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The Shaping Healthy Choices Program: Improving the impact through community partnerships

Community partnerships are key to helping youth make healthy lifestyle choices.

by Marcela D. Radtke, Melanie A. Gerdes, Anna M. Jones, Angie Keihner, Barbara McNelly, Kamaljeet Singh-Khaira and Rachel E. Scherr

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Abstract

The high prevalence of childhood overweight and obesity demonstrates the need for effective intervention strategies. The Shaping Healthy Choices Program (SHCP) is a school-based intervention that promotes nutrition and physical education, develops family and community partnerships, and incorporates foods available on the school campus, with the goal of achieving sustainable student health outcomes. Partnerships developed through implementation of the SHCP were analyzed using the RE-AIM: Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework to assess the potential for adoption, scaling and sustainability of the program. The RE-AIM framework is a comprehensive approach to evaluating public health interventions through reach, effectiveness, adoption, implementation and maintenance. Partners of the SHCP include site staff (teachers, administration and health professionals), parents, peer teachers, and state and federal agencies, such as the Supplemental Nutrition Assistance Program Education (SNAP-Ed), which funds CalFresh Healthy Living, University of California (CFHL, UC), and UC Cooperative Extension. This analysis highlights how partnerships developed and sustained with the SHCP may serve as a model for other programs to expand, while also enabling programs to remain responsive to the diverse challenges and needs of local community partners.

Childhood overweight and obesity are ubiquitous public health concerns requiring immediate attention (Pulgarón 2013). Recommendations made by state and federal agencies have highlighted the importance of schools in obesity prevention, particularly multi-component, coordinated programs (Hayes et al. 2018; Hoelscher et al. 2013). Due to the potential for sizable impact, integrating nutrition curriculum into schools may result in sustainable outcomes in reducing and preventing childhood obesity (Murimi et al. 2018). However, teachers are often reluctant to incorporate optional lessons due to limited instruction time to meet state and federal education standards (Jones and Zidenberg-Cherr 2015). Successful nutrition interventions often include age-appropriate curriculum, family engagement, identifying promising behavior for modification before starting the program, instructional fidelity (adherence to curriculum content and procedures), and substantial duration of six or more months (Murimi et al. 2018). Nutrition interventions that lack a multi-component approach and focus solely on direct education are less effective,



Students participate in a school-based experiential nutrition lesson on estimating serving sizes. Photo: Evett Kilmartin.

as demonstrated by a reduced magnitude of impact or a lack of sustained behavior change (Bandeira Silva de Medeiros et al. 2022). Incorporating theory driven, multi-component nutrition programming into existing standards and establishing partnerships with outside agencies may increase the feasibility of nutrition education in the school setting.

The Shaping Healthy Choices Program (SHCP) was designed as a comprehensive nutrition and healthy lifestyles intervention for fourth through sixth grade elementary students (Linnell, Zidenberg-Cherr et al. 2016; Scherr et al. 2014). The program has the following objectives:

- increase nutrition knowledge and use of science process skills;
- promote availability, consumption and enjoyment of fruits and vegetables in the school environment;
- improve dietary patterns and encourage physical activity;
- foster positive changes in the school environment; and
- facilitate development of infrastructure to sustain the program.

To achieve these objectives, the SHCP incorporates four components: nutrition education and promotion (including an emphasis on physical activity), family and community partnerships, foods available on the school campus, and school-site specific wellness policies. Each of these components has the goal of contributing to sustainable student outcomes. Program activities that address these components include classroom nutrition and physical activity education, cooking demonstrations, an instructional garden, on-site school wellness committees, and partnership with school nutrition services to increase availability of locally procured fresh fruits and vegetables (Scherr et al. 2014). The cornerstone of the program is classroom education utilizing the garden-enhanced curriculum, *Discovering Healthy Choices* (DHC), along with a learner-centered cooking curriculum, *Cooking Up Healthy Choices* (CUHC) (Linnell et al. 2015). Inquiry-based, experiential teaching strategies have been shown to promote student engagement and improve learning outcomes (Smith et al. 2015).

Results from the initial 2012–2013 pilot intervention at four school sites indicated the SHCP was effective at improving nutrition knowledge, vegetable identification, physical activity patterns, reported and observed vegetable intake, body mass index (BMI) percentile-for-age, and BMI classifications (Beccarelli et al. 2017; Fetter et al. 2018; Linnell, Smith et al. 2016; Scherr et al. 2017; Taylor et al. 2017). While this program was successful as an intensive research intervention, the ability to expand and execute the program beyond the pilot schools was a major challenge after initial funding concluded (Scherr et al. 2017). Thus, partnerships were developed to continue implementation of the SHCP following the conclusion of the pilot intervention.

