#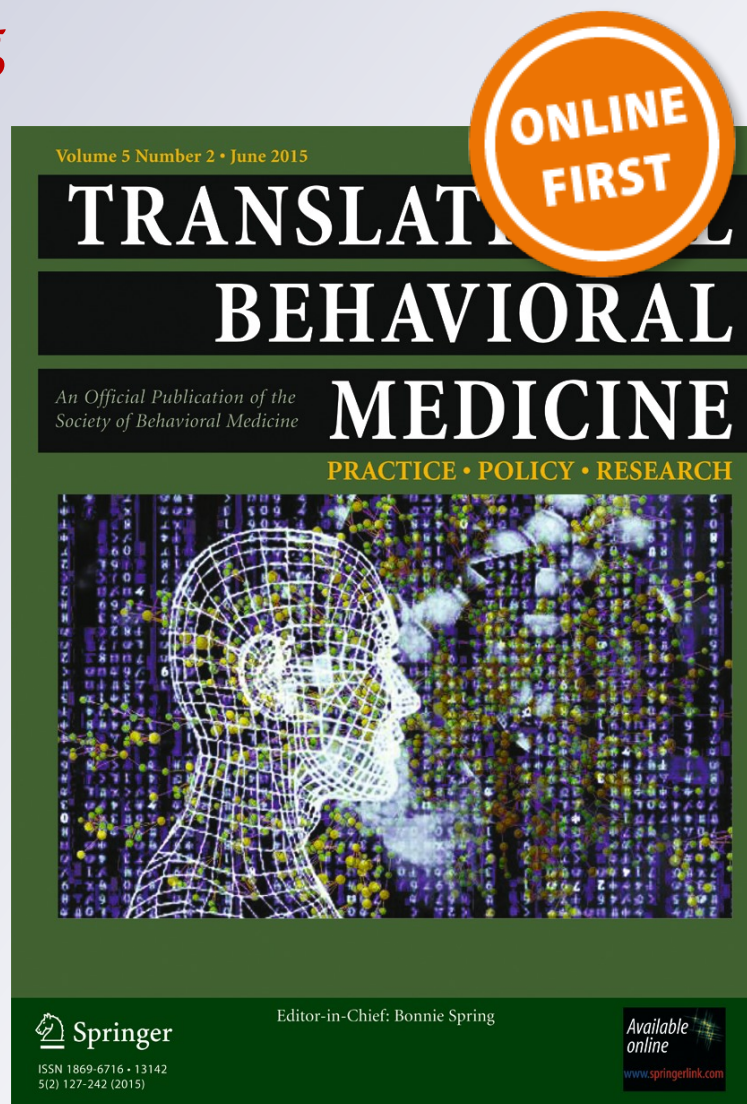 Assessing intervention fidelity in a multi-level, multi-component, multi-site program: the Children's Healthy Living (CHL) program

Jean Butel, Kathryn L. Braun, Rachel Novotny, Mark Acosta, Rose Castro, Travis Fleming, Julianne Powers & Claudio R. Nigg

Volume 5 Number 2 · June 2015

TRANSLATIONAL BEHAVIORAL MEDICINE

An Official Publication of the Society of Behavioral Medicine

PRACTICE · POLICY · RESEARCH

ONLINE FIRST

Springer

ISSN 1869-6716 · 13142
5(2) 127–242 (2015)

Editor-in-Chief: Bonnie Spring

Available online
www.springerlink.com

Springer

Springer

TBM

Assessing intervention fidelity in a multi-level, multi-component, multi-site program: the Children's Healthy Living (CHL) program

Jean Butel, MPH,[1] Kathryn L. Braun, DrPH,[2] Rachel Novotny, PhD, RDN,[1] Mark Acosta, BS,[3] Rose Castro, BS,[4] Travis Fleming, RDN,[5] Julianne Powers, BA,[6] Claudio R. Nigg, PhD[2]

[1]College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa, Honolulu, HI, USA
[2]Office of Public Health Studies, University of Hawaii at Manoa, Honolulu, HI, USA
[3]University of Guam, Mangilao, Guam
[4]Northern Marianas College, Saipan, Northern Mariana Islands
[5]American Samoa Community College, Mapusaga, American Samoa
[6]University of Alaska at Fairbanks, Fairbanks, AK, USA

Correspondence to: J Butel
jbutel@hawaii.edu

Abstract

Addressing complex chronic disease prevention, like childhood obesity, requires a multi-level, multi-component culturally relevant approach with broad reach. Models are lacking to guide fidelity monitoring across multiple levels, components, and sites engaged in such interventions. The aim of this study is to describe the fidelity-monitoring approach of The Children's Healthy Living (CHL) Program, a multi-level multi-component intervention in five Pacific jurisdictions. A fidelity-monitoring rubric was developed. About halfway during the intervention, community partners were randomly selected and interviewed independently by local CHL staff and by Coordinating Center representatives to assess treatment fidelity. Ratings were compared and discussed by local and Coordinating Center staff. There was good agreement between the teams (Kappa=0.50, p<0.001), and intervention improvement opportunities were identified through data review and group discussion. Fidelity for the multi-level, multi-component, multi-site CHL intervention was successfully assessed, identifying adaptations as well as ways to improve intervention delivery prior to the end of the intervention.

