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# Strategies to reduce attrition in managing paediatric obesity: A systematic review

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## Summary

**Objective:** To conduct a systematic review of the literature for strategies designed to reduce attrition in managing paediatric obesity.

**Methods:** We searched Ovid Medline (1946 to May 6, 2020), Ovid Embase (1974 to May 6, 2020), EBSCO CINAHL (inception to May 6, 2020), Elsevier Scopus (inception to April 14, 2020), and ProQuest Dissertations & Theses (inception to April 14, 2020). Reports were eligible if they included any obesity management intervention, included 2 to 18 year olds with overweight or obesity (or if the mean age of participants fell within this age range), were in English, included experimental study designs, and had attrition reduction as a main outcome. Two team members screened studies, abstracted data, and appraised study quality.

**Results:** Our search yielded 5,415 original reports; six met inclusion criteria. In three studies, orientation sessions ( $n = 2$ ) and motivational interviewing (MI) ( $n = 1$ ) were used as attrition-reduction strategies before treatment enrollment; in three others, text messaging ( $n = 2$ ) and MI ( $n = 1$ ) supplemented existing obesity management interventions. Attrition-reduction strategies led to decreased attrition in two studies, increased in one, and no difference in three. For the two strategies that reduced attrition, (a) pre-treatment orientation and (b) text messaging between children and intervention providers were beneficial. The quality of the six included studies varied (good [ $n = 4$ ]; poor [ $n = 2$ ]).

**Conclusion:** Some evidence suggests that attrition can be reduced. The heterogeneity of approaches applied and small number of studies included highlight the need for well-designed, experimental research to test the efficacy and effectiveness of strategies to reduce attrition in managing paediatric obesity.

## KEYWORDS

attrition, child, obesity management, paediatric obesity, systematic review

## 1 | INTRODUCTION

In Canada, overweight and obesity are present in 27% and 13% of 3 to 19 year olds, respectively.<sup>1</sup> Similar (and higher) levels have been

reported in many countries around the world.<sup>2</sup> Obesity tends to track from the paediatric to adult years,<sup>3</sup> which can increase the risk of several common chronic diseases, including cardiovascular disease, type 2 diabetes, and some forms of cancer.<sup>4</sup> The high prevalence<sup>1,2</sup> and persistence<sup>3</sup> of paediatric obesity underscore the importance of effective and accessible interventions for managing obesity. Multi-disciplinary, family-centred interventions that focus on healthy lifestyle habits and behaviour changes can help to manage paediatric obesity,<sup>5,6</sup> but often require a moderate to high intervention dose delivered over an extended period.<sup>7</sup> Children and their families who attend more intervention sessions and remain enrolled in care for longer periods achieve the greatest improvements in weight and health.<sup>8-10</sup> Unfortunately, for a variety of reasons (eg, logistical barriers, unmet needs or expectations), many families discontinue obesity management interventions prematurely.<sup>11,12</sup> To achieve improvements in health outcomes, children benefit from remaining in treatment. As clinicians and researchers working alongside children and families, we recognize that attrition (ie, permanent discontinuation of treatment<sup>13</sup>) can be a very challenging and vexing issue in obesity management, limiting the potential benefits that children with obesity and their families can achieve.

In paediatric obesity management, attrition is as high as 80%<sup>14</sup> and 30% to 40% attrition is common.<sup>15-17</sup> When attrition occurs, healthcare resources are misused, clinicians are less productive, and families become discouraged and unlikely to access obesity management health services in the future.<sup>18-20</sup> Paradoxically, families that are most likely to discontinue obesity management are the ones who may benefit the most from continued support (ie, families living in more deprived areas, children with greater degrees of obesity),<sup>21</sup> thereby worsening existing health inequalities.<sup>22</sup>

Literature reviews on factors related to attrition in managing paediatric obesity have revealed important insights. For instance, Dhaliwal et al<sup>11</sup> documented predictors of and reasons for attrition. Their quantitative data revealed that attrition was higher in older children ( $\geq 12$  years old) and among families receiving social assistance; qualitative data indicated common reasons for attrition included logistical barriers and interventions not meeting families' needs (eg, families disagreed with the treatment focus or intervention length). Initial data from the CANadian Pediatric Weight management Registry (CANPWR), an ongoing study of children enrolled in multi-disciplinary obesity management,<sup>23</sup> showed that attrition often occurs early in treatment.<sup>24</sup> Other reports showed that predictors of attrition differed depending on when attrition occurred (ie, earlier vs later in treatment).<sup>25,26</sup> For instance, Spence et al<sup>25</sup> showed that higher self-assessed health of the family system was associated with lower short-term attrition (ie, up to 4-months post-baseline) whereas higher percentage of intervention sessions attended by parents was associated with lower long-term attrition (ie, from 4- to 12-months post-baseline). Nobles et al<sup>26</sup> found that initiators (ie, families that attended the first one-third of a 10- to 12-week intervention) were more commonly of white ethnicity, enrolled in larger group sizes, and had April and September intervention start dates. They also reported that late dropouts (ie, families that did not attend the final one-third of a 10- to

12-week intervention) included children with higher BMI Z scores, enrolled in more recent intervention years, and who began the intervention in April.

