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Joshua S Yudkin

Kelsey Koym

Yasmin Hamad

Lauren Q Malthaner

Rebecca Meredith Burgess

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Authors

Joshua S Yudkin, Kelsey Koym, Yasmin Hamad, Lauren Q Malthaner, Rebecca Meredith Burgess, Leslie N Ortiz, Nalini Dhurjati, Sharmin Mitha, Gabriela Calvi, Kristina Hill, Mckenna Brownell, Elena Wei, Kyle Swartz, Folefac D Atem, Carol A Galeener, Sarah E Messiah, Sarah E Barlow, and Marlyn A Allicock

Family-based pediatric weight management interventions in US primary care settings targeting children ages 6–12 years old: A systematic review guided by the RE-AIM framework

Joshua S. Yudkin,¹  Kelsey Koym,² Yasmin Hamad,¹ Lauren O. Malthaner,¹ Rebecca Meredith Burgess,¹ Leslie N. Ortiz,³ Nalini Dhurjati,¹ Sharmin Mitha,¹ Gabriela Calvi,¹ Kristina Hill,^{1,4,5} Mckenna Brownell,⁶ Elena Wei,⁷ Kyle Swartz,¹ Folefac D. Atem,¹ Carol A. Galeener,¹ Sarah E. Messiah,^{1,5} Sarah E. Barlow,^{4,8} Marlyn A. Allicock^{1,*}

¹The University of Texas Health Science Center at Houston (UTHealth) School of Public Health, Dallas, TX, USA,

²Texas Medical Center Library, Houston, TX, USA,

³Fulbright Colombia, Bogota, Colombia,

⁴Children's Health, Children's Medical Center Dallas, Dallas, TX, USA,

⁵Center for Pediatric Population Health, The University of Texas Health Science Center at Houston (UTHealth) School of Public Health, Dallas, TX, USA,

⁶Georgetown University, School of Medicine, Washington, DC, USA,

⁷Johns Hopkins University, School of Medicine, Baltimore, MD, USA,

⁸Department of Pediatrics, Division of Pediatric Gastroenterology, University of Texas Southwestern Medical Center, Dallas, TX, USA

*Correspondence address. The University of Texas Health Science Center at Houston (UTHealth) School of Public Health in Dallas, 2777 North Stemmons Freeway, Dallas, TX 75207, USA. Tel: +1-972-546-2932; Fax: 713-500-3356; E-mail: Marlyn.Allicock@uth.tmc.edu

Abstract

Obesity is a pandemic that disproportionately affects children from vulnerable populations in the USA. Current treatment approaches in primary care settings in the USA have been reported to be insufficient at managing pediatric obesity, primarily due to implementation challenges for healthcare systems and barriers for families. While the literature has examined the efficacy of pediatric obesity interventions focused on internal validity, it lacks sufficient reporting and analysis of external validity necessary for successful translation to primary care settings. We conducted a systematic review of the primary-care-setting literature from January 2007 to March 2020 on family-based pediatric weight management interventions in both English and/or Spanish for children ages 6–12 years in the USA using the Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework. A literature search, using PRISMA guidelines, was conducted in January 2022 using the following electronic databases: Medline Ovid, Embase, and Cochrane Library. 22 270 records were screened, and 376 articles were reviewed in full. 184 studies were included. The most commonly reported dimensions of the RE-AIM framework were Reach (65%), Efficacy/Effectiveness (64%), and Adoption (64%), while Implementation (47%) and Maintenance (42%) were less often reported. The prevalence of reporting RE-AIM construct indicators ranged greatly, from 1% to 100%. This systematic review underscores the need for more focus on external validity to guide the development, implementation, and dissemination of future pediatric obesity interventions based in primary care settings. It also suggests conducting additional research on sustainable financing for pediatric obesity interventions.

Lay summary

Pediatric weight management research focused on primary care centers for children ages 6–12 in the USA has typically focused on assessing the effectiveness of the intervention rather than how to translate and disseminate such interventions into different settings for diverse populations, or external validity. Using the Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework, we conducted a systematic review to report how existing research reports external validity.

Keywords: pediatric; obesity; primary care; RE-AIM; external validity

Implications

Practice: Overweight and obesity interventions in primary care clinic-based settings should consider using the Reach, Efficacy/Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework for planning, implementation, and evaluation to maximize effectiveness and ensure validity of data collection, analysis, and reporting.

Policy: Policymakers and stakeholders should develop guidelines and prioritize programs for at-risk populations in primary care clinic-based settings based on findings from evidenced-based implementation science research to ensure effectiveness, feasibility, acceptance, and appropriateness for target populations.