One effective partnership in the implementation of the SHCP was with SNAP-Ed, which promotes healthy eating and physical activity habits in low-income populations who qualify for SNAP benefits or other federal assistance programs (SNAP-Ed Factsheet 2016). In California, SNAP-Ed is known as CalFresh Healthy Living, with several agencies administering services, including CalFresh Healthy Living, University of California (CFHL, UC). In 2014, the UC Davis Department of Nutrition Center for Nutrition in Schools (CNS) partnered with CFHL, UC to pilot SHCP in three counties during the 2014–2015 school year (Bergman et al. 2018). The success of the comprehensive approach and partnership led to the expansion of the SHCP into ten counties, with each county tailoring its delivery to meet the needs of its respective community. There were various levels of involvement and collaboration between CFHL, UC and school site educators in different counties. Program components, including direct education, school or community garden maintenance, and district and school site-specific wellness policies, were supported through various levels of involvement and collaboration between CFHL, UC and school site educators.

The purpose of this evaluation is to use the RE-AIM framework to assess the implementation of the SHCP in partnership with CFHL, UC (table 1). As discussed above, the RE-AIM framework is a method of assessing the reach, effectiveness, adoption, implementation, and maintenance of community-based, public health interventions (Glasgow et al. 1999; Jilcott et al. 2007). This framework was selected to understand the evolution of the SHCP from a research-based intervention into a sustainable health promotion program supported through partnerships. This model for program sustainability may serve as the impetus for other multi-component programs to effectively meet the needs of the school-site, educators, student audience, and local community partners involved in program dissemination.

Shaping Healthy Choices

Following comprehensive training on SHCP implementation, CFHL, UC staff delivered the program curriculum during the 2014–2015 academic year. The implementation of the SHCP varied and evolved over time based on county preferences and resources. One example is the extender model employed by CFHL, UC to extend the program's reach through partnerships with individuals other than UCCE staff to deliver programming. These partners included classroom teachers, after-school staff, youth educators, and other volunteers. The SHCP extender model was introduced in 2015–2016, with classroom teachers serving as extenders for the in-class lessons and CFHL, UC educators delivering the garden and cooking components of the curriculum (Scherr et al. 2020).

Over the course of implementation, professional development meetings were held using the lesson

study model (Bergman et al. 2018). In these meetings, educators were encouraged to share their experiences, provide advice on implementation, and problem solve together to collectively build skills and knowledge (Slattery et al. 2019). At the conclusion of the school year, a forum was held to reflect on the past year and collect feedback to suggest modifications to the program for the following implementation year.

All SHCP-related research was approved by the UC Davis Institutional Review Board. Youth assented to participate in the SHCP; however, parents or legal guardians were required to provide consent when data collection of minors consisted of measures in addition to nutrition knowledge. Obtaining consent in school-based intervention research involving minors proved

challenging (with a consent rate of less than 50% for the SHCP). This is more successful when partners such as teachers participate in recruitment (Blom-Hoffman et al. 2009). Pre- and post-intervention data were collected annually at various points in time throughout the implementation cycle (fig. 1). Pre-data were collected prior to the SHCP intervention to determine a baseline at both the control and intervention school sites. Post-data were collected following the completion of the intervention, which varied depending on the implementation timeline, such as a consecutive weekly dissemination of the SHCP or the multi-year extender model. Individual data (matched scores for each consenting student) and/or aggregated data (unmatched average classroom scores) were collected from the students and teachers.

TABLE 1. RE-AIM framework components for the SHCP in partnership with CalFresh Healthy Living, University of California (CFHL, UC) and methods for measuring each component

RE-AIM component	SHCP application of RE-AIM	Measurement method
Reach	Number of individuals reached by the SHCP through partnership with CFHL, UC	- Enrollment data on the number of counties, schools, classrooms and students collected annually - Student demographic information
Effectiveness	Impact of the SHCP dissemination through CFHL, UC partnership on individual health and behavioral outcomes, including broader impacts and potential negative effects, if any	- Nutrition knowledge - Anthropometrics - Dietary intake (block food frequency questionnaire) - Skin carotenoid scores measured using the Veggie Meter
Adoption	Intervention agencies/agents within CFHL, UC and associated collaborators who are willing to initiate and deliver the SHCP	- Monitoring enrollment - Annual forums on successes and challenges of program implementation
Implementation	Key components to implementing the SHCP through partnership with CFHL, UC, such as consistency of delivery, quality, fidelity and time and cost of intervention	- Fidelity observations - Cost of program materials - Qualitative instructor feedback on extender model
Maintenance	Incorporation of the SHCP as part of institutionalized practice or policy with CFHL, UC; individual behavior change sustained following the completion of the SHCP	- Local school wellness policy changes - Shaping Healthy Choices School Health Check (SHC²)