A recent systematic review of adult obesity interventions<sup>27</sup> showed that financial incentives, multi-component interventions, and self-monitoring were strategies that reduced attrition, although most studies were rated low to moderate in methodological quality. To our knowledge, a similar review has not been published regarding attrition-reduction strategies in paediatric obesity. Interventions for managing adult and paediatric obesity may differ in important ways (eg, focus on individual [adult] vs family [paediatric] changes; require individual [adult] vs parent/family [paediatric] participation), so there is a need for a standalone review to synthesize the available evidence regarding attrition in managing paediatric obesity. Accordingly, the purpose of our systematic review was to search and synthesize the literature for strategies designed to reduce attrition in managing paediatric obesity to inform future experimental research and obesity interventions in clinical practice.

## 2 | METHODS

For transparency, this research was originally conceptualized as a rapid review to synthesize information to inform a new, multi-centre collaboration to reduce attrition in several Canadian pediatric weight management clinics led by team members (GDCB, JH, IZ). The review was based on systematic review guidance established by Cochrane<sup>28</sup> with adaptations for a rapid approach that were based on the World Health Organization rapid review guide.<sup>29</sup> While writing the methods section for the rapid review manuscript, we realized the rigour of our methodological approach was very closely aligned with a systematic review, so to meet the standard of a systematic review, we searched and screened an additional electronic database and a grey literature source and updated our original search to meet the new searching timeline. No other deviations were made from our original protocol.

### 2.1 | Search strategy

A systematic search strategy was developed in consultation with an experienced librarian and peer-reviewed by a second librarian based on the Peer Review of Electronic Search Strategies (PRESS) guidelines.<sup>30</sup> We searched the following electronic databases: Ovid Medline (1946 to May 6, 2020), Ovid Embase (1974 to May 6, 2020), EBSCO CINAHL (inception to May 6, 2020), Elsevier Scopus (inception to April 14, 2020) and ProQuest Dissertations & Theses (inception to April 14, 2020). Reference lists of relevant systematic reviews identified by the database search were also screened. The search was limited to English studies only and used a Low-Middle Income Country filter (<https://data.worldbank.org/income-level/low-and-middle-income>), which narrowed the scope of our search given that childhood obesity interventions and clinics are

less common in these countries and any attrition-reduction strategies would have limited applicability to higher income countries given differences in family, social, economic, and environmental contexts. Citations were exported and managed in EndNote (version X9, Clarivate, Analytics). As an example, the details of our Medline search strategy are provided (see Table S1).

## 2.2 | Study selection

Studies were eligible if they (a) included any kind of intervention for managing obesity, (b) included participants between (or had a mean age that fell within) 2 to 18 year olds with overweight or obesity, (c) were written in English, (d) included experimental study designs (randomized controlled trials [RCTs], quasi-RCTs, pre-post, case series, and case studies), and (e) included prevention of attrition (ie, permanent discontinuation of treatment) as a main outcome. The academic literature includes substantial heterogeneity in the use and definition of engagement-related terms (eg, participation, adherence, attrition, drop out). For specificity, the definition of attrition that we applied in this review was based on a conceptual framework of engagement-related terms published recently by team members.<sup>13</sup> Some may consider our inclusion criteria to be overly conservative, but in comparison to a recent review of attrition in adult obesity,<sup>27</sup> our criteria are more liberal. Two team members (MS and JW) undertook a two-stage screening process; study titles and abstracts were reviewed independently against the inclusion criteria, which was followed by a review of full texts. Discrepancies in screening decisions were resolved by discussion or with the input from a third party (GDCB).

## 2.3 | Data abstraction and analysis

Data from the included studies were abstracted by one reviewer (JW) and verified by a second reviewer (MS) using a data collection form that was piloted a priori. Data included general study characteristics (eg, study design, research objectives), baseline participant characteristics (eg, number of participants, age, sex, mean BMI), intervention details (eg, intervention and control groups, length of follow-up), and outcomes (eg, attrition). Quantitative data were analysed descriptively (eg, frequencies, means, proportions) and synthesized narratively, including a discussion of implications for research and clinical practice.

