

Integrating Bone Health Information Into Existing Health Education Efforts

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[doi:10.1177/1941406413487769](https://doi.org/10.1177/1941406413487769)

Abstract: Consuming recommended amounts of calcium and vitamin D and participating in bone-strengthening physical activities during childhood and adolescence can help prevent osteoporosis. Both the Surgeon General's *Report on Bone Health and Osteoporosis* and the *National Action Plan for Bone Health* emphasized the importance of promoting bone-healthy behaviors during childhood and adolescence and integrating bone health information into other health promotion efforts. The *Best Bones Forever!* Three-Community Study enlisted community coalitions to: (1) incorporate bone health information into community outreach and education activities; and (2) implement BodyWorks, a nutrition and physical activity program for parents and daughters that was modified to include bone health content. Results indicated that the sites successfully exposed their communities to bone health information by integrating bone health messages into community outreach and education activities. Participants in the modified BodyWorks program showed significant improvements in most measures of bone-health knowledge, attitudes, self-efficacy, behaviors, and intentions. These findings suggest that incorporating bone health messages into related health promotion efforts around healthful eating and physical activity was both feasible and effective.

Keywords: bone health; community health promotion; nutrition; osteoporosis prevention

Integrating Bone Health Information Into Existing Health Education Efforts

The 2004 Surgeon General's report on bone health and osteoporosis recognized the contribution of bone health to quality of life and emphasized the importance of promoting bone-healthy behaviors during childhood and adolescence.¹ Engaging in bone-healthy behaviors, such as consuming recommended amounts of calcium and vitamin D as well as participating in bone-strengthening physical activities, during childhood and adolescence can help prevent osteoporosis.¹⁻⁶ Promoting bone healthy behaviors to girls is important because females attain 90% of their skeletal mass by age 18⁷ and women are at higher risk for bone diseases.⁸ The Surgeon General's report also recommended integrating bone health information into other health promotion efforts because of similarities among key messages about healthful eating and physical activity. The 2009 National Action Plan for Bone Health reported that bone health messages have not been well integrated with other health messages and programs about the importance of healthy lifestyles in preventing chronic diseases.⁹

This paper describes a collaborative project that focused on integrating bone health messages from the *Best Bones Forever!* campaign into community-based promotional and educational activities related to nutrition and physical activity. The U.S. Department of Health and Human Services' Office on Women's Health (OWH), the Centers for Disease Control and Prevention, and the National Osteoporosis Foundation launched a national bone health campaign for girls in 2001.^{10,11} In 2008-2009, the campaign was updated and rebranded as *Best Bones Forever!* to better target girls 9 to 14 years old.¹² The rebranded campaign is informed by ecological models, which posit that multi-level interventions are most effective in changing behavior because multiple factors exist and interact to influence an individual's behavior at intrapersonal, interpersonal, organizational, community, and public policy levels.¹³

The *Best Bones Forever!* Three-Community Study was created to study the process used and outcomes achieved when coalitions within a community address multiple ecological model levels and expand the opportunities girls have to engage in bone-healthy behaviors with their peers, increase their motivation by offering enjoyable activities consistent with the campaign, and improve their abilities by teaching relevant skills. The study enlisted three community coalitions to (1) incorporate bone health information into current or new community outreach and education activities; and (2) implement BodyWorks,¹⁴ an OWH program designed to help parents and caregivers of adolescents improve family eating and activity habits, which was modified to include bone health information. Process and outcome evaluations were conducted to identify promising practices and activities to share with other communities.

This paper focuses on two research questions: (1) Were the coalition sites able to expose their communities to bone health information by integrating bone health into their community outreach and education activities? and (2) Was it effective to include bone health content in a general nutrition and physical activity education program?

Methods

***Best Bones Forever!* Three-Community Study Overview**

The *Best Bones Forever!* Three-Community Study team included personnel from OWH, a communications firm that managed the project, and an evaluation firm. Three community coalitions were selected to participate from among those responding to a Request for Proposals. The community sites were coalitions in Pinal County, Arizona; North Las Vegas, Nevada; and Ulster County, New York. Coalitions varied in their focus, longevity, cohesiveness, and types of member organizations. All reported experience delivering nutrition education programs; two had implemented the original BodyWorks program. Communities had two obligations: to plan and implement community education and outreach

activities that integrated bone health content and to implement four cycles of a modified BodyWorks program.

Community education and outreach activities. The community sites were asked to plan and implement community education and outreach activities that incorporated bone health information in ways they thought best fit their community. Resources such as *Best Bones Forever!* educational and promotional materials were available to the sites to assist their efforts.

