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# Strength of obesity prevention interventions in early care and education settings: A systematic review

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ABSTRACT

*Time and place of study: 2010–2015; international.* Given the high levels of obesity in young children, numbers of children in out-of-home care, and data suggesting a link between early care and education (ECE) participation and overweight/obesity, obesity prevention in ECE settings is critical. As the field has progressed, a number of interventions have been reviewed yet there is a need to summarize the data using more sophisticated analyses to answer questions on the effectiveness of interventions. We conducted a systematic review of obesity prevention interventions in center-based ECE settings published between 2010 and 2015. Our goal was to identify promising intervention characteristics associated with successful behavioral and anthropometric outcomes. A rigorous search strategy resulted in 43 interventions that met inclusion criteria. We developed a coding strategy to assess intervention strength, used a validated study quality assessment tool, and presented detailed descriptive information about interventions (e.g., target behaviors, intervention strategies, and mode of delivery). Intervention strength was positively correlated with reporting of positive anthropometric outcomes for physical activity, diet, and combined interventions, and parent engagement components increased the strength of these relationships. Study quality was modestly related to percent successful healthy eating outcomes. Relationships between intervention strength and behavioral outcomes demonstrated negative relationships for all behavioral outcomes. Specific components of intervention strength (number of intervention strategies, potential impact of strategies, frequency of use, and duration of intervention) were correlated with some of the anthropometric and parent engagement outcomes. The review provided tentative evidence that multi-component, multi-level ECE interventions with parental engagement are most likely to be effective with anthropometric outcomes.



## 1. Introduction

Childhood obesity continues to be a global public health problem whereby the number of overweight or obese infants and young children (0 to 5 years) increased from 32 million globally in 1990 to 42 million in 2013 (Facts and Figures on Childhood Obesity, 2014). In the US, 22.8% of preschool aged children (2–5 years) were classified as overweight or obese (Ogden et al., 2014). Although obesity rates have recently decreased among this age group, racial/ethnic and socio-economic disparities continue (Ogden et al., 2014). The high rates and disparities are of concern, given that children who are overweight by age 5 are more likely to be obese later in life (Cunningham et al., 2014). To reduce lifetime risk of obesity, the Institute of Medicine recommends that obesity prevention interventions begin before the age of 5 (Early Childhood Obesity Prevention Policies, 2011).

Obesity-related diet and physical activity patterns of preschoolers do not meet national guidelines (Cortes et al., 2013; Hinkley et al., 2012; Kranz et al., 2006; Wilson et al., 2009). Children, especially those from racial/ethnic minorities and low-income communities in the U.S., eat too few fruits, vegetables, and whole grains, and consume too many energy dense snacks and beverages (Piernas and Popkin, 2011; Reedy and Krebs-Smith, 2010). Similarly, only half of preschool-aged children engage in the recommended 60 min of physical activity per day, and many exceed recommended limits for screen time, averaging 4 h per day (Beets et al., 2011; Tandon et al., 2011). Thus, interventions to improve eating and activity behaviors of preschool children are needed.

Although home environments are important for shaping eating and activity behaviors, >63% of U.S. mothers with preschool-aged children work outside the home (The State of America's Children, 2013) and 70

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to 80% of children with working mothers spend on average 35 h per week in formal early care and education settings (ECE) (America's Children: Key National Indicators of Well-Being, 2009; Larson et al., 2011a, 2011b; Ogden et al., 2012; Ward et al., 2008), mostly in center-based care (Child Care Costs on the Upswing, Census Bureau Reports, 2013). For children in fulltime center-based care, approximately 50% of their daily dietary intake comes from meals and snacks served on site, and this location may be the main source of their physical activity (Bollella et al., 1999; Gubbels et al., 2014; Padget and Briley, 2005). Given the numbers of children enrolled and the amount of time spent in this setting, promoting healthy eating and physical activity in ECE settings are integral to obesity prevention (Obesity in the Early Childhood Years, 2016). Because U.S. children who attend child care are at increased risk for obesity (Gubbels et al., 2010; Neelon et al., 2015; Woo Baidal et al., 2016), identifying successful interventions in these settings is critical, so they can be recommended for wide implementation.

Many reviews of obesity prevention efforts in ECE settings have been published (Blake-Lamb et al., 2016; Ciampa et al., 2010; D'Onise et al., 2010; Hesketh and Campbell, 2010; Kreichauf et al., 2012; Larson et al., 2011a; Laws et al., 2014; Ling et al., 2016; Mikkelsen et al., 2014; Nelson et al., 2003; Nixon et al., 2012; Skouteris et al., 2011; Summerbell et al., 2012; Wolfenden et al., 2012), including a paper by Sisson and colleagues published in this journal (Sisson et al., 2016). Using broad inclusion criteria, Sisson et al. identified 71 ECE interventions, with more than two-thirds published since 2010. With this recent growth in ECE intervention studies, it is important for review papers to move beyond the single question of whether an intervention is generally effective and explore which specific characteristics and strategies contribute to intervention effectiveness.

