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Social marketing approaches to nutrition and physical activity interventions in early care and education centers: A systematic review

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Abstract

Introduction—Social marketing is a promising planning approach for influencing voluntary lifestyle behaviors, but its application to nutrition and physical activity interventions in the early care and education setting remains unknown.

Methods—Pubmed, ISI Web of Science, PsycInfo, and the Cumulative Index of Nursing and Allied Health were systematically searched to identify interventions targeting nutrition and/or physical activity behaviors of children enrolled in early care centers between 1994 and 2016. Content analysis methods were used to capture information reflecting eight social marketing benchmark criteria.

Results—The review included 135 articles representing 77 interventions. Two interventions incorporated all eight benchmark criteria, but the majority included fewer than four. Each intervention included behavior and methods mix criteria, and more than half identified audience segments. Only one-third of interventions incorporated customer orientation, theory, exchange,

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and insight. Only six interventions addressed competing behaviors. We did not find statistical significance for the effectiveness of interventions on child-level diet, physical activity, or anthropometric outcomes based on the number of benchmark criteria used.

Conclusion—This review highlights opportunities to apply social marketing to obesity prevention interventions in early care centers. Social marketing could be an important strategy for early childhood obesity prevention efforts, and future research investigations into its effects are warranted.

Keywords

social marketing; early care and education; obesity prevention interventions

Introduction

Interventions that address child overweight and obesity remain an important, international public health priority (1). Early childhood, ages 2 – 5 years, has been identified as a critical time to impact lifelong weight-related behaviors (2, 3), but to date, public health efforts have made little progress to reduce overweight and obesity in young children (4, 5). Since approximately one-third of children under the age of six in the United States spend an average of 25 – 30 hours per week in center-based early care and education (6), this is an opportune setting for interventions to influence obesogenic behaviors (7-10). Many early care and education-based interventions have been developed to address dietary and physical activity behaviors, but the results have been inconclusive regarding what works (11, 12). Based on the number of children who are at risk for overweight and obesity, and the lack of evidence for effective obesity prevention strategies, it is essential to identify how to develop more useful approaches for interventions in early care and education settings (13).

Social marketing is one possible approach for enhancing early care and education-based interventions. Social marketing emerged as a discipline in 1971 as a way to address social problems including health and the environment (14). In 1994, Andreasen defined social marketing as “the application of commercial marketing technologies to the analysis, planning, execution and evaluation of programs designed to influence the voluntary behavior of target audiences in order to improve their personal welfare and that of their society”(15). Core concepts of social marketing have been applied to design interventions that successfully influenced voluntary lifestyle behaviors, such as reducing tobacco use, increasing immunizations, and increasing fruit and vegetable consumption (16). Specifically, the social marketing approach: 1) emphasizes understanding the perspectives of the full range of target audiences necessary to bring about change (e.g., children and midstream audiences such as child care providers, center directors, or parents), 2) underscores the importance of developing a research-based program, relying on formative research to develop and test concepts with members of the target audience(s), and 3) recognizes the need to include all elements of the methods mix (i.e., product, price, place, promotion) to bring about behavior change (16). In addition, social marketing acknowledges that there are multiple levels of influence on individuals' health behaviors – downstream (i.e., intrapersonal level), midstream (i.e., interpersonal), and upstream (i.e., organizational or public policy level). Accordingly, social marketing can be applied to change voluntary

behaviors of upstream targets (e.g., policy makers), midstream targets (e.g., children's caregivers), and/or downstream targets (e.g., children).

The National Social Marketing Centre has developed a set of eight social marketing benchmark criteria to promote the understanding and use of core social marketing concepts (17, 18). The Centre's benchmark criteria are a set of integrated concepts, or domains, and include: behavior, customer orientation, theory, insight, exchange, competition, segmentation and methods mix (Table 1). The benchmark criteria provide a useful framework for assessing the extent to which an intervention is consistent with the social marketing approach and for identifying opportunities to potentially increase the impact of an intervention (17). Although many interventions may not consciously apply the benchmark criteria, some or all of the underlying concepts of the criteria are often present in intervention design. Gracia-Marco et al. (19) and Aceves-Martins et al. (20) reviewed the use of benchmark criteria in childhood obesity prevention programs. More specifically, Gracia-Marco et al. reviewed community-based interventions targeting participants 18 years and younger from 1990 to 2009 and found increasing use and reporting of social marketing benchmark criteria. Aceves-Martins et al. reviewed school-based interventions for participants aged 5 to 17 years from 1990 to 2014 and found that the inclusion of at least five benchmark criteria in the development of school-based interventions could benefit efforts to prevent obesity in young people.

Although there is evidence that interventions utilizing a social marketing approach can improve dietary and physical activity behaviors (15, 16, 21, 22) and effectively support behavior change among children aged 5 to 18 years (23-27), explicit application of the social marketing approach to design interventions for young children within the early care and education setting has been rare. However, as previous reviews have shown, social marketing still provides a useful lens through which to describe the development, refinement, and evaluation of interventions. The social marketing approach and its benchmark criteria describe a rigorous planning process, similar in some ways to intervention mapping (28). In fact, social marketing and intervention mapping include many similar elements such as clarifying specific goals and behavioral targets, integrating theory, and incorporating formative work and pilot testing. Hence, the social marketing approach and its benchmark criteria can still provide an informative method for describing the thoroughness of the intervention design process even when applied to interventions that are not explicitly described as social marketing.

Therefore, the primary aim of this study is to assess the use of social marketing benchmark criteria to develop and implement diet and physical activity interventions in early care and education centers and to identify opportunities to apply benchmark criteria to the development and implementation of such interventions in the future. A second, exploratory aim is to determine whether there is a relationship between the application of the benchmark criteria and the effectiveness of interventions in the early care and education setting. A novel, interdisciplinary approach that combined the systematic review method typical of health behavior intervention assessment with the content analytic methods commonly used in the field of mass communication was employed to achieve the aims of this study. Interdisciplinary work, including the integration of techniques and tools from different

disciplines, is increasingly recognized as important for confronting and addressing complex issues, such as obesity prevention (29).

Methods

Study Design

A systematic review of early care and education-based interventions targeting children's dietary and/or physical activity behaviors was conducted. This review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (30). It was registered with PROSPERO (Registration number: CRD42015026611) and can be accessed at http://www.crd.york.ac.uk/prospero/.

Search strategy

The initial search was conducted in October 2014 using four search engines: Pubmed, ISI Web of Science (limited to the Core Collection, MEDLINE, and SciELO database), PsycInfo, and the Cumulative Index of Nursing and Allied Health. The search was updated in April 2016. The search was designed to identify interventions or campaigns targeting dietary and/or physical activity behaviors of children enrolled in early care and education centers. Search terms were selected to capture the setting (e.g., child care), intervention (e.g., intervention, campaign), and outcomes of interest (e.g., diet, physical activity, weight). A detailed description of search terms can be found in Supplemental List S1. The search was limited to publications in the English language since January 1994 that focused on children aged 0 to 5 years.