Research: Standardized reporting for implementation science outcomes should be regularly conducted by researchers to inform the future translation, implementation, and evaluation of overweight and obesity interventions for children ages 6–12 years in primary care clinic-based settings.

Introduction

Obesity has been labeled a pandemic repeatedly in peer-reviewed research [1–7]. In the USA, obesity is a major public health challenge, given approximately one-third of children have overweight or obesity [8, 9], and it is an issue that disproportionately affects vulnerable children [10]. Furthermore, during the recent COVID-19 pandemic, one study showed the rate of change in child body mass index (BMI) nearly doubled, as compared with the pre-pandemic period. Moreover, the incidence of obesity was 5.3 times as high during the pandemic than before the pandemic [11]. As a result, there is a renewed urgency to identify effective and sustainable solutions to prevent and manage overweight and obesity that are appropriate and feasible for the US health-care system [11].

Comprehensively addressing obesity and its associated risk factors is important because obesity has been associated with a myriad of diseases and conditions, ranging from cardiovascular diseases and gastrointestinal and metabolic disorders. Specific proximal behavioral factors that are important biological and environmental drivers of the pediatric obesity pandemic have been well documented in previous research, and include the high consumption of sugar-sweetened beverages and energy-dense, ultra-processed foods [12–14]. Low levels of physical activity, disrupted sleep patterns, and extended screen time are also major contributors [15–17]. All these risk factors, behaviors, and obesity often continue into adulthood, making it important to address them as early as possible [18]. Importantly, food insecurity is a major risk factor of pediatric obesity and has only been exacerbated by the current COVID-19 pandemic [19].

Similarly, there are consistent evidence-based recommendations and interventions for the prevention, assessment, and treatment of pediatric obesity [18, 20, 21]. Multicomponent family-based behavioral interventions that have at least 26 h of contact are recommended. Yet, evidence-based approaches in primary care settings have been reported to be insufficient at managing pediatric obesity [22]. Historically, the U.S. Preventive Services Task Force (USPSTF) concluded that there was insufficient evidence to recommend screening for childhood obesity in primary care settings [23, 24]. However, the more recent guidelines recommend screening children ages 6 years and older in primary care settings, aligning with recommendations from professional organizations including the American Academy of Pediatrics [25], the National Heart, Lung, and Blood Institute [26], and the Canadian Task Force on Preventive Health [27].

Therefore, aligned with the Chronic Care Model [28], the medical diagnosis should be made in a clinical setting by a pediatric provider, but solutions will require family and community support in endeavors that take place outside the clinical setting. Importantly, there are significant implementation challenges of evidence-based interventions for the healthcare system (e.g. limited time in clinical visits, insufficient financial resources) and significant barriers to family participation and adoption of such programs (e.g. lack of time, transportation, or childcare) [14, 29, 30]. For almost two decades, organizations such as the Institute of Medicine (IOM) have emphasized the need to identify and understand such contextual factors that influence the potential impact of an intervention, or external validity factors [24, 31]. Yet, despite this documented opportunity, research continues to synthesize evidence from only controlled trials [32, 33], and does not expand the measured indicators to reflect advancements in the field. In addition to controlled trials, there is also a need to inclusively assess observational study designs to support external validity, versus controlled trials that emphasize internal validity but may not apply to many real-world settings [34].

While the existing literature [35–38] has examined the efficacy of weight management efforts in this age group and focused on internal validity, it often lacks sufficient reporting and analysis of external validity, as described above. The Reach, Efficacy/Effectiveness, Adoption, Implementation, Maintenance (RE-AIM) framework was introduced in 1999 to help improve and standardize data collection and reporting of external validity [39]. In our study, we chose the RE-AIM framework given that it is a validated framework used across fields, including pediatric obesity, to assess external validity [30, 33, 40–42] and often used to address key issues important for dissemination and generalization [30, 40]. Yet, despite its increased use in the literature, there are still few studies that comprehensively report on all aspects of external validity [30]. This is a documented problem in research, where it takes, on average, 17 years, for research to be translated to the real-world setting where it impacts patients [43].

Therefore, aligned with Chronic Care Model and evidence-based recommendations [20], we conducted a systematic review of the primary-care-setting literature from January 2007 to March 2020 on family-based pediatric weight management interventions in both English and/or Spanish for children ages 6–12 years in the USA. Children ages 6–12 years are the target for overweight and obesity interventions given that they are somewhat autonomous, but still dependent on

their parents or guardians. Research has shown that interventions for this age population are useful [44, 45]; therefore, the USPSTF recommends screening children for obesity beginning at age 6 [15, 20].