Keywords

Childhood obesity, Community-based research, Ecological model, Implementation fidelity

BACKGROUND

Addressing complex chronic disease prevention like childhood obesity requires multi-level, multi-component interventions, i.e., those that intervene at the policy, community, and organizational levels, as well as the intra- and interpersonal levels [1]. However, assuring intervention fidelity across multiple sites engaged in a multi-level, multi-component intervention is a challenge, especially as community-based interventions require local buy-in and are shaped by local context [2].

Almost 40 % of children are overweight or obese by age 8 years old in the US-Affiliated Pacific, including Alaska, American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, and Hawai'i [4]. Therefore, The Children's Healthy Living

Implication
Practice: Assessing implementation fidelity while activities are being conducted can identify program adaptations to fit local context as well as fidelity.
Research: Protocols to evaluate implementation fidelity of complex interventions need to be developed early, follow a coding model, and be adapted to fit the local context.
Policy: For community-driven programs, sufficient time needs to be allocated to build and develop relationships.

Program for Remote Underserved Minority Populations of the Pacific Region (CHL) was funded for 5 years (2011–2016) from the U.S. Department of Agriculture (USDA) to address childhood obesity in the US-Affiliated Pacific [3].

Based at the University of Hawai'i, the CHL coordinating center subcontracts with four other Land Grant institutions in the US-Affiliated Pacific (the University of Alaska at Fairbanks, American Samoa Community College, the College of the Northern Marianas, and the University of Guam) to carry out activities to meet the CHL mission in their respective jurisdictions. CHL's mission is "to elevate the capacity of the region to build and sustain a healthy food and physical environment to help maintain healthy weight and prevent obesity among young children" (http://www.chl-pacific.org/). The purpose of this paper is to present the CHL-developed approach to fidelity monitoring, which documented how well intervention components were being implemented, assessed intervention adaptations (expected given vastly different intervention site contexts), and identified ways to improve intervention delivery.

The CHL intervention was developed by the five jurisdiction community members and CHL staff during a 14-month process guided by the ANGELO intervention development model [5]. Jurisdiction

community meetings were held, where participants identified and prioritized proposed intervention strategies based on importance and feasibility [6]. The jurisdiction's CHL staff presented their communities' priority lists in CHL conference calls, and these were merged with findings from the literature on effective interventions. The final intervention (Table 1) required sites to implement 26 activities categorized into four cross-cutting functions: (1) improving preschool policy, (2) advocating and partnering for environmental changes, (3) promoting CHL messages related to healthy behaviors;, and (4) training trainers. Because of the diverse settings and the community-driven intervention, the activities told communities "what" to do, but not "how." For example, one required activity was to "work with existing organizations and coalitions and/or form new coalitions to advocate for better access to parks that are safe and inviting." However, it was up to the community to decide exactly how parks could be improved and which resources to leverage.

The CHL study design is a cluster randomized controlled trial (CRCT) in which one or two communities in each jurisdiction ($n=9$ communities) received the intervention and one or two matched communities ($n=9$ communities) served as delayed-intervention controls. The CRCT aimed to evaluate the intervention's impact on anthropometric indicators (e.g., BMI and waist circumference), as well as fruit and vegetable intake, water consumption, physical activity, sleep duration, recreational screen time, and sugar-sweetened beverage consumption [7].

To monitor intervention progress, jurisdictions completed monthly reports addressing reach, adoption, and maintenance of the 26 intervention activities. An implementation fidelity protocol was developed and implemented, as well. This is important for intervention studies, especially when the intervention is complex and is being delivered in multiple sites with vastly different contexts [8]. Lack of implementation fidelity potentially weakens outcomes, makes interventions appear ineffective, masks mechanisms of effect for interventions, and can lead to type-III errors (i.e., failure to implement a program as planned) [9, 10]. Even though there is limited research to assess the fidelity of multi-level multi-component interventions [11, 12], some good models exist. A Canadian model utilized an ecological coding procedure to distinguish program components that aimed to impact individuals directly or through organizations, communities, or policies [13]. This coding model was also applied to Australian multi-level, obesity-control interventions, which found that proximal (individual and interpersonal) intervention components were more likely to be implemented with fidelity than distal intervention components, as the latter often were adapted in response to contextual barriers [14].

Gearing et al. [15] consolidated information from 24 review articles to develop a comprehensive guide to assessing intervention fidelity. They stressed the importance of protocols to promote fidelity during intervention design and training, as well as for monitoring intervention implementation. However, a Cochrane review of childhood obesity interventions noted that only a few of 55 studies reported intervention fidelity assessments [16]. This paper presents the CHL fidelity approach, which documented how well intervention components were being implemented, assessed intervention adaptations, and identified ways to improve intervention delivery.