Modified BodyWorks program. BodyWorks is a multi-session program that focuses on parents as role models and provides them with tools to make small, specific changes in their eating and exercise behaviors. As part of the *Best Bones Forever!* Three Community Study, the BodyWorks program was adapted to include bone health information. Additionally, a companion program for 9 to 14 year old daughters was developed and implemented that focused on the same general healthy eating and exercise objectives as the parents' program, included bone health content, and also provided opportunities for engaging in bone-strengthening physical activities. The parent and daughter programs met separately, with the exception of three sessions that were conducted with parents and daughters together.

Evaluation Methods

Qualitative and quantitative methods were used to collect process and outcome data for this evaluation (See Table 1).

Table 1. Data collection methods for *Best Bones Forever!* Three-Community Project

Data Collection Method	Participants	Focus
Review of coalition site documents, (e.g. quarterly reports, monthly reports)	Coalition members	Reach of specific community outreach and education activities
Telephone Interviews (n=11)	Coalition representatives from each site and <i>Best Bones Forever!</i> campaign team leaders	Coalition structure and activities
Pretest and Posttest Questionnaires (n=271)	Parents and daughters who participated in the BodyWorks program and no-intervention comparison group	Outcome evaluation of BodyWorks program

Coalition site documents, including monthly reports, meeting agendas and minutes, evaluation summaries, and final reports were reviewed to determine the types and reach of community outreach and education activities. When the study concluded, telephone interviews were conducted with the coalition leader, site coordinator, and a coalition member at each site (n=9) and two *Best Bones Forever!* staff to gain a deeper understanding of their experiences with the project overall and to provide additional detail on outreach and education activities.

A quasi-experimental design was used to evaluate the modified BodyWorks program. Pretest and posttest questionnaires were completed by program participants (n=159) and a no-intervention comparison group (n=112) constructed using five community organizations in another metropolitan area

selected for demographic similarities to the community sites. The questionnaires included items related to bone health knowledge, attitudes, self-efficacy, and behaviors (See Table 2 for items).

Table 2. Bone-health related items from the BodyWorks pretest and posttest questionnaires

Construct and Items	Response Options
<p>Knowledge¹</p> <p>Which foods contain calcium? (Check all that apply: <i>milk, fortified orange juice</i>, peaches, <i>broccoli</i>, water)</p> <p>The most important time in a female's life for building strong bones is when she is a...Baby or young child (ages 0-8), <i>Preteen or teen girl</i> (ages 9-18), Young women (ages 19-29), adult woman (ages 30-54), Older woman (age 55+)</p>	<p>19 multiple choice questions</p>
<p>Attitudes</p> <p>How important to you is...</p> <ul style="list-style-type: none"> • Eating and drinking foods and drinks that are high in calcium and vitamin D as part of regular meals and snacks every day? • Preventing diseases like osteoporosis (a disease that causes bones to become brittle and break more easily) later in life? <p>How important is it to you that your daughter is...²</p> <ul style="list-style-type: none"> • Eating and drinking foods and drinks that are high in calcium and vitamin D as part of regular meals and snacks every day? • Preventing diseases like osteoporosis (a disease that causes bones to become brittle and break more easily) later in life? 	<p>1=Not at all to 4=Very important</p>
<p>Self-efficacy</p> <p>Do you think you can ...</p> <ul style="list-style-type: none"> • Choose healthier foods and drinks, including foods with calcium & vitamin D? • Do bone-strengthening physical activities (walking, running, jumping rope)?³ <p>Do you think you can help your daughter...²</p> <ul style="list-style-type: none"> • Choose healthier foods and drinks, including foods with calcium & vitamin D? • Exercise for 60 minutes each day, including bone strengthening activities (high-impact activities such as running or jumping rope)? 	<p>1= No, not at all to 4=Yes, definitely</p>
<p>Dairy Consumption</p> <p>Thinking about what you eat on an average day, how many times do you eat or drink...Milk or milk products (yogurt, cheese) or milk substitutes (soy)?</p>	<p>0=0 times to 5=5 or more times</p>
<p>Intentions</p> <p>During the next month, I plan to...</p> <ul style="list-style-type: none"> • Eat and drink more foods and drinks high in calcium and vitamin D • Exercise more often, including bone-strengthening physical activities.³ 	<p>1=Strongly disagree to 4=Strongly agree)</p>

¹Sample of knowledge items. Italicized options indicate the correct responses.