This review fills several important gaps in the literature. Previous reviews have been conducted for similar purposes in similar populations, but not for the intervention setting (primary care) or the population of interest (children ages 6–12 years) [33]. Similarly, other reviews are restricted by study design [e.g. only randomized controlled trials (RCTs)] [33], follow-up time (e.g. greater than 12 months) [46], and intervention components (e.g. eHealth strategies) [40, 46–48]. Specifically, this inclusive systematic review summarized the reporting of outcomes measuring external validity, or the study's generalizability, related to overweight and obesity treatment in primary care settings for children ages 6–12 years. We hypothesized that family-based pediatric interventions for the target population delivered in pediatric primary care settings are reported to be effective, but the published literature inadequately reports whether these interventions can feasibly be translated and scaled into real-world settings, according to the RE-AIM framework.

Methods

Study design and rationale

A systematic review of peer-reviewed literature on pediatric family-based weight management interventions in primary care settings was conducted in the USA for children ages 6–12 years to summarize the evidence of external validity, using the RE-AIM framework. Importantly, while there has been other research on this topic conducted in countries such as the UK and Australia, we restricted the intervention location in this review only to the USA given the significant differences in healthcare systems among countries. Given the strong focus on external validity and implementation science, the healthcare system, as measured by the intervention location, is an integral eligibility criterion i.e. often excluded in pediatric overweight and obesity research.

Search strategy

A literature search was conducted in January 2022 using the following electronic database: Medline Ovid, Embase, and Cochrane Library. Guidelines for the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) were followed, and search strategies can be found in [Appendix 1](#). Key word searches were conducted using Boolean operators “AND” and “OR” to specify or broaden the search. Key words were searched throughout the entire text of identified manuscripts and included all relevant terms. The main search was conducted in Medline Ovid using the MeSH Headings as well as equivalent key words and phrases. These terms were then tested for relevancy and the main search was finalized in Medline on 4 January 2022. The search terms in the baseline database, Ovid Medline, were then translated into Embase on 5 January 2022, and Cochrane Library on 5 January 2022, yielding a gross total (before deduplication) of 34 623 results. Duplicate records were removed, yielding 22 270 for initial screening.

The eligibility criteria for articles to be included in the review were (i) publication date between January 2007 and March 2020, from the start of the year when the latest expert committee recommendations for treating overweight and

obesity were published to the inception of the COVID-19 pandemic in the USA; (ii) published in English; (iii) focused on interventions in pediatric primary care settings (either the intervention setting and/or place of referral); (iv) conducted in the USA; (v) were research studies; and (vi) reported on family-based pediatric weight management interventions delivered in English and/or Spanish for children ages 6–12 years. Case reports, study protocols, commentaries, editorials, and non-peer-reviewed articles were excluded. Eligibility criteria are presented in [Supplementary Table 1](#).

Article screening

In the first round of article screening, the titles and abstracts of all articles were reviewed for meeting search criteria independently by two different reviewers. One author reviewed all 22 270 titles and abstracts, and additional reviewers each reviewed approximately 3000 titles and abstracts. Kappa statistics reporting the level of inter-rater reliability or agreement for article inclusion were calculated between each reviewer, and an overall score was created for the entire sample size. All discrepancies were resolved by jointly reviewing the article and reaching a mutually agreed conclusion.

In the second round of article screening, the 377 articles that were identified as meeting the study inclusion criteria were reviewed in full by two different reviewers. One author reviewed the full text of all 377 articles and additional authors each reviewed the full text of approximately 63 articles each. Kappa statistics reporting the level of inter-rater reliability or agreement were calculated between each reviewer, and an overall score was created for the entire sample size.

Data abstraction

In order to identify the reporting of RE-AIM constructs in the included articles, the same authors who conducted the second round of article screening also independently abstracted data. Each of the two reviewers independently recorded whether the RE-AIM construct's indicator was present in each article (i.e. yes/no) using a data abstraction checklist ([Supplementary Table 2](#)). Their findings were reviewed, reconciled, and aggregated to produce the prevalence of each RE-AIM indicator which is presented in [Table 1](#).

Key reported outcomes

Similar to previous research [40], our systematic review focused on each included article's reported outcomes within the RE-AIM framework using a modified checklist created by the Implementation Science Team at the National Cancer Institute as a guide to score National Institutes of Health (NIH) grant proposals but easily adapted for policy/program analysis and journal articles [49]. RE-AIM constructs are defined below.

“Reach” was defined by the sample size, eligibility criteria related to the child's weight, the assessment of selection bias, and sample characteristics, including child sex, race/ethnicity, socioeconomic status, food insecurity level, age range, and geographic location.