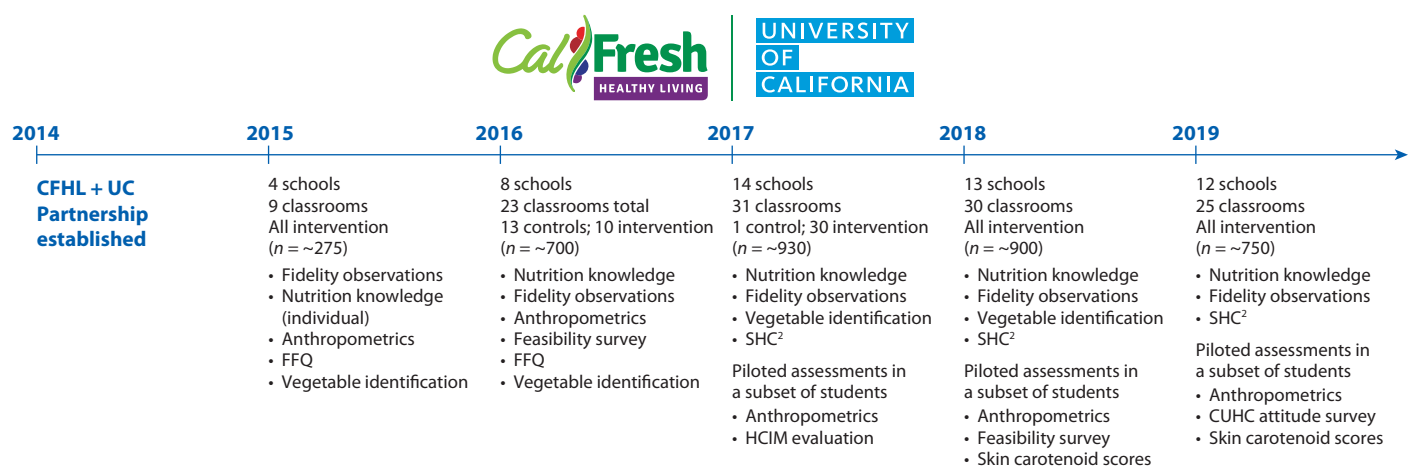


FIG. 1. SHCP implementation timeline and type of assessment collected by year following partnership with CFHL, UC (2014–2019). Multi-year implementation had data collection occurring at the pre- and post-assessment periods that corresponded with SHCP implementation, not in accordance with the academic term. All other assessments occurred at baseline and follow-up in the same academic year. CUHC = *Cooking Up Healthy Choices* curriculum; FFQ = food frequency questionnaire; SHC² = Shaping Healthy Choices School Health Check.

Adhering to curriculum

Fidelity observations were collected at least once during the academic year in each classroom. The purpose of these observations was to confirm that teachers were adhering to all curriculum procedures. Fidelity data were collected to ensure the following criteria: all components are fully delivered, youth are interested and engaged, youth are attentive and actively participating, youth are engaged in peer-to-peer discussion most of the time (75% of the lesson), and concepts are discovered by the youth (Murimi et al. 2018). Scores from each component were averaged to determine a score between 0 and 100%. As a result of past research, a minimum threshold of 80% adherence is considered the required level in order to be able to interpret study findings (Bergman et al. 2018; Ruiz et al. 2020).

Measuring health outcomes

School-site wellness was assessed using the Shaping Healthy Choices School Health Check (SHC²). This is a tool specific to the desired outcomes of the SHCP, designed to identify areas of improvement in local school wellness policy (LSWP) efforts. Student nutrition knowledge was measured using a validated questionnaire (Morris et al. 2002), with the addition of a subset of behavior questions from the Student Physical Activity and Nutrition (SPAN) questionnaire in the 2018–2019 implementation year (Thiagarajah et al. 2008). Other measures to assess student outcomes included body measurements, vegetable identification and preferences, food frequency questionnaires (FFQs), and skin carotenoid scores (SCS) measured by pressure-mediated reflection spectroscopy using the Veggie Meter. This tool is used to measure skin carotenoids (which are primarily derived from red and orange vegetables) within a specific spectral detection wavelength and is used as a proxy for fruit and vegetable intake (Ermakov et al. 2018; Jones et al. 2021; Radtke et al. 2021).

The partnerships developed through the implementation of the SHCP were analyzed using descriptive statistics and applied to the components of the RE-AIM framework (table 1). For the purposes of this paper, data collected between 2014 and 2019 were assessed using the RE-AIM framework to understand the importance of CFHL, UC partnership in the SHCP.

What was the program’s reach?

The initial SHCP pilot was conducted in four school sites from two counties with similar demographics, school sizes, and percent of students qualifying for free or reduced meals in 2012–2013. The results demonstrated significant improvements in the intervention arm ($n = 252$) compared to control students ($n = 238$), thus supporting the expansion of the SHCP to improve health and nutrition-related behaviors (Scherr et al. 2017). Following the partnership with CFHL, UC, the program expanded from 250 youth in 2014–2015 to a cumulative total of over 1,100 in the 2015–2016 school year (table 2). Although the number of counties willing to participate in the 2016–2017 year decreased, the number of schools and classrooms implementing the SHCP within a given county increased. However, staffing changes and time constraints resulted in a slight decline in the number of students in the 2017–2018 and 2018–2019 academic years. Nevertheless, over the five-year partnership with CFHL, UC, over 3,500 youth in California participated in the SHCP.