²Asked to parents only

³Asked to daughters only

Analysis

Content analysis of site documents determined the types and reach of community education and outreach activities. Clarification of these activities and discrepancies among documents were resolved during the telephone interviews. Notes from telephone interviews were summarized and coded to identify common themes and key differences across sites.

Quantitative data from the BodyWorks participants' and the comparison group's pretest-posttest questionnaires were analyzed using nonparametric statistics due to small sample size, unequal group sizes, and non-normally distributed data using SPSS (SPSS for Mac, GradPack 17.0). No baseline adjustments were made because few pretest differences were found between the groups. Analyses determined if within-group and between-group differences existed in bone health knowledge, attitudes, self-efficacy, and behaviors between the BodyWorks participants and the comparison group. Analyses included cross-tabulation analyses with chi-square tests of significance, the Mann-Whitney U-test, and the Wilcoxin test.

Results

Ability to Integrate Bone Health Content Into Community Outreach and Education Activities

The community sites promoted bone health at health fairs and community events, gave presentations to community and professional organizations, and engaged in other promotional activities. (See Table 3).

Community events and health fairs. The communities promoted bone health by distributing materials at booths and tables they staffed at a total of 30 existing community events and health fairs. Over 13,000 community members attended these events and had the opportunity to be exposed to the bone health messages. Sites used a variety of strategies to draw attention to their booths, including an interactive display created by the *Best Bones Forever!* campaign that allowed girls to have their picture taken with skeleton figures, dance performances by girls in skeleton costumes, smoothie demonstrations, milk taste tests, and other giveaways.

Presentations to community and professional organizations. The three communities provided at least 22 presentations to community and professional organizations, exposing more than 900 people to bone health information. Presentations to community organizations were made to groups such as 4-H club chapters, local Girl Scout troops, Family Fitness and Nutrition nights held at community schools, and during the USA Gymnastics Camp. Bone health information was presented at annual professional meetings including the Black Nurses Association and the School Nurses Association. Additional presentations to health professionals were given during the New York Osteoporosis Prevention and Education Program and the Area Health Education Center (AHEC) Annual Continuing Education Program.

Promotional activities. Communities promoted bone health information through local media coverage, a performance at a university sporting event, and a school environment promotion. These promotional activities potentially reached over 1.3 million people. The largest activity was a school-based promotion. The community worked with a local dairy company to have the *Best Bones Forever!* logo and the message "Drink milk, build best bones forever!" printed on milk cartons sold in school cafeterias.

Effectiveness of Including Bone Health Information in a General Health Program

BodyWorks participants. A total of 125 parents and 146 girls completed the pretest and posttest questionnaires, with 71 parents and 88 girls in the BodyWorks program and 54 parents and 58 girls in the comparison group. Parents in both the BodyWorks program and the comparison group were primarily

women between the ages of 31 to 50 (>90%). They self-identified as white (60%), Hispanic (26%), black or African American (11%), and other (3%). The girls participating in the BodyWorks group and the comparison group were between the ages of 9 and 14 years.

Table 3. Overview of communication and outreach activities conducted by the community sites

Activity	Community Sites		
	Arizona	Nevada	New York
Community events and health fairs	<ul style="list-style-type: none"> • 9 community events (Total estimated event attendance: 7,540) 	<ul style="list-style-type: none"> • 15 community events (Total estimated event attendance: 3,230) 	<ul style="list-style-type: none"> • 6 community events • Booth visitors at 4 events: 1,077 • Estimated attendance at 1 event: 1500 • 1 event: no attendance reported
Presentations to community organizations	<ul style="list-style-type: none"> • Presentations to 4-H Club Chapters, local Girl Scout troops, Celebrating Women of Today and Tomorrow at local middle schools, and USA Gymnastics Camp • Estimated attendance for events reporting attendance: 160 	<ul style="list-style-type: none"> • 12 presentations at Family Fitness and Nutrition Nights at area schools, Pearson Community Center, HELP of Southern Nevada Baby First Program¹ • Total estimated attendance for events reporting attendance: 710 	<ul style="list-style-type: none"> • 1 presentation at New Horizon Program (high school students)¹
Presentations to professional organizations	<ul style="list-style-type: none"> • Not conducted 	<ul style="list-style-type: none"> • Black Nurses Association¹ • AHEC Annual Continuing Education Program¹ 	<ul style="list-style-type: none"> • New York Osteoporosis Prevention and Education Program (32 providers) • Health and Human Service Providers Fair (35 providers) • School Nurses Association¹
Promotional activities	<ul style="list-style-type: none"> • Stories in local media surrounding the campaign launch² • Lady Sun Devils Basketball Team Event: Flock of Skeletons dancers performed with ASU cheerleaders¹ 	<ul style="list-style-type: none"> • Hosted national campaign launch¹ • <i>Best Bones Forever!</i> logos printed on 1.3 million milk cartons distributed in Clark County school cafeterias. • <i>Best Bones Forever!</i> posters hung in some of the school cafeterias.¹ 	<ul style="list-style-type: none"> • Stories in local media surrounding the campaign launch² • Article in Hudson Valley Parent publication²