“Effectiveness” was defined by the primary and secondary outcomes, study design, and the statistical significance of results. Specifically, effectiveness was measured by the presence of a reported BMI/weight measure, a reported behavioral change, a reported mental health outcome (e.g. depression), a reported weight-related outcome for parent or guardian (in addition to the child). Effectiveness also included whether the primary outcome was BMI/weight related.

Table 1 Proportion of pediatric weight management studies focused on children ages 6–12 offering family-based interventions based in primary care settings reporting RE-AIM indicators and components

RE-AIM dimensions and components	Number reporting	Percentage reporting
<i>Reach</i>		
Average overall proportion: 65%		
Eligibility criteria: inclusion criteria respect to child's weight	145	79%
Sample size	184	100%
Selection bias assessed	62	34%
Child sex	123	67%
Child race/ethnicity	134	73%
Child age	178	97%
Socioeconomic status	96	52%
Food insecurity	5	3%
Geographic location	152	83%
<i>Effectiveness</i>		
Average overall proportion: 64%		
Study design	184	100%
Primary outcome is BMI related	136	74%
Mental health outcome reported	30	16%
Behavioral health outcome reported	132	72%
BMI/weight outcome reported	159	86%
Parent BMI/weight reported	42	23%
Statistically significant results	145	79%
<i>Adoption</i>		
Average overall proportion: 64%		
Facilitator is articulated (description of staff and level of expertise or training provided)	140	76%
Adoption rate (enrollment and retention of primary change agents)	112	61%
Change-agent satisfaction (characteristics of adoption/non-adoption)	53	29%
Intervention financing reported	114	62%
Remote aspect via eHealth reported (as eHealth can be either the facilitator and/or delivery mode)	171	93%
<i>Implementation</i>		
Average overall proportion: 47%		
Intervention intensity	150	82%
Fidelity reported (extent protocol delivered as intended)	13	7%
Measures of cost (delivery)	16	15%
Based in a theoretical framework	68	37%
Delivery mode (i.e. if group or individual or both)	167	91%
Intervention setting	145	79%
Barriers reported	35	19%
<i>Maintenance</i>		
Average overall proportion: 42%		
Follow-up duration	160	87%
Current status of the intervention	69	38%
Future funding (cost of maintenance)	2	1%

“Adoption,” or family and organizational engagement, was defined by adoption rate (i.e. enrollment and retention of parents/guardians), the family's satisfaction (i.e. characteristics of adoption/non-adoption), the intervention financing source(s), who facilitated the intervention (i.e. a description of staff and level of expertise and/or training), and setting (e.g. in-person or virtual).

“Implementation” was defined by capturing the use of a theoretical framework, attention to fidelity (i.e. the extent to which the protocol was delivered as intended), adaptations, barriers to implementation, intervention length and/or intensity, measures of cost, intervention setting, and delivery mode (i.e. whether it was geared toward individuals, groups, or both).

“Maintenance” was defined by the measure of follow-up after the intervention ended on both a family and organizational level, including outcomes measurements, current program status, and funding source.

The average overall reporting proportion of each RE-AIM construct was calculated by adding the prevalence proportions of all indicators and dividing the total by the number of indicators for that construct.

Results

Of the 34 623 records that were identified, 9411 were removed as duplicate records. Of the 22 270 remaining records, 377 advanced past the first round of abstract review into the second round of full-article review. In this first round, the inter-rater reliability (the kappa coefficient) was 0.9838.

In the second round, 376 of the 377 records sought for retrieval were obtained successfully. Despite repeatedly contacting the authors, one article [50] was not obtained. Of the 376 articles reviewed, 184 were included in the final review; 107 were controlled trials. In this second round, the inter-rater reliability (the kappa coefficient) was 0.8783. Of the 192 excluded, 47 did not state that they took place in primary care settings, 44 were conference abstracts, and 39 were not family-based weight management interventions. Full exclusionary information can be found in the PRISMA flow diagram (Fig. 1). The proportion of studies that reported on RE-AIM indicators is presented in Table 1.

Reach

The average overall proportion of studies reporting Reach was 65%. 100% of studies reported sample size. A total of 79% of studies reported child BMI information as part of the inclusion criteria; this was assessed to ensure the study population was children with overweight and obesity. The most common criteria were a Child BMI \geq 85th percentile [51–53]; however, some studies had a minimum threshold of Child BMI \geq 95th percentile [54, 55]. Some studies also set a maximum Child BMI percentile [56, 57]. 34% of studies conducted statistical testing to assess for selection bias.