In addition to adding a more comprehensive analysis, this review was also designed as a follow-up to the Larson et al. (2011a) review paper, which summarized child care-based intervention studies that covered the 10-year period between 2000 and 2010. The goal of the current study was to systematically review obesity prevention interventions in center-based ECE settings published 2010–2015 in order to identify the most promising intervention characteristics associated with successful behavioral and/or anthropometric outcomes. We hypothesized that more comprehensive and intensive interventions would be more effective. To accomplish this goal, we developed a coding strategy to assess intervention strength and allow for examination of several study questions:

1. Is intervention strength related to successful behavioral and/or anthropometric outcomes?
2. Are interventions that incorporate parent engagement more effective than those that do not?
3. Can specific intervention elements be identified that relate to desired outcomes, including number of intervention strategies used, potential impact of the strategies, and frequency and duration of these strategies?
4. Is overall study quality related to successful behavioral and/or anthropometric outcomes?

## 2. Methods

### 2.1. Search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were used (Moher et al., 2009). Separate searches (healthy eating, physical activity, and screen time) were conducted in three databases (PubMed, ERIC, and Web of Science) in December 2015, and search terms and methods are available in an online appendix (Appendix 2). Each search string contained four tailored components and corresponding terms: ECE setting; healthy eating, physical activity, or screen time; behavioral and anthropometric outcomes; and intervention-related. These searches returned 7494 results. After duplicates were removed, 6824 results were imported into EndNote for title and abstract review. Twenty-two additional papers were identified, nine of which were included, after cross-referencing included papers and recent reviews. Fig. 1 describes this process in more detail.

### 2.2. Inclusion and exclusion criteria

Papers were included if they were: peer-reviewed, published between 2010 and 2015, took place primarily in a center-based ECE setting, targeted children ages 0–6 years, included an intervention targeting healthy eating, physical activity and/or screen time, used an objective or validated measure of dietary intake, physical activity, screen-time, or anthropometric outcomes, provided a statistical measure of intervention success, and were published in English. All study designs, except case studies, were included if a pre- and post-evaluation was conducted.

### 2.3. Selection and data extraction

Two authors (EW & AC) each reviewed titles and abstracts, identifying 86 papers for full text review. EW and AC independently reviewed each article and extracted information using a template that included information on study design, location, sample characteristics, intervention components, and outcomes; meetings were held to discuss scoring and identify discrepancies. Any disagreements remaining following this discussion were resolved by consensus with a third reviewer who also read the full text (blinded to the other reviewers' decisions). One author from a pool of five (ML, DW, KH, AW, and AT) reviewed summary entries to validate the extracted data and affirm inclusion of the paper. The goal of this review was to reach consensus; thus, statistics evaluating level of agreement were not computed.

### 2.4. Evaluation of intervention strength

For the purpose of this review we defined intervention *strength* as a composite of the number of intervention strategies used, their potential impact, and the frequency and duration of their use. This coding method is similar to ones used to characterize community health efforts for obesity prevention (Fawcett et al., 2015; Schwartz et al., 2015b). Individual intervention strategies were identified as described in the outcome paper and treated individually unless presented as part of a package (e.g., tool kit). Each intervention strategy was identified, evaluated for potential impact (scores 4 vs 1), and weighted by intensity (scores 1–4) and frequency (scores 1–4). Based on previous literature and ecological models (Sallis and Owen, 2015), high impact intervention strategies included changes in food, physical activity, and screen time environments or policies that provided ongoing support or structure for behavior change (e.g., revising menus or nutrition policies; providing more physical activity in the ECE setting; and in-person staff training). Low impact strategies included educational activities that encouraged individuals to make changes (e.g., field trips, information, posters, and games). High impact parent engagement included in-person strategies such as parent trainings or family days, while low impact strategies were more passive (e.g., sending materials home). Frequency of use was based on how often each strategy was employed. For example, if the intervention included the use of a weekly DVD, it was scored as a 3 on frequency (i.e., not daily but ≥1/week). A policy change such as increasing daily outdoor time by 30 min was scored as a 4 since it was in place during the entire intervention period. Duration of an intervention strategy was coded based on the length of the intervention period; thus there was one code per study. Two authors assessed intervention strength scores for each component (healthy eating, physical activity and screen time combined, and/or parent engagement). Disagreements were resolved by consensus. A cumulative strength score was then tallied. See Table 1 for a description of the coding scheme.