METHODS

CHL intervention delivery was overseen by the 18+ member CHL intervention team, which included the CHL principal investigator (PI), four coordinating center staff, and two to five local CHL team members from each of the five jurisdictions. To ensure implementation quality of the multi-level multi-component CHL intervention, the fidelity assessment was conducted about halfway through the 24-month intervention period. This timeline was chosen to allow enough time for jurisdictions to solidify the relationships needed to understand community dynamics and establish intervention activities [17], while leaving enough time for jurisdictions to make intervention adjustments, if needed. A CHL intervention team sub-group determined a method to assess the intervention implementation quality (treatment fidelity). The aim of the treatment fidelity method was to balance staff burden and time effectiveness with obtaining a representative indication of implementation quality.

The fidelity-monitoring method included five steps: (1) develop a fidelity-scoring rubric for the 26 CHL intervention activities, (2) randomly select community partners to be interviewed for each of the 26 activities, (3) conduct 2 independent interviews with the selected community partners (1 by a local CHL team member and another by 2 coordinating center representatives) and score each intervention activity using the rubric, (4) qualitatively compare the local CHL team score with the coordinating center score for each activity, and (5) discuss the findings with the local CHL intervention teams and coordinating center representatives to identify strengths and areas for improvement.

Step 1 Developing the fidelity-scoring rubric. Coordinating center individuals responsible for intervention delivery (JB, KLB, and CRN) developed the fidelity of intervention delivery rubric. For each of the 25 activities, specific benchmarks ranked how well each activity was being implemented, from 1 = not well at all to 5 = very well, operationalized by anchor answers at each point (Table 2). The rubric was reviewed and refined by the 18+ member intervention team through the monthly teleconferences.

Step 2 Selecting community partners to be interviewed. For each of the 26 activities, the local CHL team listed names of individuals in their

Table 1 | CHL Intervention cross-cutting functions and activities, and how they impact the six CHL behavioral outcomes

	↓ SSB intake	↑ F/V intake	↑ PA	↑ Water intake	↓ Rec screen time	↑ Sleep
1. Improve school wellness policy						
a. Review preschool wellness policy assessment data to identify training needs	X	X	X	X	X	X
b. Address policy gaps with preschool administration	X	X	X	X	X	X
c. Assess policy implementation quality (strength and weaknesses)	X	X	X	X	X	X
d. Work with preschools to address weakness and implement solutions	X	X	X	X	X	X
2. Partner and advocate for environmental change						
a. Review and act on CAT (community assessment toolbox) data			X			
i. Assess the physical environment using the CAT			X			
ii. Review CAT data to identify areas for improvements and advocacy			X			
iii. Improve CAT-indicated physical environments			X			
iv. Advocate (with partners, stakeholders, role models, coalitions, etc) for CAT-indicated environment changes			X			
b. Work with existing organizations and coalition and/or form new coalitions to advocate for:						
i. Better access to parks that are safe and inviting			X			
ii. Better access to clean water				X		
iii. Safer environments for walking, biking, etc (e.g., bike lanes/racks, sidewalks, greenways)			X			
iv. Better food placement and availability		X				
v. Gardens and hydroponics		X				
c. Partner with existing entities to purchase or obtain sponsorship for:						
i. Water in the preschools and childcare centers				X		
ii. Gardening supplies for preschool kids		X				
iii. Sports equipment for preschool kids			X			
iv. Campaigns and messages	X	X	X	X	X	X
3. Promote the CHL Message						
a. Support role models to deliver CHL messages in various ways	X	X	X	X	X	X
b. Support exiting social marketing campaigns, and distribute CHL social marketing materials	X	X	X	X	X	X
c. Advertise CHL or other activities that promote six CHL target behaviors	X	X	X	X	X	X
4. Train the trainers						
a. Train individuals to promote gardening in preschools and communities		X				
b. Train individuals to lead interactive, hands-on sessions to promote the six CHL behaviors	X	X	X	X	X	X
c. Train individuals to organize and lead family-based activities that support the six CHL behaviors	X	X	X	X	X	X
d. Provide TA to preschool and childcare staff on wellness policies	X	X	X	X	X	X
e. Train childcare providers and preschool teachers in curricula related to 6 CHL behaviors	X	X	X	X	X	X
f. Train CHL role models (community champions, role celebrities, role models)	X	X	X	X	X	X

Table 2 | Sample items from the fidelity-scoring rubric

Activity
Interview question
and response options
	1c. Assess policy implementation quality (strengths and weaknesses)
	Has CHL staff looked at how well you are implementing your wellness policy? If not, has CHL staff contacted you about looking at how well you are implementing your wellness policy?
	    1. Not well at all—No contact with preschool administrators; no plans to assess quality of wellness policy implementation
	    2. Not well—Some initial contact with preschool administrators, but no plans yet to assess quality of wellness policy implementation
	    3. Neutral—Plans to assess quality of wellness policy implementation with preschool administrators have been made
	    4. Somewhat well—Policy implementation assessment has been discussed, and preschool administrators agree, and plan have been made to assess quality of wellness policy implementation
	    5. Very well—CHL staff in constant communication with preschool administrators and actively assessing or already assessed the quality of wellness policy implementation.