Study selection

Text files of citations were extracted from each database and imported to Refworks online software (Proquest LLC) to identify and remove duplicates. One author (CL) screened titles. Two authors (CL, CI, SM) screened each abstract to identify studies that potentially met inclusion and exclusion criteria. Disagreements were resolved through discussion. Full text articles were then retrieved and assigned to pairs of authors (all authors involved) to screen for eligibility. Covidence systematic review software (Veritas Health Innovation) was used to track each author's decision regarding inclusion or exclusion and to document resolutions for disagreement. Disagreements were discussed by all authors. In order to comprehensively code interventions, the reference list of included articles was reviewed to identify all relevant publications that had been published for a particular intervention. All publications related to a specific intervention were grouped together for coding.

Inclusion criteria—To be included, the study population had to include healthy children aged 2 to 5 years. There must have been an intervention or campaign that targeted dietary behaviors (e.g., quantities, proportions, or variety of foods and drinks), physical activity (e.g., motor skills, intensity/frequency/duration of activity), and/or sedentary time (e.g., screen time). Additionally, interventions or campaigns must have been delivered in the early care and education setting during normal operating hours (i.e., excluding afterschool programs). Although the aim of this review was to describe the use of social marketing principles in the early care and education-based interventions, studies did not have to self-

identify as utilizing a social marketing approach. Outcomes had to quantitatively report changes in children's dietary intake or physical activity. Randomized control or cluster trials, quasi-experimental, and single group designs were included.

Exclusion criteria—Studies that focused on health problems, diseases, or samples exclusively of children with special needs were excluded. Interventions that manipulated or focused on an individual food or nutrient (e.g., feeding studies, repeat exposure techniques for a single food), solely used early care and education centers for recruitment for interventions delivered outside of the child care setting, were based in family or home child care facilities, or treated obesity were excluded. Case studies, qualitative studies, and non-experimental designs were also excluded.

Data extraction protocol

In line with systematic review procedures, a protocol for extracting and coding information from identified studies was developed. Content analysis, a research method commonly used in in a number of disciplines to systematically study texts (31), was used to identify and code characteristics of interest from the included interventions. The rigor associated with this method stems from creating a detailed protocol so that research team members consistently identify what and how to code material (31). Three authors (CL, HH, CI) piloted a draft protocol using three school-based interventions (outside the scope of this review) to practice coding and discuss revisions to improve the precision and consistency of data extraction. Then, the team underwent extensive training on the use of the protocol, including practice coding of four school-based interventions, before beginning data extraction.

In addition to basic study characteristics, the final protocol captured and coded characteristics of the intervention and the use of each of the eight social marketing benchmark criteria (see Supplemental List S2). Because the primary aim of this review was to examine the use of social marketing benchmark criteria, the protocol did not evaluate the quality of study design or potential for bias. The benchmark criteria were operationalized based on the literature (16, 21, 32) and the National Social Marketing Centre in the United Kingdom (17) (Table 1). For example, the act of gaining *insight* to motivational forces behind the target audience's thoughts and actions was assessed by answering yes or no for whether 1) any publication associated with the intervention revealed benefits and/or barriers from formative work, 2) the intervention was designed to promote the perceived benefits of adopting or ceasing the targeted behavior(s), and/or 3) the intervention was designed to decrease perceived barriers or costs of adopting or ceasing the targeted behavior(s). When summarizing data, and in alignment with other investigations regarding the use of benchmark criteria (19, 20), interventions were given credit for including specific benchmark criteria when at least one attribute of the criterion was addressed. For example, interventions received credit for customer orientation if they performed formative research, pretesting of messages, and/or pilot tested the feasibility of the intervention. Additionally, the protocol captured whether publications explicitly used the term ‘social marketing.’

The final protocol also captured study outcomes and process evaluation. The primary outcomes of interest were at the child level (e.g., dietary intake, physical activity, weight). When summarizing outcome information, results of child-level behaviors were coded in a dichotomous manner to reflect any successful vs. not successful outcomes (12). Success was defined as at least one statistically significant ($p < 0.05$) change favorable for the intervention arm. Effectiveness was independently coded for dietary, physical activity, and/or anthropometric outcomes for each intervention. In addition to these child-level outcomes, the protocol also captured when outcomes were evaluated for other targeted market segments (e.g., parents, child care providers). A key tenet of the social marketing approach is the use of segmentation to identify and target multiple stakeholders (18). Ideally, outcome evaluation will capture behavior change among each of the target market segments, whether downstream or upstream (33), in order to evaluate outcomes of social marketing interventions in a manner that aligns with intervention design (16, 33, 34).

Using this protocol, each intervention was reviewed independently by two authors based solely on published information. All authors contributed to this process and the team met periodically to resolve disagreements.

Data analysis and synthesis

Data analysis was carried out using IBM SPSS version 24.0. Primarily descriptive statistical tests were undertaken to determine the prevalence of the benchmark criteria across the study interventions. Following this, a series of chi-squared tests were conducted to determine the relationship between the number of benchmark criteria addressed in a study and success in favorably changing dietary, physical activity, and/or anthropometric outcomes.

Results

Results of the systematic review

The search strategy yielded 10,522 records. After removing duplicates and screening titles and abstracts, 185 full-text articles were reviewed for inclusion. Ultimately, 135 publications representing 77 unique interventions were included (Supplemental List S3). Figure 1 illustrates results from the search and review process; and Table 2 provides a detailed summary of included intervention studies and their use of benchmark criteria and outcomes.

Nearly half the interventions (47%) were conducted in the United States. Interventions were also conducted in Australia (10%), the United Kingdom (9%), Germany (5%), China (4%), Switzerland (4%), Belgium (3%), Chile (3%), Israel (3%), and Thailand (3%). Greece, Portugal, Sweden, Finland, Iran, Colombia, and Turkey each hosted a single intervention, and one intervention was tested across multiple countries. A majority of studies (60%) involved a randomized control trial at either the group or individual level. Other study designs represented in the sample included: quasi experimental, single group, and cross over.

Presence of social marketing benchmark criteria

Behavior—Social marketing is intended to change people's actual behavior, not simply knowledge, beliefs, or attitudes. Hence, it is important for interventions to clearly identify

the behavior(s) being targeted for change. Given the inclusion criteria for this review, all the interventions addressed a specific, measurable, and time-bound behavior goal for children (Table 3). Twenty-one interventions targeted dietary behaviors, 31 targeted physical activity, and 25 targeted both dietary and physical activity behaviors (Table 2). Across the 77 interventions, a range of dietary and/or physical activity behaviors were targeted. The most commonly targeted dietary behaviors included increasing consumption of healthy foods, specifically fruit and vegetables, and/or decreasing consumption of high calorie snacks and beverages. The most commonly targeted physical activity behaviors included increasing the intensity and/or minutes of physical activity, improving locomotor or gross motor skills, and/or decreasing sedentary behaviors such as screen time.

Customer orientation—Customer orientation involves making the target audiences(s) central to the planning process, often through formative research, pretesting, and pilot testing. Approximately one-third (34%) of the interventions incorporated some form of customer orientation into their approach. More specifically, 16% conducted formative research with one or more target audience(s), most often this involved focus group discussions or key informant interviews with midstream audiences such as child care teachers or parents. None of the interventions conducted formative work with the downstream, child audience. Another 14% pretested intervention materials or practices with one or more members of the target audience(s), which often involved using focus groups with teachers and parents to get reactions about planned intervention delivery or materials. Pilot testing was conducted in 17% of interventions with the goal of assessing intervention feasibility (e.g., acceptability, compliance, etc.).