97% of studies reported child age, and those that did not were typically reviews [58, 59] and/or qualitative studies [60]. 67% reported child sex, and those that did not were often cost analyses [61] or reviews [44, 62, 63], often focusing on cost or other nonclinical outcomes. 73% of studies reported race/ethnicity, 83% provided a geographic location of the study, and 52% reported socioeconomic status. Importantly, only five (3%) studies reported whether the child came from a house with food insecurity [63–67].

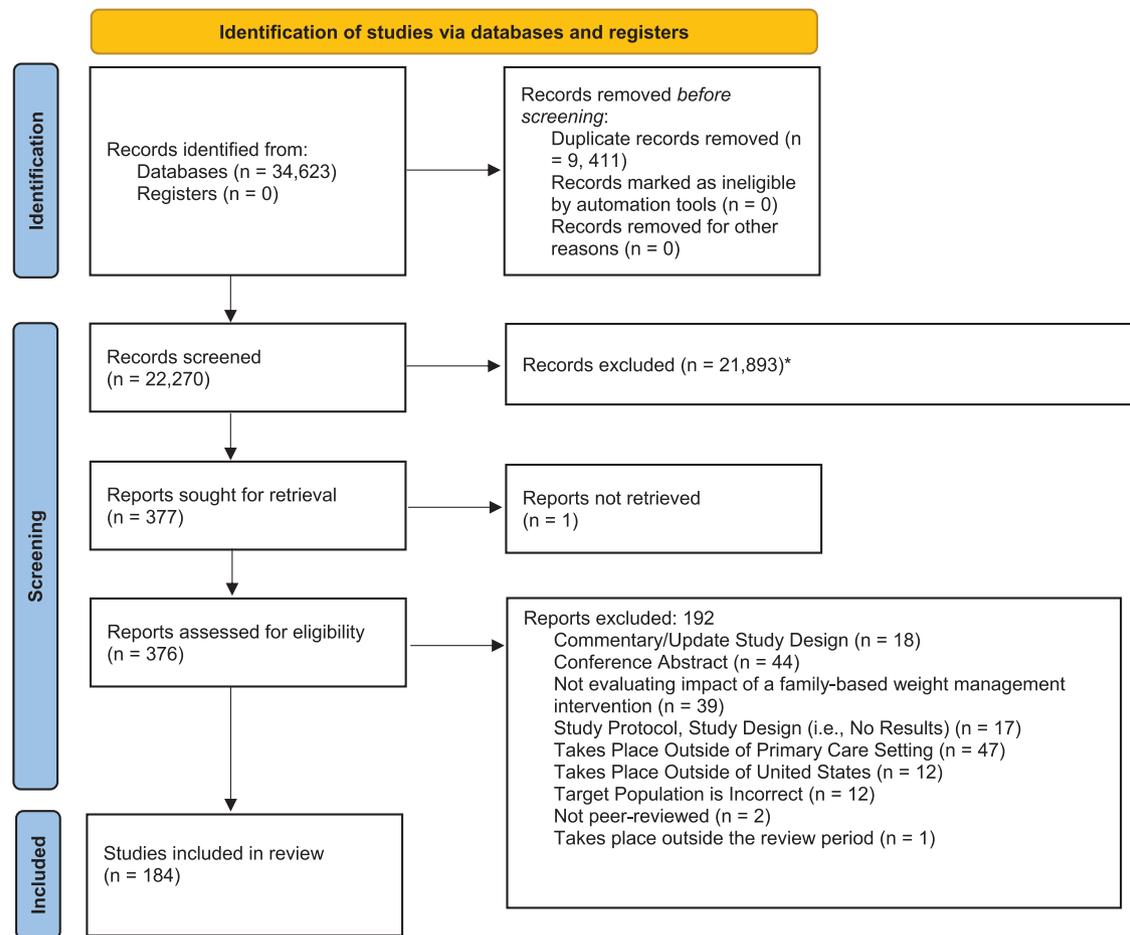


Figure 1 PRISMA 2020 flow diagram for new systematic reviews which included searches of databases and registers only. *Note: Given that reviewers only captured one reason for exclusion rather than all reasons for exclusion (and many articles were excluded for multiple reasons), counts per criterion cannot be provided. From Page MJ, McKenzie JE, Bossuyt PM *et al.* The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi:10.1136/bmj.n71. For more information, visit: <http://www.prisma-statement.org/>