Activity
Interview question
and response options
	2ai. Work with existing community organizations and coalition and/or form new coalitions to advocate for better access to parks that are safe and inviting.
	How well has CHL staff supported and participated in advocating for better access to parks that are safe and inviting?
	    1. Not well at all—No contact with community organizations/coalitions; no plans made for advocating park access.
	    2. Not well—Some, but minimal contact with community organizations/coalitions; no plans made for advocating park access or encountering problems/issues to be resolved.
	    3. Neutral—In contact with community organizations/coalitions, and currently developing plans for advocating park access.
	    4. Somewhat well—Good contact with community organizations/coalitions, with completed plans for advocating park access; soon to be actively carrying out plans.
	    5. Very well—Constant communication with community organizations/coalitions, actively advocating park access.

Activity
Interview question
and response options
	3c. Advertise CHL or other activities that promote six CHL target behaviors
	How well did the CHL staff advertise CHL or other activities that promoted the six CHL target behaviors?
	    1. Not well at all—No plans developed to advertise CHL or six CHL target behaviors, no means of advertising in place; or unable to implement for other reasons.
	    2. Not well—Beginning to develop plans to advertise CHL or six CHL target behaviors, developing means for advertising, but encountering certain problems/issues to be resolved.
	    3. Neutral—Beginning to develop plans to advertise CHL or six CHL target behaviors, developing means for advertising, any problems/issues have been resolved.
	    4. Somewhat well—Currently developing/finished developing plans to advertise CHL or six CHL target behaviors, finalizing advertising plans and means, but not yet actively advertising.
	    5. Very well—CHL or activities that promote six CHL target behaviors are well-advertised in the community, community response to advertising.

Activity
Interview question
and response options
	4f. Train role models (community champions, role celebrities, role models)
	In regards to the role model workshop, how well do you feel role models are developed and can communicate the CHL message to others?
	    1. Not well at all—No contact with role models, no plans in place for training in the CHL message and the six CHL behaviors, or unable to implement for other reasons.
	    2. Not well—Some contact with role models, plans in place for training, but plans are not yet active, or training is complete but role models still struggling with CHL message/six CHL behaviors.
	    3. Neutral—Role models are currently training in the CHL message and the six CHL behaviors.
	    4. Somewhat well—Role models have completed training, addressing some minor questions/concerns after training, currently developing plans and methods for how they can address CHL as role models.
	    5. Very well—Role models are well-trained in the CHL message and the six CHL behaviors, questions/concerns have been addressed. Role models able to create new methods/improve current methods to address CHL, there is community response to role models.

communities with whom they had partnered for this activity. Ten percent or at least one of the individuals listed for each activity was randomly selected to be interviewed by the local site team and separately by a coordinating center representative who was not directly supervising CHL intervention activities in that jurisdiction.

Step 3   Scoring each activity. The interview question(s) in the scoring rubric were asked by the local team and the coordinating center via email, telephone, or in person. Local CHL site team members scored each activity based on their interviews with the selected community representatives. At the same time, two representatives of the coordinating center interviewed the same representatives and provided scores. The coordinating center representatives also conducted a site visit in each jurisdiction, which included visits to the intervention communities to see gardens, parks, preschools, and social marketing and training activities. This allowed coordinating center representatives to better understand the context within which CHL activities were occurring and to assess local adaptations to the CHL template of intervention activities. Responses were documented on a spreadsheet for each community. If an activity had not been implemented, a rating of 1 (not at all) was assigned. If an activity was not applicable to a community, it was not rated and was not included in the rating average.

The assessments occurred between February and June 2014 (14 to 18 months into the 24 month intervention). The predominant participant contact method was by telephone followed by email. American Samoa was an exception as a majority of the participants were contacted face to face, as is culturally appropriate. Intervention activities that required observation (social marketing materials, park improvements, etc.) were observed by both the local site team and then again by the coordinating center during the site visit. During the site visit, the coordinating center team also spoke with community members and local CHL team members about community resources and barriers to implementing CHL activities. These qualitative data were useful in identifying strengths and opportunities for the intervention activities.

Step 4   Comparing the scores. The local intervention team and the coordinating center rankings were recorded, correlated, and were presented, and Kappa measures of agreement were calculated. Richard's bi-dimensional model principles were used to categorize activities based on whether they addressed individuals directly or through organizations, communities, or policies [13].

Step 5   Discussing findings. On the last day of the site visit, the coordinating center team consolidated the results and their observations into a presentation. The presentation consisted of graphs showing how well each activity and each cross-cutting function was being implemented in the jurisdiction as rated by the local team and by the coordinating center team. Along with the ratings, both the local site team and the intervention coordinating center shared qualitative data from respondents. The identified intervention strengths and opportunities were discussed and ideas generated from the local team on ways to improve the intervention efforts in their communities. For activities still in development, the jurisdictions were asked to complete an implementation timeline and present the timeline at the CHL annual meeting in June 2014. The protocol for conducting the evaluation is outlined in Table 3.