## 2.4 | Quality assessment

Quality of the included studies was assessed independently by two reviewers (MS and JW) using quality assessment tools published by the National Institutes of Health.<sup>31</sup> Different tools were applied based on study design (ie, controlled intervention studies tool for

RCTs; observational cohort tool for retrospective cohort studies; before and after study tool for pre- /post-studies). The quality of individual studies was rated as good, fair, or poor based on overall responses to the signalling questions. Any discrepancies between reviewers were resolved through discussion. As a complementary step, online registries (eg, clinicaltrials.gov) were searched to determine whether studies were registered publicly, either prospectively or retrospectively.

## 3 | RESULTS

### 3.1 | Overview of studies

Of the 5,415 articles retrieved by the search, six met study inclusion criteria and were included in the review (Table 1). The number of records identified at each screening stage are presented in Figure 1. Four studies were RCTs,<sup>32-35</sup> one was a retrospective cohort study,<sup>36</sup> and one was a pre- /post-study.<sup>37</sup> Four studies<sup>32,35,37</sup> were conducted in the context of established multidisciplinary pediatric obesity management clinics while two others recruited families from the community at-large.<sup>33,34</sup> Two studies included both children (~6 to 12 years old) and adolescents (~13 to 21 years old),<sup>36,37</sup> three included children,<sup>32,33,35</sup> and one included adolescents<sup>34</sup> only. In five studies, parents or adult caregivers participated along with their sons and daughters in family-based, multi-disciplinary obesity management interventions<sup>32,34-37</sup>; one study targeted parents exclusively.<sup>33</sup> Four studies<sup>33-35,37</sup> included participants with either overweight or obesity and two<sup>32,36</sup> included participants with obesity only.

### 3.2 | Strategies to reduce attrition

The attrition-reduction strategies included in the six studies were implemented in the treatment group either prior to initiating obesity management<sup>33,36,37</sup> or during the obesity interventions.<sup>32,34,35</sup> Two studies implemented an orientation session to reduce attrition.<sup>36,37</sup> Germann et al<sup>36</sup> established a group-based, single-appointment orientation session that families completed prior to initiating obesity management, allowing program providers to share details about the structure and expectations of the cognitive behavioural therapy (CBT) intervention. At orientation, families received information packets about the intervention to emphasize the importance of making changes as a family, the requirement for both parents and children to attend weekly CBT sessions, and parents' leadership role in making and maintaining healthy habits. The one-day orientation session implemented by Zenlea et al<sup>37</sup> included (a) a psychosocial, behavioural, and mental health screening for children and parents, (b) an orientation video to provide an overview of treatment objectives and expectations, (c) medical assessment, and (d) review of screening results and recommendations to guide obesity management. Both studies included non-contemporaneous comparisons of historical data (pre-orientation implementation) vs contemporary data (post-

**TABLE 1** Overview of characteristics and results from included studies (n = 5) designed to reduce attrition in managing paediatric obesity

Country & reference	Study design	n, mean age (SD); %female; % ethnicity	Experimental intervention (frequency; duration)	Comparator intervention (frequency; duration)	Mode of delivery	Attrition-reduction strategy	Effect on attrition
USA <sup>32</sup>	RCT	n = 101; 9.9 (N/A); 61%; 48% AA	Lifestyle counselling visits from a physician and dietitian (3 sessions; 3 mo), plus text messaging based on MI (5 d/wk; 12 wk)	Lifestyle counselling visits from a physician and dietitian (3 sessions; 3 mo)	1-on-1	MI-based text messaging (≤3 messages/weekday for 3 mo) between parents and research staff	↔
USA <sup>33</sup>	RCT	n = 140; ~9.0 (~2.0); 59%; 58% AA	Lifestyle counselling and experiential learning for parents (8 sessions; 8 weeks) with pre-intervention MI	Lifestyle counselling and experiential learning for parents (8 sessions; 8 weeks)	Group	MI (two 20 to 30 minute sessions pre-intervention) between parents and research staff	↔
USA <sup>34</sup>	RCT	n = 99; 13.8 (1.8); 74%; 73% AA	Lifestyle and behaviour modification (dietitian and behaviour counselling biweekly + physical activity 3x/wk; 10 wk) with MI	Lifestyle and behaviour modification (dietitian and behaviour counselling biweekly + physical activity 3x/wk; 10 wk) with health educational videos	1-on-1 + Group	MI (two 30-minute sessions at 1 and 10 wk)	↔
Netherlands <sup>35</sup>	RCT	n = 144; 9.9 (1.3); 64%; 75% C	CBT with lifestyle and behaviour modification with text messaging (11 sessions + text messaging; 12 mo)	CBT with lifestyle and behaviour modification without text messaging (11 sessions; 12 mo)	Group	Text messaging (children self-monitored lifestyle habits weekly + unlimited messaging to share thoughts and experiences between 3 to 12 mo; researchers sent tailored feedback in response)	↓
USA <sup>36</sup>	Retro. Cohort	n = 342; 13.0 (2.3); 54%; 89% AA	CBT with lifestyle and behaviour modification (nutrition sessions, structured exercise, self-monitoring) (~100 sessions; 12 mo)	CBT with lifestyle and behaviour modification (nutrition sessions, structured exercise, self-monitoring) (~100 sessions; 12 mo)	Group	Pre-intervention orientation session + written materials regarding obesity management intervention details and expectations	↓
USA <sup>37</sup>	Pre/Post	n = 539; 11.2-11.3 <sup>a</sup> (3.5-3.8); 60%-62%; 41%-49% C 12%-27% AA 32%-39% O/U	Lifestyle and behaviour modification (5-10 sessions; 15 mo)	Lifestyle and behaviour modification (5-10 sessions; 15 mo)	1-on-1	Pre-intervention orientation session (mental health screening, program overview video, medical and behavioural assessment)	↑