Efficacy/Effectiveness

The average overall proportion of studies reporting Efficacy/Effectiveness was 64%. 100% of studies reported a study design, allowing the reader to discern which studies (65%) provided measures for at least one follow-up. Given the high quantity of literature available on this topic, 2% of studies were umbrella reviews [37, 68, 69], and 28% were reviews. 46% of the studies were comparative trials, and 21% were cohort designs. The remaining studies were cross-sectional [70], budget impact analyses [61], and qualitative [71]. A total of 86% of studies had an outcome related to child BMI or weight [56, 72], and 74% of studies had child BMI or weight as its primary outcome [72, 73]. 72% of studies reported a behavioral health outcome such as the number of minutes the child engages in physical activity [74, 75], dietary intake [70, 76, 77], and/or sedentary behavior [78, 79]. 16% of studies reported a mental health outcome, which was most commonly assessing quality of life [80–82]. Additionally, 23% of studies had a parent BMI or weight outcome reported. Some studies included parent BMI or weight only as a baseline measure [83, 84], whereas others included it both as a baseline and outcome measure [51, 85–87]. 79% of studies reported results that were statistically significant at the $P \leq .05$ level.

Adoption

The average overall proportion of studies reporting Adoption was 64%. 61% of studies reported both enrollment and retention of the primary change agents (i.e. parents and/or guardians). To better understand characteristics of adoption/non-adoption, only 29% of studies reported parent/guardian satisfaction [88–90]. 76% identified who the facilitator(s) was for the intervention and their training. 93% of studies reported the intervention setting; 66% of studies took place only in person, while 33% of studies had some sort of e-Health/virtual component. 62% of studies reported where they obtained their funding. Funding sources from the NIH [91–93] were most commonly reported (29%), but details about duration and amount were not provided.

Implementation

The average overall proportion of studies reporting Implementation was 47%. Only 37% of studies were based on a theoretical framework, with social cognitive theory (14%) being the most common [57, 84, 94–96]. 82% of studies reported intervention length and/or intensity. While some studies reported the length in time [97–99], others provided only the duration [52, 73, 100]. One study only reported the number of text messages per week [101], and another shared

the number of healthy food vouchers the provider gave the family [102]. Only 19% of studies reported implementation barriers (e.g. high costs [56, 92], time-intensive and costly recruitment [93, 103]; contact information for participants [103]; competing family responsibilities) [104], and only 7% of studies reported fidelity. Videotaping sessions were the most common way for assessing intervention fidelity [90, 105, 106]. 91% of studies reported the intervention delivery method: 41% were individual only, 19% were group only, and 32% had both an individual and group component. 79% of studies reported the intervention setting, such as primary care settings [107–109], the YMCA [80, 84], or remote [77, 101, 110]. Only 15% of studies reported the cost of the intervention itself [61, 62, 65, 99, 111–120].

Maintenance

The average overall proportion of studies reporting Maintenance was 42%. On a family level, the average follow-up time for the studies in this review was between 13 and 17 months, depending on if the average or longest follow-up time on studies that had variable follow-up times reported was used. Notably, some studies were just minutes long during a primary care visit [107, 121, 122], whereas others lasted for more than 2 years [69, 85, 123]. On an organizational level, only 38% of studies reported the program status at the time of publication, and most of those studies had ended [86, 124]—only three studies reported being ongoing [61, 125, 126]. Only two studies [61, 65] reported that they would be funded in the future. For example, the authors of one study wrote, “Unlike many interventions that are funded by one-time grants, AHF is feasible and financially sustainable for FQHCs due to income from physician reimbursements. For the FQHCs in Contra Costa County, AHF has generated a positive net-income” [65]. The other study reported how the program is reimbursable under existing ICD billing codes [61]. 87% of studies reported the follow-up duration.

Discussion

For effective programs to have a sustainable impact on preventing and treating obesity broadly, they must be implemented and disseminated beyond narrow populations and settings were originally studied. Evaluation of external validity can bridge the chasm between discovery and broad spread use, purportedly 17 years for medications [127]. However, it is not clear how often evaluation of external validity, frequently categorized with the RE-AIM framework, is performed. Accordingly, this inclusive systematic review assessed primary-care-setting literature from January 2007 to March 2020 on family-based pediatric weight management interventions in both English and/or Spanish for children ages 6–12 years in the USA using the RE-AIM framework. As hypothesized, most articles did not sufficiently report on external validity to allow replicability. Importantly, evaluations focused on external validity may increase the effectiveness of weight-loss interventions, especially for the most at-risk vulnerable populations [95].