Theory—Behavioral theories can strengthen intervention design by helping identify what influences behavior as well as the process of behavior formation or change. Social marketing itself is not a theory; rather, it is an approach that guides the process of intervention development. Theory is an important part of this process as it will help inform content and messaging of the intervention. Approximately one-third of the interventions (34%) in this sample mentioned using one or more behavior change theories to plan, implement, or evaluate the intervention. The Social Cognitive Theory was used for 14% of interventions and the Social Learning Theory was used for 8% of interventions. The Health Belief Model and the Transtheoretical Model each were used for 4% of interventions. Other theories, including Competence Motivational Theory, Exchange Theory, Self Determination Theory, and Theory of Reasoned Action, were mentioned by 20% of interventions. In addition, nearly a quarter of interventions (22%) mentioned the Social Ecological Model, Community-based Participatory Research, Intervention Mapping, or another planning model or framework to guide the intervention development process.

Insight—A keen understanding of the motivational forces behind the target audience's thoughts and actions obtained through customer orientation efforts can help sharpen intervention design. Gaining this often involves identifying target audiences' perceived benefits and barriers around changing their behavior(s). Approximately 29% (n=22) of the interventions were designed to promote perceived benefits and/or decrease perceived barriers or costs of adopting or ceasing the targeted behavior(s). Only five of these

interventions derived insights regarding perceived benefits and barriers directly from formative research with one or more target audience(s). While formative work privileges the voice and perceptions of the target audience, insights may also be derived from existent literature/research with similar audiences; both contribute to customer orientation and insight. Most often these efforts to gain insight into perceived benefits and barriers focus on child care teachers and/or parents; rarely is the child perspective considered. Perceived benefits to changing behavior often centered on improving health and promoting learning; barriers to changing behavior often related to time, space, or cost.

Exchange—Exchange involves considering the actual and perceived costs (or price) the target audience associates with adopting the desired behavior change. Effective social marketing messages try to attenuate actual and perceived costs while also strengthening the appeal and value of the desired behavior change. Customer orientation and insight are critical elements that help ensure that exchange can be adequately addressed in the intervention. Nearly one-third of the interventions (n=24) considered the benefits and/or costs of adopting behavior change. Most often this manifested by promoting benefits (e.g., to improve health, to promote learning) and/or minimizing barriers (e.g., space, equipment) through some aspect of the intervention (n=22). According to the National Social Marketing Centre, the price ‘P’ of the methods mix is an important element of exchange. Only six interventions (8%) specifically addressed financial, psychological, or social costs of adopting the desired behavior(s).

Competition—Intervention design can be strengthened through explicit consideration of the options available to the target audience that compete with the desired behavior. For example, interventions promoting increased consumption of fruits and vegetables must recognize that sweet and salty snacks are competing for space on children's plates. Similarly, interventions encouraging increased physical activity are competing with sedentary activities like watching TV and playing video games. Ideally, the intervention will seek to minimize the competing behaviors. In this sample, only six interventions (8%) explicitly acknowledged behaviors that compete with the desired behavior change(s). One intervention discussed the conflict between selling unhealthy food items to raise funds for the center and instituting healthy eating policies that would prevent such fundraising (35). Other interventions developed strategies to promote physical activity in place of screen time, snacking on fruit or vegetables instead of typical, salty or sweet snack foods, or to drink water in place of sugar sweetened beverages.

Segmentation—Segmentation involves identifying and prioritizing meaningful population segments relevant to the intervention objectives based on clear criteria. Intervention components are then tailored to specific audience segments. This component is strongest once behavior, customer orientation, insight, exchange and competition have been considered. Nearly half of the interventions (46%) identified one or more target audience segments that share similar characteristics and tailored the intervention accordingly. Segments included midstream audiences such as parents, caregivers, and community stakeholders, as well as children, the downstream audience. Audiences were characterized

by demographic (e.g., age, socioeconomic status), geographic, psychographic (e.g., values, attitudes), and/or behavioral information.

Methods mix—The methods mix is commonly referred to as the 4 P's: product, price, place and promotion. Every intervention included at least one element of the methods mix, specifically *place*, because inclusion criteria required that each intervention be instituted in an early care and education center. Centers are an opportune place for intervention given the meals and snacks served and physical activity opportunities provided to children in these settings. Most interventions (89%) included a *product* component (e.g., curriculum or lesson plans and supporting materials, play equipment, informational brochures). Just under half (49%) of the interventions incorporated *promotional* components (e.g., flyers, posters, family events). Six (8%) of the interventions discussed or acknowledged the *price* associated with the desired behavior change(s). Most often this included time, space, or financial cost. Collectively, 45% of interventions included three components of the methods mix, 42% included two, and 9% did not include a component other than place, which resulted from the review's inclusion criteria. Only three studies (4%) included all four elements of the methods mix (Table 4).

Evaluation—In addition to the eight benchmark criteria, outcome evaluation measures were examined. The inclusion criteria for this review required a quantitative outcome measure of dietary or physical activity behaviors of children. Thus, all the interventions included an outcome measurement of the downstream audience. Approximately 75% of interventions that targeted dietary behaviors or physical activity behaviors reported at least one successful outcome. Only 40% of interventions that measured anthropometric outcomes reported at least one favorable change. More than half of the interventions (61%) developed an intervention component addressing some midstream audience (e.g., caregivers, parents, center directors). However, only 25% of interventions measured outcomes for midstream audiences.

Another key activity of the social marketing approach is process evaluation. This provides an essential feedback loop for midcourse corrections, which may be particularly important given the array of products and promotional materials for downstream (e.g., children), midstream (e.g., caregivers, parents), and upstream (e.g., policy makers) target audiences (16, 33). Process evaluation is also important to understand how programs were implemented and to interpret observed outcomes. Only half of the included interventions (52%) discussed process evaluation.

Explicit reference to social marketing—Three of the interventions (4%) explicitly referenced ‘social marketing’. Of these, one intervention incorporated all eight benchmark criteria (36), while the other two interventions incorporated seven criteria (26, 37).

Benchmark criteria—As previously discussed, every intervention included the behavior criterion and at least one element of the methods mix criterion; hence, the lowest number of criteria any intervention contained was two. Interventions were grouped into three levels: 1) low included 2-3 of the benchmark criteria; 2) medium included 4-6 benchmark criteria; and

3) high included 7-8 benchmark criteria. More than half of the interventions (53%) were in the low category, 38% in the medium, and 9% in the high category.

While there were no significant differences in intervention effectiveness based on the number of benchmark criteria employed (Table 5), a trend was noted in that as the number of benchmark criteria increased, a larger proportion of interventions had successful physical activity outcomes.

Discussion

This review aimed to describe the use of social marketing benchmark criteria in early care and education center-based nutrition and physical activity interventions and explore relationships between the application of the benchmark criteria and the effectiveness of these interventions. By virtue of inclusion criteria, all interventions in this sample included at least two benchmark criteria, behavior and methods mix, yet fewer than half of the interventions incorporated four or more benchmark criteria.

