that reported by Campbell and colleagues<sup>62</sup> for the *Active For Life Year 5* PA and FV intervention, likely because FFF implementation staff delivered the activities in partnership with school staff rather than by the teachers alone. Adab et al<sup>63</sup> and Clarke et al<sup>64</sup> noted similar challenges in the West Midlands *Active* lifestyle and healthy Eating in School children active lifestyle and healthy eating trial for first-year school children. *Fuel for Fun* teachers were invited to complete an online survey after the first year of the intervention. As described by Prescott and colleagues,<sup>18</sup> teachers rated their overall experience with FFF and their food educator. Teachers gave positive ratings for the CWK-CO lessons, especially because of the inclusion of relevant academic content and student food acceptance and engagement in activities. They also noted strong food educator professionalism and interaction with students. Teacher responses in focus group interviews after implementing the CWK intervention in New Mexico public schools revealed an appreciation for the uniformity of curriculum implementation and its integration into academic standards.<sup>17</sup> Burgermaster et al<sup>65</sup> and Koch et al<sup>66</sup> similarly reported the importance of a strong partnership between the classroom teacher and outside health educator for delivery and fidelity in the *Food, Health & Choices 5th* intervention provided to 20 New York City public schools.

Although parent and student responses to the intervention were

very positive, parent participation in FFF was variable partly because of competing family activities. However, this level of participation is similar and, in some cases, higher than that reported in the literature.<sup>67,68</sup> For example, only 7% of parents in the *Texas Sprouts* gardening and cooking intervention for fourth graders attended  $\geq 1$  of the 8 monthly lessons designed for them despite incentives and reminders.<sup>5</sup> Reasons included lack of transportation and time. Although survey completion was low, greater than one-third of FFF parents completing the survey reported preparing 1 or more of the CWK-CO recipes with their child; the most frequent were similar to familiar Chinese, Mexican and Italian dishes. There was a disappointing response for parent involvement in the Action Packs, despite program-specific homework being a recommended strategy.<sup>28,29</sup> This could have been due to other homework expectations or family commitments. Our team developed and applied an algorithm to standardize and assess the types and intensity of parent participation in FFF, including when those opportunities offered participation in family activities and completion of surveys. We learned that the types of participation and their associated intensities (ie, based on convenience, frequency, effort, and invasiveness) increased when the requirements were fewer, and the activities were novel, convenient, and personalized.<sup>69</sup> These results can inform the future investigation of the many considerations parents must make to engage in health promotion programs with their children, whether virtually or in person, and the intervention elements that facilitate parent involvement.

Implementation challenges were typical of health interventions in the school setting, such as the necessity of adjusting the planned activity schedule because of changes in school event schedules.<sup>37</sup> Additional modifications to FFF included those noted above, such as modifying the family night dinner menus because of food quantity supply issues. Other school-based

interventions have also experienced schools dropping out of participation because of school and district-level policy changes.<sup>5,63</sup>

Sustaining evidence-based community interventions remains a challenge once program support and resources end.<sup>70</sup> Implementing FFF as a research-based intervention was made possible partly because of the significant resources such as curricular materials, program staff, and college students who assisted with programmatic and evaluation activities. Ultimately, the complexity and resources needed for the intervention and competing academic priorities hindered the schools' ability to sustain the program. Dissemination through the Cooperative Extension network has been limited because of competing priorities. Adopting and implementing the original CWK curriculum was strong with trained New Mexico Extension agents; reasons included high expectations by supervisors and compatibility with current activities.<sup>71</sup> These factors, had they been fully established before FFF implementation, could have improved adoption and dissemination. Of note, experience with FFF has provided insight for developing a culinary-focused *Expanded Food and Nutrition Education Program* for youth being tested.

Study limitations must be recognized when interpreting the process evaluation results. These include those common to school-based interventions, such as schools' self-selection, which likely meant participating schools prioritized health education. The influence of self-selection of parent survey responders was especially evident in attendance at the family nights; 60% of online survey respondents compared with 25% of all eligible parents. Observations intended to document the implementation of the *Cafeteria Connections* component were infrequent to such an extent that no conclusions about fidelity and dose received were possible. One school stopped participation after 1 year of implementation because of school-wide academic performance concerns; how much this nonparticipation influenced these results is unknown.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

Although the school environment provides opportunities for incorporating experiential nutrition education and active games into the school day, features such as frequent alterations in school schedules and academic priorities require flexibility in program delivery. For example, the 2-hour CWK-CO cooking classes were lengthy and difficult to replicate through sustainability and dissemination efforts; they could be modified to accommodate shorter program schedules. Future studies can fully implement and evaluate the Cafeteria Connections component to examine its impact. Exploring more deeply the challenges and opportunities to engage parents is of critical importance in enhancing and reinforcing the intervention goals. We also encourage researchers and practitioners to incorporate the implementation and dissemination of science best practices into planning school-based health promotion programming to support the continuation and spread of successful programs.<sup>42,72</sup> In addition, of importance, is the need for comprehensive process evaluation measures to monitor all aspects of program delivery for accurate determination and characterization of intervention impact. Systematically collecting this information can also identify implementation aspects to support sustainability and promote dissemination to other venues. Strong public support for teaching cooking and PA skills in public schools,<sup>73,74</sup> can motivate health educators to continue to strive for determining effective strategies for comprehensive implementation and widespread adoption of effective programs.

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