In addition to the students participating in the SHCP, additional resources were developed to engage parents and families, such as parent newsletters. To encourage supplementary nutrition education outside of the classroom, the SHCP was promoted at school health fairs and other events, where families, teachers, principals and other staff members were introduced to the program objectives. While the reach clearly extends beyond the 3,500 youth to families, teachers, school staff, and administration through these activities, this impact was not measured directly and therefore cannot be quantified.

Was the program effective?

Although the SHCP evaluation methods have been modified over the years, pre- and post-nutrition knowledge and body metrics have been consistently assessed on an annual basis. Improvements in nutrition knowledge have been sustained every year of implementation. Body measurement data were collected to determine changes in BMI percentiles, which were not significant between students receiving the SHCP intervention compared to control sites in the 2014–2015 or the 2015–2016 implementation. In the 2016–2017 and the 2017–2018 academic years, significant decreases in BMI percentiles were observed, $P = 0.01$ and $P = 0.026$, respectively

After five years of positive outcomes, it is apparent that program results are achievable through partnerships and adaptations to support the individualized needs of the counties, educators and schools.

TABLE 2. Information on the reach of the SHCP from 2014 to 2019*

Reach	2014–2015	2015–2016	2016–2017	2017–2018	2018–2019
Number of counties	3	7	7	10	9
Number of districts	4	10	11	12	11
Number of schools	4	8	14	13	12
Number of classrooms	9	23	31	30	25
Number of students	~275	~700	~930	~900	~750

* Reach values are cumulative totals of counties, districts, schools, classrooms and students; values may include new or repeated representation.

TABLE 3. Changes in nutrition knowledge scores and BMI percentiles from 2014–2019 calculated using paired-sample t-tests for students receiving the SHCP intervention from CFHL, UC educators

Effectiveness		2014–2015	2015–2016	2016–2017	2017–2018	2018–2019
Nutrition knowledge	Pre	20.73* (59.23%)	20.3* (58%)	20.31* (58.03%)	20.7* (59.14%)	9.45† (47.25%)
	Post	22.57* (64.48%)	23.11* (66.03%)	21.79* (62.26%)	22.5* (64.29%)	12.14† (60.70%)
		$P < 0.001^{\ddagger}$	$P = 0.02^{\ddagger}$	$P < 0.001^{\ddagger}$	$P < 0.001^{\ddagger}$	$P < 0.001^{\ddagger}$
BMI percentiles	Pre	77.1	73.6	78.8	72.5	63.8
	Post	77.4	73.0	74.0	69.8	65.2
		$P = 0.49$	$P = 0.51$	$P < 0.01^{\ddagger}$	$P = 0.03^{\ddagger}$	$P = 0.11$

* Indicates the original questionnaire, which had 35 questions.

† Indicates revised questionnaire, which had 20 questions.

‡ Indicates statistical significance.

(table 3). In 2018–2019, only the multi-year implementation models, which evaluated program effectiveness when the curriculum is split across multiple years, collected body measurements. However, improvements in BMI classifications were confirmed from baseline to the end of the intervention and were sustained into the baseline measurements for the following year. This provided insight into the sustainability of program outcomes, as these results were sustained over summer break, when no nutrition education was provided.

To reduce the burden of program evaluation, the number and duration of assessment tools decreased due to feedback from CFHL, UC educators about the difficulties of managing the SHCP assessments. The nutrition knowledge questionnaire was adapted from the original 35 questions, to the current 20 questions, using item discrimination and item difficulty measures to eliminate questions (Bergman et al. 2016). In addition, supplementary questions from the SPAN questionnaire were incorporated to assess changes in dietary and physical activity behaviors.

In 2018–2019, the Veggie Meter was approved for piloting at a single school site to measure SCS in elementary students ($n = 35$) at three timepoints. This rapid, non-invasive, and objective biomarker for fruit and vegetable intake reflects dietary behavior change without requiring FFQs or other subjective measures of dietary intake. Mean SCS increased from 158.0 ± 76.6 to 210.8 ± 74.4 ($P = 0.002$), indicating increased consumption of carotenoid-rich fruits and vegetables (Jones et al. 2021).

How widespread is adoption?

Since the partnership in 2014, CFHL, UC educators have implemented the SHCP with SNAP-Ed eligible schools. The program expanded into additional districts, schools and classrooms, resulting in a demand for effective and sustainable implementation strategies. With time commitment a documented barrier to SHCP adoption and sustainability, CFHL, UC and CNS staff sought alternative avenues to implement classroom lessons, such as extender models. A two-year extender model was developed and piloted with the goal of expanding program reach. In the first phase of

the extender model pilot, interested classroom teachers at SHCP schools observed CFHL, UC educators and prepared to deliver lessons themselves. This allowed teachers to observe best practices, along with common questions from students, and ultimately increased comfort with delivering SHCP curriculum in the following year. In the second phase, classroom teachers implemented lessons from DHC, and the CFHL, UC nutrition educators completed the garden lessons (CUHC) and provided support in additional program components, such as evaluation (Scherr et al. 2020).