We did not find statistical significance for effectiveness of interventions on child-level diet, physical activity, or anthropometric outcomes based on the number of benchmark criteria used. This is in contrast to the findings from Alceves and colleagues who suggest there may be a tipping point. They found that inclusion of five or more benchmark criteria was associated with better outcomes. While we did observe similar trends around physical activity and diet outcomes, unlike Alceves, we did not find this to hold true for anthropometric outcomes. Some of the inconsistencies in our findings across outcomes may have been the result of an uneven distribution of interventions across categories of low, medium, and high inclusion of benchmark criteria. Hence, caution is warranted in attempting to draw conclusions regarding the effectiveness of benchmark criteria to institute change in children's behaviors, because 1) only a small number of interventions (three) explicitly referenced a ‘social marketing’ approach; 2) interventions were judged on the presence or absence of criteria, not the quality of how criteria were applied; 3) interventions utilized different measures over differing periods of time; and 4) the quality of study design or potential for bias was not taken in to account when evaluating effectiveness of an intervention, and without rigorous evaluation, an intervention may be more likely to exhibit positive outcomes. We also refrain from offering specific recommendations about which criteria are “most effective” because the value of the social marketing approach stems from these criteria building off of each other to inform intervention development. As a result, these criteria cannot be considered mutually exclusive, which makes it impossible to disentangle the effects of one criterion over the other.

This review of interventions in early care and education centers identified several gaps in applying a comprehensive planning and evaluation approach, such as social marketing, for designing interventions to influence children's dietary and physical activity behaviors. Through the lens of social marketing, all interventions addressed the benchmark criteria of behavior and methods mix, and more than half of the interventions identified audience segments (segmentation). However, the other benchmark criteria (customer orientation, theory, insight, exchange, and competition) were present in less than one-third of the

interventions. Although we applied the social marketing framework to interventions that did not identify as social marketing, we were careful to look for presence of the underlying concepts rather than the particular terminology used in the manuscripts. These concepts often align with other recommended approaches for planning, executing, and analyzing outcomes of behavioral interventions, including use of formative research, theoretically guided behavior change approaches, and pretesting materials (28, 38). Despite our broad interpretation, the interventions in this sample had an overall low application of these benchmark criteria. Hence, this review helps to identify several missed opportunities whereby future researchers might apply a more comprehensive approach to the design, implementation, and evaluation of these types of interventions in early care and education centers. Adhering to, and reporting on, systematic planning approaches like social marketing will help improve the transparency of intervention development and facilitate synthesis of findings to generate evidence-based recommendations (39, 40).

One opportunity for future research in the early care and education setting is for more comprehensive use of behavior change theories. It is generally accepted that interventions with an explicit theoretical basis are more effective than those without (41). For the purposes of this review, interventions received credit for theory if they articulated using a behavior theory, but we were unable to evaluate the quality of how theoretical constructs were operationalized. Even with liberal criteria for crediting interventions for use of behavior change theory, only a small proportion of interventions incorporated theory. This highlights an opportunity, and need, to systematically use theory to both understand the target audience behavior(s) and inform intervention development and evaluation. It is suggested that targeting multiple levels of influence is better for long term change. This is important context for this review, because children (downstream) are dependent on the behaviors of their caregivers, parents and/or teachers (midstream), and the environment that is created within early care and education centers (upstream). Many interventions targeted multiple levels; however, a missing attribute could be engaging in customer orientation to better understand each target market and existing relationships.

Another opportunity to strengthen future research is to incorporate customer orientation and insights (e.g., formative work and pilot testing) into studies. Addressing these criteria allow for researchers to incorporate perspectives and get early buy-in from target audiences, which should improve intervention compatibility and fidelity (33). For interventions, such as the ones reviewed in this study where children were the primary downstream target audience for behavior change, it may not be realistic or feasible to conduct formative research. In these instances, midstream audiences, such as parents and caregivers, become increasingly important. In addition to serving as representatives for children, the midstream audiences serve as gatekeepers and stakeholders whose own changes in behavior will be required for prompting and supporting change in children's behaviors. Furthermore, while not a focus of this review, upstream audiences, including community agency or health service leaders and policy makers, are another important target for supporting change in children's and caregiver's behaviors. Accordingly formative research with these upstream target audiences should also be considered for the development of community-based (e.g., Romp and Chomp) and state or federal policy interventions (e.g., child care licensing, Child and Adult Care Food Program). Although time and funding resources may be limited, it is likely a

worthwhile investment to engage all appropriate downstream, midstream, and upstream audiences early in the intervention development and testing process so that the resulting program is practical and addresses the needs of all the audiences who are necessary to initiate change within the centers.

While all interventions employed some parts of the methods mix, there is still an opportunity for future research to incorporate all elements of the methods mix more comprehensively. Interventions in this setting frequently incorporated the place (e.g., the child care center) and product (e.g., curriculum) components of the methods mix, but price and promotion were largely unaddressed. Effectiveness of the social marketing approach is ideally maximized when all four elements of the methods mix are included (16). Price is particularly important to address when targeting children in early care centers because centers are highly regulated and have increasing demands for staff, yet the organizations are often under-resourced (42). The competing behaviors and costs to change practices or policies for both the midstream audiences and the organizational setting could deter the desired behavior changes for children. It is necessary to acknowledge what needs to be given up (e.g., time, money) in order to achieve the new, target behavior(s) and design programs that highlight the perceived benefits and minimize barriers.

Lastly, evaluation is a critical component for any intervention. While many of the manuscripts analyzed for this review identified parents and other caregivers act as a conduit for behavior change for children and designed intervention components for these midstream audiences, very few assessed the behaviors of those audiences. This is a missed opportunity to not only fully understand the effect of the intervention at all levels, but also to explain the observed results. Furthermore, only half of the interventions mentioned process evaluation in their papers. This type of evaluation is particularly important to help explain how an intervention was implemented, identify mechanisms of change, and provide context for interpreting the results of the intervention (43). It is no longer acceptable to simply provide evidence that an intervention did or did not have the intended effect; intervention research will advance when process evaluation is incorporated and analyzed in a way that sheds light on the often unknown, or the ‘black box’, of intervention effects (44, 45). Once we have a better understanding of how obesity prevention interventions work, we can begin to more widely disseminate them and better replicate successful outcomes in a greater number of settings.

A key strength of this review was the combination of a systematic review with content analysis to code qualitative information as well as quantitative data and to analyze a large number of studies. Even though we investigated interventions that did not self-identify as social marketing, the National Social Marketing Centre's benchmark criteria provided a robust, broadly applicable framework for determining the extent to which an intervention is consistent with the principles associated with the social marketing approach (17). Furthermore, we examined interventions for underlying intervention design concepts and processes rather than the explicit labels associated with social marketing. The process helped identify important gaps in applying methodical planning and evaluation processes, such as social marketing, which should inform future research efforts in in early care and education settings.