¹Attendance figures not reported

²Circulation figures not reported

BodyWorks outcomes. Compared to their pretest scores and the comparison groups' posttest scores, parents and girls in the BodyWorks program significantly increased bone health knowledge (all $P < .001$).

Items showing the largest increases in the percentage of correct responses among BodyWorks participants included knowing the daily recommendation for calcium consumption, the most important time in a female's life for building strong bones, and that salmon contains vitamin D. At pretest, most parents and girls (>80%) already knew that consuming foods high in calcium and vitamin D can help build strong bones, that milk contained calcium and vitamin D and that drinking soda would not help build strong bones.

Parents and girls in the BodyWorks program also increased the importance they attached to consuming calcium and vitamin D-rich foods and preventing diseases like osteoporosis (all $P < .05$), as well as their self-efficacy to engage in bone health-related behaviors (all $P < .05$ except for one parent item) in comparison to their pretest scores (See Table 4 for parents' outcomes and Table 5 for girls' outcomes). In contrast, no significant gains from pretest to posttest were found for comparison group parents or children on these items.

Table 4. Within-group and between-group differences for BodyWorks (n=71) and Comparison Group (n=54) Parents

Construct/Item	Pretest-posttest Within-group Differences ¹				BodyWorks Group and Comparison Group Posttest Between-group Differences ²		
	Comparison Group		BodyWorks Group		U	z	p
	z	p	z	p			
Bone Health Knowledge	-1.16	.87	-4.67	<.001	975	-4.73	<.001
Attitudes: Importance of:							
Consuming calcium/vitamin D (Ca/VitD)-rich foods	-.25	.81	-4.31	<.001	975.5	-5.48	<.001
Preventing diseases like osteoporosis	-.21	.84	-2.21	.03	1590.0	-2.07	.04
Daughter consuming Ca/VitD-rich foods	-.78	.44	-3.18	.001	1425.5	-3.49	<.001
Daughter building bones to prevent disease	-.87	.38	-2.63	.009	1573.5	-2.59	.01
Self-efficacy to:							
Choose Ca/VitD -rich foods	-.50	.62	-3.77	<.001	1511.0	-3.07	.002
Help daughter choose Ca/VitD -rich foods	-1.29	.20	-3.40	.001	1480.5	-3.01	.003
Help daughter exercise daily, including bone-strengthening exercise	-.41	.68	-3.32	.001	1582.0	-1.86	.06
Daily consumption of Milk/milk products	-1.49	.14	-4.27	<.001	1200.5	-3.55	<.001
Intention³ in the next month to consume more Ca/VitD foods	-	-	-	-	1185.0	-4.10	<.001

¹Based on Wilcoxin test

²Based on Mann-Whitney U test

³ Asked on posttest only

Table 5. Within-group and between-group differences for BodyWorks (n=88) and Comparison Group Girls (n=58)

Construct/Item	Pretest-posttest Within-group Differences ¹				BodyWorks Group and Comparison Group Posttest Between-group Differences ²		
	Comparison Group		BodyWorks Group		U	z	p
	z	p	z	p			
Bone Health Knowledge	-1.56	.12	-6.37	<.001	1524.0	-4.14	<.001
Attitudes: Importance of:							
Consuming calcium/vitamin D (Ca/VitD)-rich foods	-0.02	.99	-3.48	.001	1416.5	-4.76	<.001
Preventing diseases like osteoporosis	-1.49	.14	-2.39	.02	1838.0	-3.21	.001
Self-efficacy to:							
Engage in bone-strengthening exercise	-0.19	.85	-3.11	.002	2016.5	-2.20	.03
Choose Ca/VitD-rich foods	-0.34	.73	-3.09	.002	1824.0	-3.30	.001
Daily consumption of Milk/milk products	-0.75	.46	-1.65	.10	2298.5	-.76	.45
Weekly frequency of bone-strengthening exercises (walking, running, jumping rope)	-1.41	.16	-3.77	<.001	2265.0	-.63	.53
Intention³ in the next month to							
Consume more Ca/VitD foods	-	-	-	-	1708.0	-3.7	<.001
Exercise more, including bone-strengthening activity	-	-	-	-	2411.0	-.52	.60