RESULTS

Quantitative results

The ratings and categorization for each activity in each of the nine communities by intervention level using Richard's bi-dimensional model [13] are shown in Table 4. There was a strong correlation ($r=0.78$,

Table 3 | Data collection process

Part 1	Completed by the jurisdiction intervention team
Step 1	List each initiative/activity for each subcategory within each cross-cutting function.
Step 2	Randomly select 10% of individuals involved in each of 26 activities in 4 cross-cutting functions for each intervention community. Provide contact person/information for each selected individual and send to coordinating center.
Step 3	Interview each selected individual using the "QA Implementation" rubric to evaluate extent to which activity was implemented.
Step 4	Send completed evaluation to CHL coordinating center.
Part 2	Completed by the CHL Intervention leads
Step 1	Review each jurisdiction's "QA Implementation" contact file.
Step 2	Schedule and conduct site visits and separately complete "QA Implementation" rubric. Those initiatives/activities requiring phone calls may be done prior to the site visit. Those initiatives/activities requiring observation will be done at the site visits along with the assessment of intervention adaptations.
Step 3	Compare the local team and the site coordinating center team "QA Implementation" findings and discuss any items with discrepant scores ›1 point on 5-point scale.
Step 4	Collaborate with jurisdiction intervention team to brainstorm and come up with ways to improve intervention quality where indicated.

Table 4 | Average implementation ratings and level of intervention of each activity

Cross-cutting function	Level of intervention [13]	Coordinating center score	Jurisdiction score	Number of communities with 2.5 or greater for this activity (total n=9)
1. Improve school wellness policy				
a. Review preschool wellness policy assessment data to identify policy gaps[b]	HP→ORG→IND	4.78 (SD=0.67)	4.33 (SD=1.32)	9
b. Address policy gaps with preschool administration	HP→POL→IND	3.33 (SD=1.58)	3.44 (SD=1.67)	5
c. Assess policy implementation quality (ID strength and weaknesses)	HP→POL→IND	3.11 (SD=1.62)	3.33 (SD=1.80)	5
d. Work with preschool administrators to address weaknesses in policy implementation[a]	HP→POL→IND	1.83 (SD=1.46)	2.67 (SD=1.52)	2
2. Partner and advocate for environmental change				
a. Review and act on CAT (community assessment toolbox) data				
i. Assess the physical environment using the CAT[b]	HP→COM→IND	5.00 (SD=0.00)	4.78 (SD=0.44)	9
ii. Review CAT data to identify areas for improvements and advocacy[b]	HP→COM→IND	4.56 (SD=0.53)	4.11 (SD=0.78)	9
iii. Improve CAT-indicated physical activity environments[b]	HP→COM→IND	3.86 (SD=1.07)	4.63 (SD=0.74)	6
iv. Advocate (with partners, stakeholders, role models, coalitions, etc) for CAT-indicated physical activity environment changes[b]	HP→POL→IND	3.71 (SD=1.25)	3.88 (SD=1.55)	6
b. Work with existing community organizations and coalitions and/or form new coalitions to advocate for:				
i. Better access to parks that are safe and inviting[a]	HP→[ORG-ORG]→IND	3.86 (SD=1.95)	3.63 (SD=1.41)	5
ii. Better access to clean water[a]	HP→[ORG-ORG]→IND	3.43 (SD=1.72)	3.43 (SD=1.72)	4
iii. Safer environments for walking, biking, etc (e.g., bike lanes/racks, sidewalks, greenways)[a]	HP→[ORG-ORG]→IND	3.00 (SD=1.85)	3.11 (SD=1.62)	5
iv. Better food placement in stores[a]	HP→[ORG-ORG]→IND	2.33 (SD=1.22)	2.50 (SD=1.41)	4
v. Gardens and hydroponics[b]	HP→ORG→IND	4.22 (SD=1.30)	4.44 (SD=1.01)	8
c. Partner with existing entities to purchase or obtain sponsorship for:				
i. Gardening supplies for preschool kids[b]	HP→ORG→IND	4.67 (SD=0.50)	3.80 (SD=1.00)	9
ii. Sports/play equipment for preschool kids[a]	HP→ORG→IND	2.63 (SD=1.77)	3.25 (SD=1.58)	4
iii. Campaigns and messages[b]	HP→ORG→IND	4.56 (SD=0.53)	4.56 (SD=0.53)	9
3. Promote the CHL message				
a. Support role models to deliver CHL messages in various ways (using the CHL role model curriculum as a guide)[b]	HP→[INT-INT]→IND	4.00 (SD=1.73)	4.61 (SD=0.70)	7
b. Enhance existing social marketing campaigns in the intervention communities, and/or develop low-cost local social marking campaigns related to the six CHL behaviors[b]	HP→COM→IND	4.78 (SD=0.44)	4.44 (SD=0.88)	9
c. Advertise CHL or other activities that promote six CHL target behaviors[b]	HP→COM→IND	4.78 (SD=0.44)	4.67 (SD=0.50)	9
4. Train the trainers				
a. Train individuals to promote gardening in preschools and communities[b]	HP→INT→IND	4.17 (SD=1.27)	4.22 (SD=1.30)	7
b. Train individuals to lead interactive, hands-on sessions to promote the six CHL behaviors[b]	HP→INT→IND	4.28 (SD=0.75)	4.22 (SD=1.30)	9
	HP→INT→IND	3.00 (SD=1.73)	3.78 (SD=1.48)	5