In addition to these strengths, this review had some limitations. First, it should be noted that we could only code for benchmark criteria based on what was reported in published material. Time and space limitations of journals may have prohibited the full description of intervention development and evaluation and would thus limit the evaluation of the full scope of included benchmark criteria. However, the process for identifying articles did try to identify both protocol and outcome related publications so that the set of articles related to an intervention could be assessed as a whole. Second, interventions were given credit for the presence of benchmark criteria when at least one subcomponent of the criteria was reported but there was no attempt to assess the quality with which criteria were applied. This liberal practice may have obscured relationships between use of benchmark criteria and intervention effectiveness. Lastly, interpreting the effectiveness of interventions to change children's nutrition and/or physical activity behaviors or anthropometric measures was complicated by the fact that many different types of measures were conducted over varying periods of time. Consistent measures across studies would allow for more meaningful interpretation of the effects of interventions and allow for generation of evidence-based recommendations.

Conclusion

A large number of children around the world are at risk for overweight or obesity, and more effective interventions are needed that support obesity prevention efforts. Social marketing provides a systematic approach for the planning, execution, and analysis of programs designed to influence voluntary behaviors of target audiences that influence weight status. Few interventions in early care and education settings have applied social marketing to the development of programs aimed to influence children's diet and activity, and thus it is still unknown how a social marketing approach influences behaviors of children who attend early care and education centers. This review highlighted several opportunities for researchers to incorporate social marketing concepts into interventions to create programs that cater to the specific needs of those whose behavior they seek to change. Social marketing could be an important intervention design approach for early childhood obesity prevention efforts, and thus future research to investigate the effects of purposeful application of the social marketing process to nutrition and physical activity interventions in early care and education settings is warranted.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. World Health Organization. World health organization. Obesity and overweight. [updated June 2016; cited 2017 February 4]; Available from: http://www.who.int/mediacentre/factsheets/fs311/en/
2. Birch LL, Ventura AK. Preventing childhood obesity: What works? Int J Obes (Lond). 2009; 33(Suppl 1):S74–81. [PubMed: 19363514]
3. Institute of Medicine. Early childhood obesity prevention policies. Washington, D.C: 2011.
4. Ogden CL, Carroll MD, Lawman HG, et al. Trends in obesity prevalence among children and adolescents in the united states, 1988-1994 through 2013-2014. JAMA. 2016; 315:2292–2299. [PubMed: 27272581]
5. Frieden TR, Ethier K, Schuchat A. Improving the health of the united states with a “winnable battles”. initiative JAMA. 2017
6. Mamedova, S., Redford, J. Early childhood program participation, from the national household education surveys program of 2012. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education; 2015.
7. Tandon PS, Tovar A, Jayasuriya AT, et al. The relationship between physical activity and diet and young children's cognitive development: A systematic review. Prev Med Rep. 2016; 3:379–390. [PubMed: 27419040]
8. Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. J Am Diet Assoc. 2011; 111:1343–1362. [PubMed: 21872698]
9. Dev DA, McBride BA. Academy of nutrition and dietetics benchmarks for nutrition in child care 2011: Are child-care providers across contexts meeting recommendations? J Acad Nutr Diet. 2013; 113:1346–1353. [PubMed: 23916973]
10. National Academies of Sciences E, and Medicine. Obesity in the early childhood years: State of the science and implementation of promising solutions: Workshop summary. Washington, D.C: The National Academies Press; 2016.
11. Zhou YE, Emerson JS, Levine RS, Kihlberg CJ, Hull PC. Childhood obesity prevention interventions in childcare settings: Systematic review of randomized and nonrandomized controlled trials. American Journal of Health promotion: AJHP. 2014; 28:e92–103. [PubMed: 24200332]
12. Ward DS, Welker E, Choate A, et al. Strength of obesity prevention interventions in early care and education settings: A systematic review. Prev Med. 2016
13. Institute of Medicine Accelerating progress in obesity prevention: Solving the weight of the nation. Washington, D.C: National Academies Press; 2012.
14. Kotler P, Zaltman G. Social marketing: An approach to planned social change. J Mark. 1971; 35:3–12. [PubMed: 12276120]
15. Andreasen AR. Social marketing: Its definition and domain. Journal of Public Policy & Marketing. 1994; 13:108–114.
16. Lee, N., Kotler, P. Social marketing: Changing behaviors for good. Thousand Oaks, CA: Sage Publications, Inc; 2015.
17. National Social Marketing Centre. Nsmc benchmark criteria. 2010. [cited 2016 January 10]; Available from: http://www.socialmarketing-toolbox.com/content/nsmc-benchmark-criteria-0
18. Andreasen AR. Marketing social marketing in the social change marketplace. Journal of Public Policy & Marketing. 2002; 21:3–13.
19. Gracia-Marco L, Vicente-Rodriguez G, Borys JM, Le Bodo Y, Pettigrew S, Moreno LA. Contribution of social marketing strategies to community-based obesity prevention programmes in children. Int J Obes (Lond). 2011; 35:472–479. [PubMed: 20975724]
20. Aceves-Martins M, Llaurado E, Tarro L, et al. Effectiveness of social marketing strategies to reduce youth obesity in european school-based interventions: A systematic review and meta-analysis. Nutr Rev. 2016; 74:337–351. [PubMed: 27018054]
21. Andreasen, AR. Social marketing in the 21st century. Thousand Oaks, CA: Sage Publications; 2006.