¹Based on Wilcoxin test

²Based on Mann-Whitney U test

³Asked on posttest only

BodyWorks parents significantly increased their milk/milk product consumption compared to their reported consumption at pretest and the comparison group's consumption levels at posttest ($P < .001$ for within-group and between-group differences). At the time of the pretest, only 36.5% of the BodyWorks parents reported consuming 3 or more servings of milk/milk products, but at posttest 72.4% did. No significant changes in milk/milk product consumption were found for the girls in either group, with their consumption remaining at a median of 3 servings per day. BodyWorks girls' posttest data showed a significant increase in the number of days they engaged in bone-strengthening exercise in the past week ($P < .001$) compared to their pretest scores, which allowed them to attain the same activity level of the comparison group girls who started off with a higher activity level but showed no change from pretest to posttest. BodyWorks parents and girls reported significantly stronger intentions to consume calcium and vitamin-D rich foods at posttest than the comparison group (all $P < .001$). There was no significant post-test difference between the BodyWorks and comparison groups in girls' intentions to engage in bone-strengthening physical activity, with most strongly agreeing that they planned to do so.

Discussion

This project focused on increasing exposure to bone health information through community-based outreach and education activities and incorporating bone health information into a general nutrition and physical activity education program. Three community sites were selected to integrate bone health

messages from the *Best Bones Forever!* campaign into community-based promotional activities and to implement a version of the BodyWorks program that was modified to include bone health information.

Each site's coalition was made up of diverse community organizations with different expertise and the roles and engagement of coalition members varied. Despite these differences, each coalition successfully integrated bone health into a variety of community activities and programs. Potentially, more than 10,000 people were exposed to the campaign through community activities, with an additional 1.3 million exposed via milk cartons in one site. Each site developed creative approaches to addressing girls' bone health that OWH plans to disseminate to other communities. While this research examined only potential exposure, site leaders reported increasing public awareness of bone health as one of their most important successes.

Findings from the BodyWorks outcome evaluation showed that bone health messages could be incorporated successfully into a general nutrition and physical activity program. BodyWorks participants significantly increased bone-health related knowledge, attitudes, and self-efficacy, as well as some behaviors and intentions. By the end of the program, the percentage of BodyWorks parents consuming three or more servings of dairy products doubled from their pretest reports and the number of BodyWorks girls engaging in three or more days of bone-strengthening physical activity also significantly increased.

Nutrition educators should be empowered by the results of this research to begin incorporating bone health information into their own educational and outreach efforts. Findings from the BodyWorks evaluation suggested that while many were aware that they needed calcium and vitamin D for strong bones and that milk was a source of calcium and vitamin D, they benefitted from specific information about daily recommendations for each, additional food sources, and bone-strengthening physical activity. Helping participants see the importance of focusing on bone health by providing information about bone health benefits and risks along with increasing their confidence in performing recommended behaviors by offering opportunities to engage in these behaviors were also key components of the BodyWorks program. Additional resources and materials to support the efforts of nutrition educators are readily available from the national *Best Bones Forever!* campaign website (www.bestbonesforever.gov). This study used BodyWorks as the health education program, which is available from OWH; however, the strategy of including bone health information could be applied to other programs that nutrition educators currently deliver.

These findings represent a step in examining the feasibility and effectiveness of incorporating bone health information into existing health promotion and education activities. As stated above, this project examined potential exposure during community promotion activities. Future research should examine whether target audiences actually receive and act on the messages received through brief exposures. While the evaluation of the modified BodyWorks program found positive changes for those participating in the program, the sample for the BodyWorks study was not randomly selected. Additional research is needed to generalize the findings to a broader population.

The Surgeon General called for efforts to promote bone health to girls in their prime bone-building years and to integrate bone health messages into existing health promotion activities because of the similarity in key messages. The *Best Bones Forever!* Three-Community Study showed that bone health information can be integrated into existing community-based activities and programming to reach girls in this target age range. At the project's conclusion, coalition members noted that there were still many in their communities and elsewhere who need greater awareness of bone health-promoting behaviors. This study identified strategies that can be adopted and adapted by other communities to meet these needs.

Conflict of Interest or Disclosure Statements

The Authors declare that there is no conflict of interest.

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