		Coordinating center	Local team	
c. Train individuals to organize and lead family-based activities that support the 6 CHL behaviors (park clean-ups, hikes, cooking sessions, etc.)[b]				
d Provide TA to preschool and childcare staff on wellness policies	HP→ORG→IND	3.00 (SD=1.80)	3.00 (SD=1.32)	5
e. Train childcare providers and preschool teachers in curricula related to six CHL behaviors[b]	HP→INT→IND	3.83 (SD=1.66)	4.22 (SD=1.30)	6
f. Train role models (community champions, role celebrities, role models)[b]	HP→INT→IND	4.11 (SD=1.36)	4.22 (SD=1.30)	8
Average for all activities		3.68 (SD=1.12)	3.92 (SD=1.13)	

HP health promotion intervention, *IND* clients, *INT* other individuals and small groups of individuals forming the interpersonal environment, *ORG* organizations, *COM* communities, *POL* political systems

[a] Intervention activities with scores ≤2 in a majority of the communities (≥5 communities)

[b] Intervention activities with scores ≥4 in a majority of the communities (≥5 communities)

$p<0.001$) in the implementation ratings between the local teams and the coordinating center (Table 4). The overall Kappa of agreement was 0.50 ($p<0.001$).

The average rating across activities and jurisdictions was 3.68 (SD 1.12) from the coordinating center and 3.92 (SD 1.13) from the local site teams. All four cross-cutting functions averaged ratings >3.6 (range 3.61 to 4.52), and a majority of the activities (65.4 %) rated 3.5 or higher.

There was a variability in the number of activities conducted per community. The largest number of activities implemented in any community was 24, and the lowest was 16. The six activities that scored 1 or 2 (not well implemented) in the majority of communities were predominately policy and environmental change activities that required collaboration of several different partners and/or organizations. Working with preschool administrators to address weaknesses in policy implementation had the lowest activity rating of 1.83 and 2.67 from the coordinating center staff and local CHL team, respectively. The Richard model indicated that these activities were either HP→[ORG-ORG]→IND or HP→POL→IND, which both rely on the development of relationships for implementation [13].

The 16 activities that scored 4 or 5 (well implemented) in the majority of communities were activities that, for the most part, were conducted by CHL staff or by partners with close relationships with the CHL program. A majority of the activities that were implemented well included assessments conducted by the CHL staff, social marketing developed and delivered by the CHL staff, and training either conducted or organized by the CHL staff. Assessing the physical environment using the community assessment toolbox (CAT) had the highest rating of 4.78 (CHL local team) and 5.0 (coordinating center). The Richard's model [13] indicated that the level of these interventions were predominantly the HP→INT→IND or the HP→ORG→IND patterns.

Qualitative results

The qualitative data from all of the communities was compiled and utilized to identify strengths and opportunities for the entire CHL intervention (see Table 5).

The complexity and variability of the CHL intervention activities provided some challenges for treatment fidelity assessment. For many activities, such as environment changes, there were only one or two activities occurring in a community. In several instances, one person was contacted for multiple activities. However, the majority of the community partners contacted spoke highly of the CHL team and the team members. Community partners understood the CHL message and supported the local CHL teams and the intervention activities. The number and variety of relationships developed by local CHL teams with individuals, groups, coalitions, and organizations showed the depth of community involvement in the intervention.

Table 5 | CHL-wide strengths and opportunities

Strengths	Opportunities

• Overall doing "Somewhat well" in 3 of the 4 cross-cutting functions
• Doing well in promoting the CHL message
• Garden training and promoting
• Training role models
• Contacts speak highly of CHL staff and efforts
• Communities are building sustainable relationships
	• Preschool wellness policy implementation
	• Environmental changes
	  - Food access and affordability
	  - Safer environment for walking, biking etc.
	• Sustaining initiatives that will not be completed by the end of the intervention period
	• Sustaining relationships with partners once the intervention period is over

As expected, the different communities used different approaches to deliver and execute the intervention activities. CHL staff, community organizations, community members, community partners, other departments within the colleges and universities, extension agents, and outside trainers were some of the approaches that were used to deliver and execute the intervention activities. Although each of the five jurisdictions used a mix of delivery methods for the intervention activities, there was a predominance of one delivery method over another between the jurisdictions. Alaska worked through local branches of statewide organizations, American Samoa worked through government and church structures, CNMI worked directly with community members, Guam engaged university cooperative extension services, and Hawaii partnered with community-based partners and organizations to deliver intervention activities.