An additional barrier for teacher adoption is a lack of pre-existing nutrition knowledge, making teachers apprehensive and reluctant to integrate the SHCP into lesson plans (Jones and Zidenberg-Cherr 2015; Linnell, Smith et al. 2016). Program adaptations, including the development of an introductory nutrition course corresponding to topics in DHC, and additional support with garden maintenance, were created with CFHL collaborators. Improvements in school-site wellness policies, as measured by the SHC², provide data to demonstrate positive program outcomes through partnership, which may increase buy-in from additional partners, such as principals, food service staff, and other administrative personnel (fig. 2).

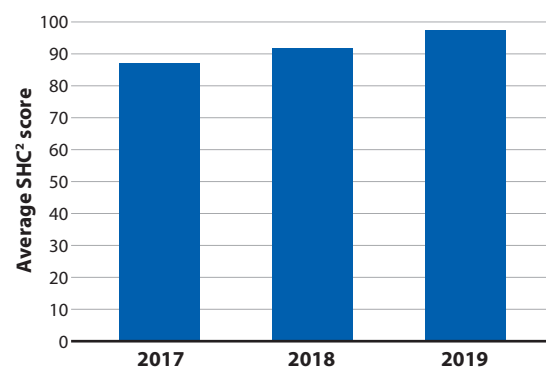


FIG. 2. Average Shaping Healthy Choices School Health Check (SHC²) scores from eight assessed school sites in 2017–2019, representing the cumulative values from the five components assessed: nutrition education and physical activity promotion, family and community partnerships, foods available on the school campus, regional agriculture, and overall wellness.

Traditional and new approaches

Curriculum fidelity is directly correlated with improvements in student performance on the SHCP assessments (Bergman et al. 2018). In the 2014–2015 and 2015–2016 academic years, fidelity over the 80% threshold was achieved at 85.6% and 85.5%, respectively, compared to a slight decrease to 81.8% in 2018–2019. Fidelity observations were inconsistent or incomplete in the 2016–2017 and 2017–2018 academic years due to the time burden required for collection.

The expansion of the program warranted new implementation models, which were piloted by CFHL, UC staff in three veteran SHCP counties in 2016–2017. This was done to address educator requests for flexibility with the implementation timeline and to include more grade levels. The first model assessed program effectiveness when curriculum is split across two years. Five fourth-grade classrooms received the first half of the SHCP curriculum. This pilot continued in the 2018–2019 academic year, with fifth-grade classrooms receiving the second half of the SHCP curriculum. A repeated measures analysis of variance using Bonferroni correction determined that nutrition knowledge increased significantly.

The second model evaluated program effectiveness when students are exposed to the garden-enhanced curriculum *Nutrition to Grow On* in third grade (Morris and Zidenberg-Cherr 2001), followed by SHCP curriculum and program activities, split over fourth and fifth grades. Six classrooms participated in the three-year pilot, which could not be completed due to the COVID-19 pandemic. All data except for the final timepoint were collected and results indicated nutrition knowledge increased, as did SCS (Jones et al. 2021).

Other adaptations developed through partnership with CFHL, UC have included introducing components of the SHCP at the middle school and high school grade levels. The SHCP was integrated into a middle school health class, meeting the nutrition and physical activity components of California state standards. *Healthy Choices in Motion*, the SHCP physical activity curriculum, was used to enhance a teens-as-teachers program, in which older youth were trained to administer the *Coordinated Approach to Child Health* physical activity lessons to younger youth. Additionally, CUHC was adapted to be used with high school-aged students and implemented in a home economics course (Hoelscher et al. 2010).

Did healthy changes persist?

The maintenance of the SHCP and observed behavioral outcomes were recorded to determine if positive outcomes were sustained. Annual trainings in pedagogical approaches and curriculum delivery were provided to ensure that CFHL, UC educators were familiar with program components. In addition to a multi-year implementation timeline, extender models and the



A student harvests a strawberry from a school garden. Photo: IrinaRio, iStock.com.

teens-as-teachers approach seek to improve program feasibility and sustainability. Extender programming was used at five school sites in the 2019–2020 school year, often through the identification of champion teachers with support of CFHL, UC educators. Champion teachers have been valuable assets to the sustainability of the program. From coordinating garden maintenance, to engaging administration, parents, and families, to increasing teacher buy-in at the school site, the role of champion teachers is fundamental to the success of the SHCP. After exploring the successes and challenges of the extender model, a multi-year implementation may be more feasible due to limited classroom time (Scherr et al. 2020).

The assessments used to evaluate the SHCP have provided insight into program maintenance. Since the implementation of the SHC² assessment tool in 2017 to compare the changes to school-site wellness from the prior year, the average scores have significantly improved in the SHC² subcategories nutrition education and physical activity promotion, family and community partnerships, foods available on the school campus, regional agriculture, and overall wellness (fig. 2).

In addition to the school-wide changes regarding LSWP facilitated by CFHL, UC educators, individual behavior change was also maintained following the completion of the SHCP. Results indicate improvements to SCS, as measured at the end of the school year following SHCP implementation and maintained over the summer break, thus indicating sustained increases in fruit and vegetable consumption (Jones et al. 2021). The maintenance of youth behavior change after CFHL, UC educators delivered the SHCP demonstrates the importance of multi-component nutrition education interventions to improve and sustain individual nutrition knowledge and other health-related behaviors and biomarkers.