22. Grier S, Bryant C. Social marketing in public health. Ann Rev Public Health. 2005; 36:319–339.
23. Evans WD. Social marketing campaigns and children's media use. The Future of children/Center for the Future of Children, the David and Lucile Packard Foundation. 2008; 18:181–203.
24. Evans WD, Christoffel KK, Necheles JW, Becker AB. Social marketing as a childhood obesity prevention strategy. Obesity (Silver Spring, Md). 2010; 18(Suppl 1):S23–26.
25. Bellows LL, Davies PL, Anderson J, Kennedy C. Effectiveness of a physical activity intervention for head start preschoolers: A randomized intervention study. The American Journal of Occupational Therapy: Official Publication of the American Occupational Therapy Association. 2013; 67:28–36. [PubMed: 23245780]
26. Johnson SL, Bellows L, Beckstrom L, Anderson J. Evaluation of a social marketing campaign targeting preschool children. American Journal of Health Behavior. 2007; 31:44–55. [PubMed: 17181461]
27. Young L, Anderson J, Beckstrom L, Bellows L, Johnson SL. Using social marketing principles to guide the development of a nutrition education initiative for preschool-aged children. J Nutr Educ Behav. 2004; 36:250–257. [PubMed: 15707548]
28. Eldredge, LKB., Markham, CM., Ruiter, RAC., Fernandez, ME., Kok, G., Parcel, GS. Planning health promotion programs. 4th. San Francisco, CA: Jossey-Bass; 2016.
29. Choi BC, Pak AW. Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. Clin Invest Med. 2006; 29:351–364. [PubMed: 17330451]
30. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The prisma statement. BMJ. 2009; 339:b2535. [PubMed: 19622551]
31. Riffe, D., Lacy, S., Fico, FG. Analyzing media messages. 3rd. New York, NY: Routledge; 2014.
32. Hastings, G., Angus, K., Bryant, C. The sage handbook of social marketing. London: Sage Publications; 2011.
33. Lefebvre, RC. Social marketing and social change: Strategies and tools for improving health, well-being, and the environment. San Francisco, CA: Jossey-Bass; 2013.
34. McVey, D., Crosier, A., Christopoulos, A. In social marketing and public health: Theory and practice. French, J.Blair-Stevens, C.McVey, D., Merritt, R., editors. New York: Oxford; 2013. p. 219-238.
35. Hardy LL, King L, Kelly B, Farrell L, Howlett S. Munch and move: Evaluation of a preschool healthy eating and movement skill program. Int J Behav Nutr Phys Act. 2010; 7
36. Davison KK, Jurkowski JM, Li K, Kranz S, Lawson HA. A childhood obesity intervention developed by families for families: Results from a pilot study. Int J Behav Nutr Phys Act. 2013; 10:3–5868. 5810-5863. [PubMed: 23289970]
37. Bellows L, Anderson J. The food friends get movin' with mighty moves: A physical activity program for preschoolers. J Nutr Educ Behav. 2013; 45:473–475. [PubMed: 23523275]
38. Glanz, K.Rimer, BK., Viswanath, K., editors. Health behavior: Theory, research, and practice. 5th. San Francisco, CA: Jossey-Bass;
39. Bian ZX, Shang HC. Consort 2010 statement: Updated guidelines for reporting parallel group randomized trials. Ann Intern Med. 2011; 154:290–291. author reply 291-292.
40. Des Jarlais DC, Lyles C, Crepaz N. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: The trend statement. Am J Public Health. 2004; 94:361–366. [PubMed: 14998794]
41. Glanz K, Bishop DB. The role of behavioral science theory in development and implementation of public health interventions. Annu Rev Public Health. 2010; 31:399–418. [PubMed: 20070207]
42. National Child Care Association. Comments on acf docket no. 2013-0001. Office of Child Care, editor. 2013
43. Moore GF, Audrey S, Barker M, et al. Process evaluation of complex interventions: Medical research council guidance. Bmj. 2015; 350:h1258. [PubMed: 25791983]
44. Saunders RP, Evans MH, Joshi P. Developing a process-evaluation plan for assessing health promotion program implementation: A how-to guide. Health Promot Pract. 2005; 6:134–147. [PubMed: 15855283]

45. Durlak JA, DuPre EP. Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. Am J Community Psychol. 2008; 41:327–350. [PubMed: 18322790]

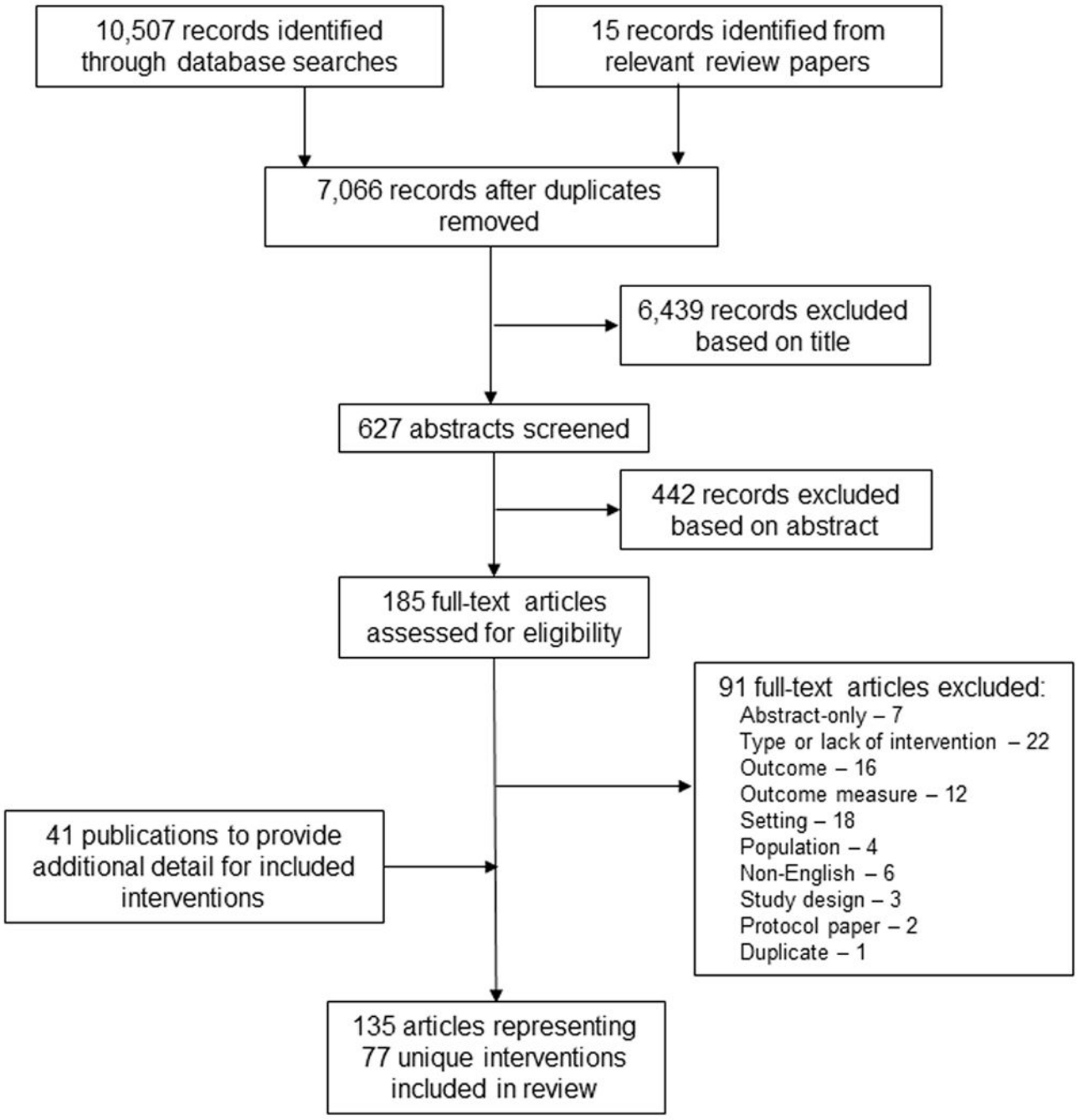

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for study selection and inclusion