Social marketing approaches also varied by jurisdiction. The CHL coordinating center intervention team developed a CHL social marketing campaign framework; however, the graphics were localized for each jurisdiction and, in some jurisdictions, for each community. Alaska included winter activities in campaign materials. Hawaii developed child-friendly Na Kii Ola (Native Hawaiian Superheroes) based on plants and animals with deep cultural meaning. CNMI and American Samoa both had community role models help in the design of their marketing materials, and Guam created cartoon-like children that reflected the culture.

The curricula chosen by the jurisdictions to train preschool teachers about the CHL behaviors were preapproved by the coordinating center intervention team to ensure quality and consistency of the message. Depending on which curriculum each jurisdiction chose, the activities involved to train the teachers varied to some degree. The ability for the intervention activities to adapt to local resources, needs, and cultures was built into the intervention framework [5] to assure community acceptability and to maximize buy-in.

The unstructured conversations during the site visits revealed insights about the ingenuity of local CHL efforts to leverage resources for improving children's play spaces. For example, one of the mayors in Guam obtained and refurbished playground equipment from the Defense Reutilization Management Office for a community park.

The CHL team in CNMI engaged help of teachers and parents to paint active games like hopscotch on paved play spaces in lieu of purchasing playground equipment. The American Samoa CHL team helped identify grants to maintain or add play equipment to a park. Due to the long winters in Alaska, emphasis was placed on winter activities and outdoor places that were young-child friendly. Alaska also organized a "Winter Gear for Kids Exchange." Hawaii supported a community organization that had obtained funding from Disney and KABOOM to build a new playground at their community center by assisting in community meetings, getting volunteers to assist with construction, and helping with activities for the younger children so that the parents could participate in building the playground.

The local intervention teams found fidelity monitoring to require less time than anticipated, and the results to be useful and time sensitive. They also found the exercise helpful in appreciating a bigger picture of their situation and determining areas for specific focus as they proceeded toward the end of the intervention. The coordinating center gained new perspectives and was better positioned to advise local teams on intervention efforts. The assessment also provided insight on ways to further engage community partners to sustain the intervention activities beyond this project. For example, because of discussion of the fidelity findings, one jurisdiction reconnected with community role models and started a "Healthy Stores" initiative, while another decided to step up contacts with teachers and parents to identify community role models to advocate for improvements to the built environment.

CONCLUSIONS

This treatment fidelity approach was successfully used across sites. It identified strengths and ways to improve delivery of a multi-level intervention to reduce childhood obesity, with active participation from the local intervention teams and their community partners.

The Pacific cultures, the community-based approach, and understanding the local contexts of adaptations confirmed the value of our decision to include site visits from the coordinating center staff as opposed to exclusively relying on assessment by email or telephone. The information gathered from face-to-face

discussions generated the richest feedback, followed by telephone and lastly email. However, the amount of time required to conduct face-to-face interviews was not practical for all activities. A combination of the three methods of contact provided an understanding of the intervention activities' quality without being too time consuming or making the assessment impractical.

With a multi-level, multi-component intervention, assessing 10 % of all activities provided a representative indication of implementation quality. This method has imbedded selection bias, but this was minimized by randomly selecting the participants to contact. Greater social desirability bias was expected when the participants were contacted by the local intervention teams; however, this was not evident, as responses to local teams were very similar to responses heard in coordinating center interviews. This is likely due to the standardized protocol, questions, and detailed answer anchors.

Activities directly carried out by CHL staff or that involved individually based trainings scored higher than activities that relied on partners for implementation or policy change. This finding confirms those of a systematic review, where barriers to implementation were more common when activities required collaboration with outside organizations [14, 18]. In addition, common barriers to implementation were found between communities. Cultural norms, lack of resources, and the need for CHL staff to build community relationships were cited as being the greatest barriers to timely implementation. This emphasizes the importance of devoting adequate time to build relationships that takes into account the cultural context, social norms, and resources of a community in order to implement intervention activities with integrity [14, 16].

Having the local site team conduct a self-assessment was more time consuming than having the coordinating center do it alone, and it proved beneficial to have both teams collect data. The local teams gained a deeper understanding of the different intervention components and the intervention as a whole. The coordinating center team was able to visit the sites and interact with the community and the local team. Importantly, conducting the implementation quality assessment during the intervention phase allowed the teams to make positive adjustments to the intervention activities.

A few months after the completion of the fidelity-monitoring activity, representatives from all five jurisdictions met together for the 2014 CHL meeting. At this week-long event, the jurisdictions presented their implementation timelines and worked in teams to develop relationship maps to graphically chart the existence and strength of connections between organizations in each community working toward the CHL goal [19]. These maps were helpful for identifying relationships that could be built, strengthened, and/or leveraged to assist with implementing the timelines and to promote lasting, positive change

in the health and well-being of young children. In retrospect, it would have been useful to conduct this exercise as part of the site visit. Along with the fidelity findings, these maps helped trigger jurisdictions to identify areas of focus for the last year of intervention.