Learning from partners

The initial SHCP pilot was conducted with the CNS research team coordinating all aspects of program implementation. The results from the program evaluation indicated that the SHCP successfully improved health outcomes for students. As outside agencies became interested in the program, plans were developed for scaling it up and sustaining it. After five years of positive outcomes, it is apparent that program results

are achievable through partnerships and adaptations to support the individualized needs of the counties, educators, and schools.

Similar studies examining school-wide health interventions in low-income schools reinforce the challenges in expanding the SHCP; this highlights the importance of providing support to reduce the burden on partners (Levine et al. 2002). A health intervention program with an emphasis on community integration significantly reduced the percentage of children who were overweight compared to the same program delivered with limited community support (Hoelscher et al. 2010). Positive results from health interventions similar to the SHCP emphasized an integrated community approach as a promising avenue to enhance program success (Hoelscher et al. 2010; Lepe et al. 2019). The integration of new evaluation tools to objectively measure dietary intake in school-based nutrition interventions also provides insight into quantifying behavior change, which previously may have been too time consuming or burdensome to measure. These findings underscore the strength of interventions that focus on incorporating community partner needs with intervention goals.

Developed using the social-ecological model (SEM), the SHCP includes components in each level to increase the magnitude of positive outcomes achieved. Similar nutrition curricula have demonstrated successful student outcomes using the SEM model in low-income community interventions (Gregson et al. 2001). However, the difficulties of school-based interventions emphasize the importance of not only addressing the different SEM spheres but also developing partnerships to sustain implementation and improve behavioral outcomes. This approach resulted in diverse partnerships with CFHL, UC educators, who were then able to develop meaningful connections with teachers, administration, food service staff, and families, creating an optimal learning environment for students that reinforces continuous exposure to nutrition-related topics beyond the classroom. Efforts to improve school staff capacity to support the SHCP are essential for program expansion.

Despite exploring various models of program delivery and support for teachers, it is difficult to overcome the well-documented barriers of lack of adequate instructional time, teacher nutrition knowledge, pressure to focus on other core subject areas, and standardized testing (Graham and Zidenberg-Cherr 2005; Jones and Zidenberg-Cherr 2015; Scherr et al. 2013). In addition, studies suggest teachers may underestimate the depth and breadth of nutrition and lose self-efficacy upon facilitating detailed nutrition curricula (Linnell, Smith et al. 2016). These findings corroborate the challenges experienced when exploring the teacher extender models within the SHCP. They emphasize the need for partnerships, such as with CFHL, UC, to integrate nutrition into schools without burdening teachers.

It is imperative to acknowledge the difficulties of collecting behavioral data from school-aged children.

Although a substantial number of youth participate in the SHCP, consent rates of approximately 50% limit the ability to make inferences. Additional barriers, such as staffing and budget changes, resulted in the inability to collect individual-level data. Unmatched aggregate data were collected in place of individual data. This may produce less-accurate results because it does not track individual changes, and the result may obscure differences among individuals.

Sustaining the program

In the 2019–2020 school year, the SHCP was ongoing in nine counties, consisting of about 600 students, with a variety of partnerships and implementation models in place to maintain the program with reduced teacher burden. The abrupt shift to virtual learning for much of 2020 and 2021 due to the COVID-19 pandemic disrupted SHCP implementation. Even so, analyzing the partnerships between CNS and CFHL, UC using the RE-AIM framework has demonstrated that collaboration between community agencies is an avenue to scale school-based nutrition interventions while maintaining effectiveness. Coordination between community partners and school staff can provide sustainable approaches to broaden program reach. Ongoing assessments of evaluation strategies and program activities can help agencies increase the quality of program delivery and improve relationships among stakeholders.

Additional research is warranted to assess alternative implementation models that build capacity for teachers to support health-related interventions. Another avenue of research is to explore the level of support needed to continue the expansion of multi-component, school-based, nutrition interventions. Although capacity building in school-level staff can improve sustainability, it does not address the systemic problem of a lack of integration of health programming into core curriculum and education standards. Higher-level advocacy is needed to mandate the incorporation of nutrition education into the school day. [CA](#)