Table 1

Social marketing benchmark criteria concepts

Benchmark criteria and definition (17)	**Additional considerations from key social marketing texts (16, 33, 34)**
Behavior: The intervention clearly identifies the behavior(s) it is aims to change.	Behavioral goals should be clear, specific, measurable, and time-bound. Ideally baseline behaviors and key change indicators are integrated into goals. Goals should recognize both the "problem behavior" and the "desired behavior".
Customer Orientation: The intervention uses market and consumer research to develop a robust understanding of the audience(s).	Customer orientation can include a range of research strategies and data (syndicated and primary), which together help improve understanding of the lives and behavior(s) of the target audience(s). To ensure that target audience(s)' wants, needs, and problems remain a central focus, intervention development is informed by formative research, pretesting of intervention materials and processes, and pilot testing implementation processes. These steps promote a co-creation process vs. top-down.
Theory: The intervention uses theory to aid understanding of what drives the behavior(s).	Theory aids understanding of the problem and the variables that influence human behavior, which should, in turn, inform intervention development by identifying key triggers and possible points of intervention that promote the process of behavior formation or change.
Insight: The intervention identifies and integrates 'actionable insights'.	Insight promotes a deeper understanding of what moves and motivates the target audience(s) and how they feel about an issue. It goes beyond gathering data and intelligence to link marketplace factors and consumer reality with what *could* be. Actionable insights often capture the target audience(s)' perceived benefits and barriers related to the behavior, concepts which are related to exchange.
Exchange: The intervention considers what it costs the target audience(s) to get the benefits of adopting and maintaining the new behavior.	Exchange takes into consideration the relative cost(s) of behavior change – both actual and perceived – in order to reach valued benefits in return for efforts (e.g., giving up unhealthy behaviors to achieve short- or long-term benefits). The intervention must help convince the target audience(s) that the costs are reasonable or not prohibitive, while the benefits are great and worth the costs.
Competition: The intervention recognizes that there are other behavior(s) that compete for the audience(s)' time and attention.	Competition understands the behavioral options (choices) that compete with the behavior goal. These alternative behaviors may be easier or better supported by the environment/context. The intervention should incorporate strategies to minimize impact of competition through exchange or methods mix.
Segmentation: The intervention identifies audience "segments" who share similar characteristics, and then tailors intervention components and messages for each segment.	Segmentation considers a range of variables (demographic, psychographic, behavioral, geographic) to identify homogeneous target audiences who share similar needs, wants, lifestyles, behaviors and values. Select segments become focal points for the intervention. Segments often include a downstream audience (adopting the behavior goal), midstream audiences (e.g., friends, family, and other influential persons that may support or hinder behavior adoption) and upstream audiences (e.g., policymakers, corporations). Identification of meaningful segments is informed by customer orientation and insight/formative work.
Methods Mix: The intervention uses a mix of methods to bring about behavior change.	The methods mix draws on all elements of the "marketing mix" to develop an intervention that reduces barriers to adoption of behavior goal(s) while also increasing the benefits that make adoption more likely. The methods mix is often referred to as the "four Ps": *product* (physical items, services, and behaviors offered to support behavior adoption); *price* (financial, psychological, social, opportunity, and other costs associated with the behavior); *place* (where products may be distributed so they reach the target audience(s) to facilitate or prompt the behavior); and *promotion* (communication strategies and tactics used to increase awareness, attitudes, self-efficacy, perceived norms and intent to try product, services and behaviors offered).

Table 2

Use of social marketing benchmark criteria and outcomes of nutrition and/or physical activity interventions in early care and education

		Social Marketing Benchmark Criteria								Successful Outcome(s)[a]		
Reference[c]	**Intervention**	**Behavior**	**Customer Orientation**	**Theory**	**Insight**	**Exchange**	**Competition**	**Segmentation**	**Methods Mix[b]**	**Diet**	**PA**	**Anthro**
Eight Criteria												
Davison, 2013	Communities for Healthy Living	√	√	√	√	√	√	√	3	√	√	√
DeCraemer, 2014	ToyBox	√	√	√	√	√	√	√	3	n/a	√	n/a
Seven Criteria												
Bellows, 2013	Food Friends: Get Moving with Mighty Moves	√	√	√	√	√		√	4	n/a	√	-
Hardy, 2010	Munch & Move	√	√		√	√	√	√	3	-	√	n/a
Johnson, 2007	Food Friends	√	√	√	√	√		√	4	√	n/a	n/a
Nyberg, 2015	Healthy School Start	√	√	√	√	√		√	3	√	√	-
Ransley, 2007	School Fruit & Vegetable Scheme	√	√		√	√	√	√	3	√	n/a	n/a
Six Criteria												
Cardon, 2009		√			√	√	√	√	2	n/a	-	n/a
Fitzgibbon, 2005	Hip Hop to Health Jr.	√	√	√	√	√			3	√	-	√
Jones, 2015	Jump Start	√	√		√	√		√	3	n/a	√	-
Korwanich, 2008		√	√		√	√		√	2	√	n/a	n/a
Puder, 2011	Ballabeina	√	√		√	√		√	3	n/a	√	√
Winter, 2011	Healthy & Ready to Learn Program	√	√	√	√	√			3	n/a	√	-
Five Criteria												
De Bock, 2012	Ene Mene Fit	√	√	√				√	3	√	√	-
Finch, 2014		√	√		√	√			2	n/a	-	n/a
Natale, 2014	Healthy Caregivers - Healthy Children	√			√	√	√		3	√	√	n/a

		Social Marketing Benchmark Criteria								Successful Outcome(s)[a]		
Reference[c]	**Intervention**	**Behavior**	**Customer Orientation**	**Theory**	**Insight**	**Exchange**	**Competition**	**Segmentation**	**Methods Mix[b]**	**Diet**	**PA**	**Anthro**
Nicaise, 2012		√			√	√		√	2	n/a	√	n/a
Salazar, 2014		√		√	√	√			3	√	√	√
Sharma, 2011	Coordinated Approach to Child Health for Early Childhood	√		√	√	√			2	-	-	n/a
Webster, 2015		√	√		√	√			3	n/a	√	n/a
Witt, 2012	Color Me Healthy	√	√	√				√	3	√	n/a	n/a
Zask, 2012	Tooty Fruity Vegie	√	√	√				√	3	√	√	√
Four Criteria												
Alhassan, 2013		√				√		√	3	n/a	√	n/a
Annesi, 2013	Start for Life	√	√	√					2	n/a	√	√
Bonis, 2014	NAP SACC	√	√					√	2	n/a	√	-
Bonvin, 2013	Youp'là Bouge	√			√	√			2	n/a	-	-
Byrne, 2002		√	√					√	2	√	n/a	n/a
Cooke, 2011		√		√				√	2	√	n/a	n/a
Dawson-McClure, 2014	ParentCorps (enhanced for health promotion)	√	√					√	3	n/a	√	-
Esquivel, 2016	Children's Healthy Living Program	√	√					√	3	-	n/a	-
Farfan-Ramirez, 2011	Nutrition Matters!	√	√					√	3	√	n/a	n/a
Krombholz, 2012		√			√	√			1	n/a	√	-
Parish, 2007		√		√				√	2	n/a	√	n/a
Reilly, 2006	Movement and Activity Glasgow Intervention in Children	√	√			√			4	n/a	√	-
Trost, 2008		√			√	√			2	n/a	√	n/a
Williams, 2014		√		√			√		2	√	n/a	n/a
Three Criteria												
Alhassan, 2007		√						√	1	n/a	-	n/a
Baskale, 2011		√		√					2	√	n/a	-