To locate our research within the current literature, we discuss five systematic reviews of behavior-based interventions for obesity in children that included the age range 6–12 years conducted since 2007. Importantly, each review demonstrates how published reviews have adequately covered some

aspects of this topic and research question, but there is not a single review to date that has comprehensively assessed this topic for the target population and in the target setting. The most comprehensive systematic review, the technical report for the USPSTF, targeted RCT studies and examined effect on weight (weight, BMI, or other BMI-related metrics), and reported race/ethnicity, location of delivery including primary care provider offices, and other factors such as baseline excess weight, content topics, parent inclusion, and motivational interviewing. Importantly, the contact time was the only behavioral intervention component associated with effect size. Maintenance of effect on child was reported (some studies reported outcomes at 6 months and very few past 12 months), but this review did not compile complete information on the interventions’ Reach, Adoption, Implementation, or Maintenance beyond the time of the study period, including information such as cost that might support maintenance and the current status of the intervention [47]. A second review also focused only on RCT study designs, in this case, RCTs that had BMI and/or a BMI z-score as an outcome and that had at least 6 months of follow-up. Yet, their analysis did not discuss Reach, Adoption, or Implementation. Moreover, while they reported both the time of the study period and follow-up period, other important aspects of Maintenance such as financial support and current intervention status were not reported [128]. In a third review, only eight non-pharmaceutical-based studies were found to have a follow-up time for 12 months or greater in a time period spanning more than a decade. While appropriately focused on longer-term effects, this review, importantly, did not compile information on the adoption, implementation, or important aspects of maintenance [46]. In a fourth review, parent-focused e-Health interventions were reviewed. Yet, while brief descriptions of interventions were provided, all aspects of the RE-AIM framework lacked sufficient reporting, a common underreporting found in e-Health pediatric overweight and obesity literature [48]. In a fifth review, a systematic review of systematic reviews (or an “umbrella review”) looking at all intervention types did not report on Reach, Adoption, or Implementation. Again, Maintenance was restricted and defined by follow-up time only [129]. Finally, Sanchez-Flack *et al.* employed the RE-AIM framework to assess external validity rigorously in their systematic review [33]. However, this review was for a different age group (2–5 years of age) and a nonclinical setting (Headstart programs and preschools). Of note, the review found only 62.3% of studies reported on Reach, 48.7% on Efficacy/Effectiveness, 21.7% on Adoption, 53.6% on Implementation, and 11.6% on Maintenance [33]. As compared with our inclusive review that incorporated all study designs, an important limitation of Sanchez-Flack *et al.*’s review is that it only focused on trials, a study design known for strong internal validity and limited external validity. Therefore, some of their indicators for RE-AIM constructs were trial specific (e.g. intent-to-treat analysis utilized) and not applicable to the entire field. Additionally, other important indicators (e.g. geographic location, intervention setting, and delivery mode) were not included in the analysis. Given that there is *always* a tradeoff between internal validity and external validity [130], inclusive reviews such as the current one that capture the full body of literature are essential to discern to whom existing research can be generalized and how such research can be disseminated.

Thus, despite the increasing number of high-quality studies of Efficacy and Effectiveness of behavior-based obesity treatment for children 6–12 years of age, the current published reviews have not attended to the factors demonstrating external validity, or ability to generalize these findings and implement such interventions in diverse populations and settings. This field of family-based behavior and lifestyle interventions to address overweight and obesity for children 6–12 years of age lacks a comprehensive summary of what is known and what needs study for external validity. This review transcends specific subtopics and study designs to provide a clearer and more comprehensive landscape of the field today, so that future research can address specific gaps, reduce the lag in translation, and achieve more equitable health outcomes.

Studies can improve reporting on different dimensions of the RE-AIM framework. With respect to Reach, only 3% of studies reported on food insecurity, a known risk factor for overweight and obesity reported in the literature [19, 131]. Given that pediatric overweight and obesity disproportionately affect low-income children who are predominantly Black and Latino, the rate of change in child BMIs in the USA nearly doubled during the COVID-19 pandemic [132], and given that the recent COVID-19 exerts a disproportionate burden on these populations [19], it is important to assess if our work is aligned with the public health code of ethics and promotes equitable health, focused on the highest risk and most affected populations [25, 133]. There is also a need to assess selection bias more regularly. When selection bias is present, the relationship between the exposure and disease differs between those included in the study and those potentially eligible for the study [134], both the internal validity and external validity are affected. With respect to internal validity, it may alter the nature of the relationships between variables of interest. With respect to external validity, the results may not be applicable to the study population as intended [135]. Therefore, to improve both the accuracy and generalizability of results, there is a need to always assess for selection bias.