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References

- Bandeira Silva de Medeiros GC, Morais de Azevedo KP, Garcia D, et al. 2022. Effect of school-based food and nutrition education interventions on the food consumption of adolescents: A systematic review and meta-analysis. *Int J Environ Res Public Health* 19:10522. <https://doi.org/10.3390/ijerph191710522>
- Beccarelli LM, Scherr RE, Dharmar M, et al. 2017. Using skin carotenoids to assess dietary changes in students after 1 academic year of participating in the Shaping Healthy Choices Program. *J Nutr Educ Behav* 49(1):73–78.e71. <https://doi.org/10.1016/j.jneb.2016.09.007>
- Bergman JJ, Linnell JD, Ginsburg, DC, et al. 2016. Adapting, implementing, and assessing the impact of the Shaping Healthy Choices Program through UC CalFresh partnerships. *FASEB J* 30(51):897.1. https://doi.org/10.1096/fasebj.30.1_supplement.897.1
- Bergman J, Linnell JD, Scherr RE, et al. 2018. Feasibility of implementing a school nutrition intervention that addresses policies, systems, and environment. *J Extension* 56(1):1FEA6. <https://archives.joe.org/joe/2018february/a6.php>
- Blom-Hoffman J, Leff SS, Franko DL, et al. 2009. Consent procedures and participation rates in school-based intervention and prevention research: Using a multi-component, partnership-based approach to recruit participants. *School Ment Health* 1(1):3–15. <https://doi.org/10.1007/s12310-008-9000-7>
- Ermakov IV, Ermakova E, Sharifzadeh M, et al. 2018. Optical assessment of skin carotenoid status as a biomarker of vegetable and fruit intake. *Arch Biochem Biophys* 15(646):46–54. <https://doi.org/10.1016/j.abb.2018.03.033>
- Fetter D, Gerdes M, Ruiz L, et al. 2018. Healthy Choices in Motion. <https://cns.ucdavis.edu/resources/classroom/healthy-choices-in-motion>
- Fetter DS, Scherr RE, Linnell JD, et al. 2018. Effect of the Shaping Healthy Choices Program, a multicomponent, school-based nutrition intervention, on physical activity intensity. *J Am Coll Nutr* 37(6):472–8. <https://doi.org/10.1080/07315724.2018.1436477>
- Glasgow RE, Vogt TM, Boles SM. 1999. Evaluating public health impact of health promotion interventions: The RE-AIM framework. *Am J Public Health* 89(9):1322–7. <https://doi.org/10.2105/ajph.89.9.1322>
- Graham H, Zidenberg-Cherr S. 2005. California teachers perceive school gardens as an effective nutritional tool to promote healthful eating habits. *J Am Diet Assoc* 105(11):1797–1800. <https://doi.org/10.1016/j.jada.2005.08.034>
- Gregson J, Foerster SB, Orr R, et al. 2001. System, environmental, and policy changes: Using the social-ecological model as framework for evaluating nutrition education and social marketing programs with low-income audiences. *J Nutr Educ* 33(1):4–15. [https://doi.org/10.1016/S1499-4046\(06\)60065-1](https://doi.org/10.1016/S1499-4046(06)60065-1)
- Hayes D, Contento I, Weekly C. 2018. Position of the Academy of Nutrition and Dietetics, Society for Nutrition Education and Behavior, and School Nutrition Association: Comprehensive nutrition programs and services in schools. *J Acad Nutr Diet* 118(5):7. <https://doi.org/10.1016/j.jneb.2018.03.001>
- Hoelscher DM, Kirk S, Ritchie L, Cunningham-Sabo L. 2013. Position of the Academy of Nutrition and Dietetics: Interventions for the prevention and treatment of pediatric overweight and obesity. *J Acad Nutr Diet* 113(10):1375–94. <https://doi.org/10.1016/j.jand.2013.08.004>
- Hoelscher DM, Springer AE, Ranjit N, et al. 2010. Reductions in child obesity among disadvantaged school children with community involvement: The Travis County CATCH Trial. *Obesity (Silver Spring)* 18 (Suppl 1):S36–44. <https://doi.org/10.1038/oby.2009.430>
- Jilcott S, Ammerman A, Sommers J, Glasgow RE. 2007. Applying the RE-AIM framework to assess the public health impact of policy change. *Ann Behav Med* 34(2):105–14. <https://doi.org/10.1007/BF02872666>
- Jones AM, Keinher A, Mills MA, et al. 2021. Feasibility of measuring skin carotenoids using reflection spectroscopy in a low-income school setting. *Nutrients* 13(11):3796. <https://doi.org/10.3390/nu13113796>
- Jones AM, Zidenberg-Cherr S. 2015. Exploring nutrition education resources and barriers, and nutrition knowledge in teachers in California. *J Nutr Educ Behav* 47(2):162–9. <https://doi.org/10.1016/j.jneb.2014.06.011>
- Jones AM, Lamp C, Neelon M, et al. 2015. Reliability and validity of nutrition knowledge questionnaire for adults. *J Nutr Educ Behav* 47(1):69–74. <https://doi.org/10.1016/j.jneb.2014.08.003>
- Lepe S, Goodwin J, Mulligan KT, et al. 2019. Process evaluation of a policy, systems, and environmental change intervention in an urban school district. *J Nutr Educ Behav* 51(3):307–17. <https://doi.org/10.1016/j.jneb.2018.07.017>