		Social Marketing Benchmark Criteria								Successful Outcome(s)[a]		
Reference[c]	**Intervention**	**Behavior**	**Customer Orientation**	**Theory**	**Insight**	**Exchange**	**Competition**	**Segmentation**	**Methods Mix[b]**	**Diet**	**PA**	**Anthro**
Bayer, 2009	TigerKids	√		√					3	√	-	-
Bell, 2015	Start Right Eat Right	√						√	2	√	n/a	n/a
Callcott, 2015	Let's Decode - Moving on with Literacy	√		√					2	n/a	-	n/a
Cason, 2001		√		√					2	√	n/a	n/a
Cespedes, 2013		√		√					3	-	-	√
Correia, 2014		√						√	1	-	n/a	n/a
Donath, 2015		√						√	2	n/a	√	n/a
Eliakim, 2007		√	√						2	n/a	√	√
Goodway, 2003		√						√	2	n/a	√	n/a
Gripshover, 2013		√						√	2	√	n/a	n/a
Hannon, 2008		√						√	2	n/a	√	n/a
Harnack, 2012		√						√	2	√	n/a	n/a
Hoppu, 2015		√						√	2	√	n/a	n/a
Horne, 2011		√		√					3	√	n/a	n/a
Jones, 2011		√		√					3	-	-	n/a
O'Connell, 2012		√						√	1	-	n/a	n/a
Sirikulchayanonta, 2010		√		√					3	√	n/a	n/a
Specker, 2003	South Dakota Children's Health Study	√						√	1	n/a	√	-
Stratton, 2005		√						√	2	n/a	√	n/a
Venetsanou, 2004		√		√					1	n/a	√	n/a
Yin, 2012	Miranos! Look at us, we are healthy!	√	√						3	√	√	√
Zhou, 2014		√		√					3	n/a	√	√
Two Criteria												
Alhassan, 2012		√							2	n/a	√	n/a
Alkon, 2014	NAP SACC	√							3	-	-	√
Cosco, 2014	Preventing Obesity by Design	√							2	n/a	√	n/a

		Social Marketing Benchmark Criteria								Successful Outcome(s)[a]		
Reference[c]	Intervention	Behavior	Customer Orientation	Theory	Insight	Exchange	Competition	Segmentation	Methods Mix[b]	Diet	PA	Anthro
Dazeley, 2015		√							2	√	n/a	n/a
Dennison, 2004	Brocodile the Crocodile	√							3	n/a	√	-
Gao, 2014		√							3	-	n/a	n/a
Hu, 2010		√							3	√	n/a	√
Kordi, 2012		√							2	n/a	√	n/a
Lerner-Geva, 2015		√							3	√	-	-
Monsalves-Alvarez, 2015		√							1	n/a	√	-
Namenek Brouwer, 2013	Watch Me Grow	√							2	√	n/a	n/a
Natale, 2014	Hi-Ho	√							3	-	-	-
O'Dwyer, 2013		√							3	n/a	√	n/a
Roth, 2015	Prevention through Activity in Kindergarten Trial	√							3	n/a	√	-
Teixeira Costa, 2015		√							2	n/a	√	n/a
Veldman, 2015	Active Beginnings	√							2	n/a	√	n/a
Vereecken, 2009		√							3	√	n/a	n/a

[a] Successful outcome(s) defined in a dichotomous manner for each category (diet, physical activity, anthropometrics). Considered successful if at least one favorable, statistically significant ($p < 0.05$) change.

[b] Methods Mix acknowledges how many components (product, price, place, promotion) were present in an intervention.

[c] References for included interventions can be found in Supplemental List S3.

√ Indicates presence of criterion or successful outcome(s)

- Indicates absence of a successful outcome

n/a Indicates outcome not measured

Abbreviations: PA, physical activity; Anthro, anthropometrics

Table 3

Prevalence of social marketing benchmark criteria and evaluation components in nutrition and/or physical activity interventions in early care and education (N=77)

Benchmark Criteria Components of criteria	Frequency (%)
Behavior[a]	**77 (100)**
Customer Orientation	**26 (33.8)**
Pilot testing	13 (16.9)
Formative research	12 (15.6)
Pretesting	11 (14.3)
Theory	**26 (33.8)**
Social Cognitive Theory	11 (14.3)
Social Learning Theory	6 (7.8)
Health Belief Model	3 (3.9)
Transtheoretical Model	3 (3.9)
Other theory	15 (19.5)
Insight	**22 (28.6)**
Intervention addressed barriers and/or benefits	22 (28.6)
Benefits and/or barriers identified with formative research	5 (6.5)
Exchange	**24 (31.2)**
Intervention addressed barriers and/or benefits	22 (28.6)
Intervention acknowledged price of behavior change	6 (7.8)
Competition	**6 (7.8)**
Competing behaviors acknowledged	6 (7.8)
Segmentation	**47 (61.0)**
Midstream intervention component	47 (61.0)
Formative research	12 (15.6)
Syndicated data	6 (7.8)
Methods Mix[a]	**77 (100)**
Place[a]	77 (100)
Product	69 (89.6)
Promotion	38 (49.4)
Price	6 (7.8)
Evaluation[b]	**77 (100)**
Downstream outcomes[a]	77 (100)
Midstream outcomes	19 (24.7)
Process evaluation	40 (51.9)
Referenced 'Social Marketing'	**3 (3.9)**

[a]Behavior, place, and downstream outcomes were part of the inclusion criteria for this review. Interventions must have focused on dietary and/or physical activity behaviors, occurred within an early care and education setting, and had a quantitative measure of children's diet or physical activity.

[b] Evaluation is not part of the social marketing benchmark criteria.

Table 4

Distribution of early care and education-based nutrition and/or physical activity interventions by total number of social marketing benchmark criteria and methods mix components (N=77)

Benchmark Criteria [a]	
Number of criteria [b]	**Frequency (%)**
2-3	41 (53.2)
4-6	29 (37.7)
7-8	7 (9.1)
Methods Mix Components [c]	
Number of components	**Frequency (%)**
1	7 (9.1)
2	32 (41.6)
3	35 (45.5)
4	3 (3.9)

[a] Benchmark criteria include: behavior, customer orientation, theory, insight, exchange, competition, segmentation, and methods mix.

[b] Due to inclusion criteria for this review, each intervention included at least two benchmark criteria (behavior and methods mix).

[c] Methods mix components include: product, price, place, and promotion.

Table 5

Frequency of any successful dietary, physical activity, or anthropometric outcome in early care and education-based interventions by benchmark criteria category

	Frequency of successful outcomes[a]					
	Diet (N=40)		PA (N=53)		Anthro (N=31)	
Benchmark Criteria[b]	Total	n (%)[c] success	Total	n (%)[c] success	Total	n (%)[c] success
2-3	22	15 (68.2)	26	19 (73.1)	14	6 (42.9)
4-6	13	11 (84.6)	22	17 (77.3)	14	5 (35.7)
7-8	5	4 (80.0)	5	5 (100)	3	1 (33.3)

[a] Successful outcome(s) defined in a dichotomous manner for each category (diet, physical activity, anthropometrics). Considered successful if at least one favorable, statistically significant ($p < 0.05$) change.

[b] Due to inclusion criteria for this review, each intervention included at least two benchmark criteria (behavior and methods mix).

[c] Percent success was calculated using the number of interventions with a successful outcome and the total number of interventions within the benchmark criteria category for the outcome of interest.

Abbreviations: PA, physical activity; Anthro, anthropometrics