The need to monitor fidelity of community-based interventions is well noted [2, 13, 16]. The CHL intervention implementation fidelity assessment method, process, and template can be easily applied to other multi-level, multi-component, multi-site, community-based interventions. Fidelity assessment helps gauge how well intervention components are being implemented, provides direction for improving intervention delivery and maximize efforts while the project is being implemented, and helps identify intervention adaptations made to tailor multi-site interventions to local context.

1. Huang TT, Drewnoskl A, Kumanyika S, et al. A systems-oriented multi-level framework for addressing obesity in the 21st century. *Preventing Chronic Disease*. 2009; 6(3): A82.
2. Cohen DJ, Crabtree BF, Etz RS, et al. Fidelity versus flexibility: translating evidence-based research into practice. *Am J Prev Med*. 2008; 35(5 Suppl): S381-9. doi:10.1016/j.amepre.2008.08.005.
3. Novotny R, Fialkowski MK, Areta A, et al. The Pacific way to child wellness: The Children's Healthy Living Program for Remote Underserved Minority Populations of the Pacific Region (CHL). *Hawai'i J Med Public Health*. 2013; 72: 406-408.
4. Novotny R, Fialkowski MK, Li F et al. Systematic review of prevalence of young child overweight and obesity in the United States–Affiliated Pacific Region compared with the 48 contiguous states: The Children's Healthy Living Program. *Am J Public Health*. 2014 epub ahead of print 2014: E1–E14. doi:10.2105/AJPH.2014.302283).
5. Braun KL, Nigg CR, Butel J, et al. Using the ANGELO framework to develop the Children's Healthy Living Program multi-level intervention to promote obesity-preventing behaviors for young children in the US Affiliated Pacific Region. *Childhood Obesity. In press.*
6. Fialkowski MK, DeBaryshe B, Bersamin A, et al. A community engagement process identifies environmental priorities to prevent early childhood obesity: the Children's Healthy Living (CHL) Program for Remote Underserved Populations in the US Affiliated Pacific Islands, Hawai'i and Alaska. *Matern Child Health J*. 2014; 18: 2261-2274.
7. Wilken LR, Novotny R, Fialkowski MK, et al. Children's Healthy Living (CHL) Program for Remote Underserved Minority Populations in the Pacific Region: rationale and design of a community randomized trial to prevent early childhood obesity. *BMC Public Health*. 2013; 13: 944-956.
8. Glasgow RE, Lichenstein E, Marcus AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *Am J Public Health*. 2003; 93: 1261-1267.
9. Dobson KS, Singer AR. Definitional and practical issues in the assessment of treatment fidelity. *Clin Psychol Rev*. 2005; 12: 384-387.
10. Sanchez V, Steckler A, Nitirat P, Hallfors D, Cho H, Brodish P. Fidelity of implementation in a treatment effectiveness trial of reconnecting youth. *Health Educ Res*. 2007; 22: 95-107.

11. Cleary M, Mackey S, Hunt GE, Jackson D, Thompson GE, Walter G. Reputations: a critical yet neglected area of scholarly inquiry. *J Adv Nurs*. 2012; 68(10): 2137-2139.

12. Valentine JC, Cooper H. A systematic and transparent approach for assessing the methodological quality of intervention effectiveness research: the Study Design and Implementation Assessment Device (Study DIAD). *Psychol Methods*. 2008; 13(2): 130-149.

13. Richard L, Potvin L, Kishchuk N, Prlic H, Green LW. Assessment of the integration of the ecological approach in health promotion programs. *Am J Health Promot*. 1996; 10(4): 318-328.

14. Richards Z, Kostadinov I, Jones M, Richard L, Cargo M. Assessing implementation fidelity and adaptation in a community-based childhood obesity prevention intervention. *Health Educ Res*. 2014; 29(6): 918-932.

15. Gearing RE, El-Bassel N, Ghesquiere A, Baldwin S, Gillies J, Ngeow E. Major ingredients of fidelity: a review and scientific guide to improving quality of intervention research implementation. *Clin Psychol Rev*. 2011; 31(1): 79-88. doi:10.1016/j.cpr.2010.09.007.

16. Waters E, de Silva-Sanigorski A, Hall BJ et al.. Interventions for preventing obesity in children. *Cochrane Database Syst Reviews*.2011; 11.

17. Foto KF, Moodie MM, Mavoa HM, et al. Process evaluation of a community-based adolescent obesity prevention project in Tonga. *BMC Public Health*. 2011; 11: 284.

18. Joffres C, Heath S, Farquharson J, et al. Facilitators and challenges to organizational capacity building in heart health promotion. *Qual Health Res*. 2004; 14: 39-60.

19. Officer SD, Price MF. Using visual reflection tools to build capacity for partnership improvement. Presented at Center for Service and Learning, IUPUI. Indianapolis, Indiana; 2012.