- Levine E, Olander C, Lefebvre C, et al. 2002. The Team Nutrition Pilot Study: Lessons learned from implementing a comprehensive school-based intervention. *J Nutr Educ Behav* 34(2):109–16. [https://doi.org/10.1016/S1499-4046\(06\)60076-6](https://doi.org/10.1016/S1499-4046(06)60076-6)
- Linnell J, Smith MH, Zidenberg-Cherr S. 2015. Discovering Healthy Choices. Davis, California: University of California, Davis.
- Linnell JD, Smith MH, Briggs M, et al. 2016. Evaluating the relationships among teacher characteristics, implementation factors, and student outcomes of children participating in an experiential school-based nutrition program. *Pedagogy in Health Promotion* 2(4):256–65. <https://doi.org/10.1177/2373379916649603>
- Linnell JD, Zidenberg-Cherr S, Briggs M, et al. 2016. Using a systematic approach and theoretical framework to design a curriculum for the Shaping Healthy Choices Program. *J Nutr Educ Behav* 48(1):60–69. <https://doi.org/10.1016/j.jneb.2015.09.010>
- Morris JL, Zidenberg-Cherr S. 2001. Nutrition to Grow On: A Garden-Enhanced Nutrition Education Curriculum for Upper Elementary School Children. Sacramento, California: California Department of Education. <https://cns.ucdavis.edu/resources/classroom/nutr-grow>
- Morris JL, Briggs M, Zidenberg-Cherr S. 2002. Development and evaluation of a garden-enhanced nutrition education curriculum for elementary schoolchildren. *J Child Nutr Manage* 26(1). <https://vegetableproject.org/wp-content/uploads/2018/02/Morris-2002-Teaching-nutrition-with-garden.pdf>
- Murimi MW, Moyeda-Carabaza AF, Nguyen B, et al. 2018. Factors that contribute to effective nutrition education interventions in children: A systematic review. *Nutr Rev* 76(8):553–80. <https://doi.org/10.1093/nutrit/nuy020>
- Pulgarón ER. 2013. Childhood obesity: A review of increased risk for physical and psychological co-morbidities. *Clinical Therapies* 35(1):A18–32. <https://doi.org/10.1016/j.clinthera.2012.12.014>
- Radtko MD, Jilcott Pitts S, Jahns L, et al. 2021. Criterion-related validity of spectroscopy-based skin carotenoid measurements as a proxy for fruit and vegetable intake: A systematic review. *Adv Nutr* 11(5):1282–99. <https://doi.org/10.1093/advances/nmaa054>
- Ruiz LD, Brian KM, Scherr RE. 2020. Lessons learned: Implementing the Shaping Healthy Choices Program with teenagers as teachers. *J Youth Dev* 15(5):126–45. <https://doi.org/10.5195/jyd.2020.761>
- Scherr RE, Cox RJ, Feenstra G, Zidenberg-Cherr S. 2013. Integrating local agriculture into nutrition programs can benefit children's health. *Calif Agr* 67(1):30–7. <https://doi.org/10.3733/ca.v067n01p30>
- Scherr RE, Jones AM, Colorafi R, et al. 2020. Assessing the effectiveness of an extender model partnership in implementing a multicomponent, school-based nutrition intervention. *Health Promot Practice* 22(6):890–8. <https://doi.org/10.1177/1524839920920305>
- Scherr RE, Linnell JD, Dharmar M, et al. 2017. A multicomponent, school-based intervention, the Shaping Healthy Choices Program, improves nutrition-related outcomes. *J Nutr Educ Behav* 49(5):368–379. <https://doi.org/10.1016/j.jneb.2016.12.007>
- Scherr RE, Linnell JD, Smith MH, et al. 2014. The Shaping Healthy Choices Program: Design and implementation methodologies for a multicomponent, school-based nutrition education intervention. *J Nutr Educ Behav* 46(6):e13–e21. <https://doi.org/10.1016/j.jneb.2014.08.010>
- Slattery CL, Jones AM, Scherr RE. 2019. Action inquiry as a strategy for professional development increases educator self-efficacy to teach nutrition. *JNEAFCS* 14:13–30. www.neafcs.org/assets/documents/journal/2019-jneafcs/2019-JNEAFCS-FINAL-Web.pdf
- Smith AL, Purcell RJ, Vaughan JM. 2015. Guided inquiry activities for learning about the macro- and micronutrients in introductory nutrition courses. *Biochem Mol Biol Educ* 43(6):449–59. <https://doi.org/10.1002/bmb.20913>
- [SNAP-Ed] Supplemental Nutrition Assistance Program Education. 2016. SNAP-Ed fact-sheet. https://snaped.fns.usda.gov/snap/SNAP-Ed%20Fact-sheet%20_August%202016.pdf
- Taylor JC, Zidenberg-Cherr S, Linnell JD, et al. 2017. Impact of a multicomponent, school-based nutrition intervention on students' lunchtime fruit and vegetable availability and intake: A pilot study evaluating the Shaping Healthy Choices Program. *J Hunger Env Nutr* 13(3):415–28. <https://doi.org/10.1080/19320248.2017.1374899>
- Thiagarajah K, Fly AD, Hoelscher DM, et al. 2008. Validating the food behavior questions from the elementary school SPAN questionnaire. *J Nutr Educ Behav* 40(5):305–10. <https://doi.org/10.1016/j.jneb.2007.07.004>