With respect to Efficacy/Effectiveness, there is a need to better understand the way such interventions impact multiple health outcomes for the child (i.e. mental health and physiological health) as well as the entire family unit. Currently, only 23% of studies in this review measured parent weight and/or BMI, and it is possible that the full impact of such interventions has not been fully captured and measured.

With respect to Adoption, there is an opportunity to improve reporting on the adoption rate and the factors that lead stakeholders to choose to adopt/not adopt such interventions. There are often many nested levels of stakeholders, facilitators, and technologies who play important roles in an intervention's uptake. Identifying all stakeholders and technologies, their training and formation, their level of adoption, and the reasons why they choose to adopt/not adopt are critical to replicability.

With respect to Implementation, more research should be based in a theoretical framework, assess fidelity, and report implementation barriers. Theoretical frameworks ensure that the research is coherent and focus the work [136]. Fidelity, or a process evaluation, is essential because it is critical to know if the results obtained were due to the *a priori* study protocol or adaptations that were made [137]. Similarly, reporting barriers can help illuminate the intervention's relationship with the context and setting.

There is also a need to report not only the funding source but also the actual cost and mechanism of payment for the intervention itself. Existing research reports both the annual cost and rise in cost for pediatric overweight and obesity [138], although most research on this topic has been conducted outside of the USA, where the healthcare system has limited comparability [139]. While reporting the funding source has utility to assess potential conflicts of interest and guide researchers to institutions that may support their research, reporting the cost of the intervention adds a necessary dimension that allows results to be assessed relative to their cost, so that policymakers and key stakeholders can make informed decisions and reduce the lag in translation [43].

Finally, with respect to Maintenance, more effort needs to be made to report if the program is ongoing (and for how much longer) as well as possible longer-term financing. This finding is aligned with previous reviews that found that studies do not report how programs were adopted long term [30]. In fact, these metrics are also proxies to show the recent shift to and focus on translation research, which is essential for having a broad public health impact [30].

Strengths

This review has several strengths. First, the review was responsive to previous research and addressed a gap in the literature focused primarily on external validity that will help reduce the translation gap. Second, this inclusive review did not restrict based on intervention setting, population, or study design, so it provided the necessary high-level view to understand the strengths, gaps, and needs for this population. Third, as part of this work, we added new RE-AIM indicators that were not previously included in similar reviews [33] that can be considered when conducting future research, such as reporting food insecurity, if selection bias was statistically assessed, whether the intervention was based on a theoretical framework, and longer-term financing. Finally, a robust team of researchers were involved in the data selection and abstraction to ensure that PRISMA guidelines were followed and reduce the possibility for selection bias.

Limitations

This review also has several limitations. First, the role of primary care settings varied greatly, with some studies using the primary care setting as the place for the intervention and others as the place for referral. While an important insight, it created a heterogeneous body of literature as the intervention settings and format varied greatly. Second, like most reviews, the data were not reported consistently across studies, making some comparisons difficult. Additionally, it is possible that there were multiple papers reporting on the same intervention and that the reported information may have been included in only one manuscript. In our study, we reviewed companion papers for the requested information when the study explicitly stated that methods and/or results were published elsewhere. Third, Adoption was captured primarily at the parent/guardian level (as they are the change agent who agrees and makes the changes in the child's environment) and not on the healthcare-system level. Finally, the inclusive nature of the review required that every study have the target ages, 6–12 years, included, but did not limit to this age range;

therefore, studies varied across the pediatric spectrum, from 0 to 19 years in age.

Conclusion and Future Directions

This inclusive systematic review demonstrated family-based pediatric weight management interventions in both English and/or Spanish for children ages 6–12 years in the USA can improve reporting on external validity to allow replicability, improve effectiveness, and reduce the lag in translation. Future research must focus on both reporting the actual cost of the intervention and sustainable financing. Without this knowledge, the necessary policy frameworks will not exist, and interventions for pediatric overweight and obesity can neither be scaled nor sustained.

Supplementary Data

Supplementary data is available at *Translational Behavioral Medicine* online.

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Conflict of Interest

None declared.

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Ethical Approval

This article does not contain any studies with human participants performed by any of the authors.

Informed Consent

This study does not involve human participants and informed consent was therefore not required.

Welfare of Animals

This article does not contain any studies with animals performed by any of the authors.

This review was registered at PROSPERO (CRD42022331304).

Transparency Statements

1. The study was preregistered at PROSPERO (CRD42022331304).
2. The analysis plan was registered prior to beginning data collection at PROSPERO (CRD42022331304).
3. Analytic code is not applicable to this study as it is a systematic review (N/A).
4. All materials are available as published research (N/A).

Data Availability

All data are available as published research (N/A).

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