Abbreviations: AA, African American; C, Caucasian; CBT, Cognitive Behavioural Therapy; MI, Motivational Interviewing; O/U, Other/Unknown; RCT, Randomized Controlled Trial; Retro., Retrospective.

<sup>a</sup>Data reported separately for two groups—before and after orientation session was implemented.

orientation implementation) to determine the impact of orientation on attrition. Bean et al.<sup>33</sup> evaluated the impact of two pre-treatment MI sessions with parents (one by phone; one in-person) to enhance intervention attendance and retention after families enrolled in the study, but before starting the parent-based intervention for managing paediatric obesity. In the MI sessions, staff sought to enhance intervention engagement, querying parents' values, reasons for enrolling, and intervention goals, which included exploring motivation for change and highlighting potential discrepancies between parents' values and children's lifestyle habits.

As for the attrition-reduction strategies that were implemented during the obesity intervention, in the experimental group, Armstrong et al.<sup>32</sup> included 12 weeks of text messaging for parents ( $\leq 3$  messages/weekday) from research staff. Messaging focused on goal setting, was based on principles of motivational interviewing (MI), and complemented standard care (monthly clinic visits over 3 months), which both experimental and control groups received. Bean et al.<sup>34</sup> supplemented their standard practice with MI to enhance treatment effects. Both groups received the same lifestyle and behavioural intervention, which included biweekly counselling and education sessions with a registered dietitian and behavioural specialist, plus supervised physical activity (3x/week). Finally, in the study by de Niet et al.,<sup>35</sup> researchers compared the impact of adding text messaging to one of two groups after participants completed the first 3 months of a 12-month CBT-based obesity management intervention. Children in the text messaging group received mobile phones to monitor their lifestyle habits and submit lifestyle tracking data on a weekly basis to study staff who replied to each message with tailored, supportive and motivating messages. In addition, children were encouraged to send an unlimited number of messages to study staff between three- to 12-months follow-up to share their successes, challenges, thoughts, and feelings.

### 3.3 | Impact of strategies to reduce attrition

Germann et al.<sup>36</sup> reported that families that began obesity management before they implemented an orientation session participated in treatment for a shorter duration (mean: 3.8 months) compared to their peers who started obesity management after orientation sessions were offered (mean: 6.4 months) ( $P < .01$ ). Conversely, by 15-months follow-up, Zenlea et al.<sup>37</sup> showed that percent attrition was higher in families that started obesity management before vs after the orientation session was implemented ( $n = 211/237$  [89%] vs  $n = 239/302$  [79%];  $P = .002$ ). Kaplan-Meier survival curves revealed that attrition happened often early in treatment, with curve separation occurring later in pre- compared to post-orientation groups (median: 2.9 vs 2.0 months;  $P = .004$ ). Bean et al.<sup>33</sup> found that a greater proportion of parents in the experimental group attended the baseline/orientation session compared to their peers in the control group (75.5% versus 63.8%;  $P < 0.001$ ), but no differences were noted in percent session attendance during the 8-session intervention or retention at post-intervention and 4-month post-intervention follow-up.

With regards to the three studies implementing attrition-reduction strategies during the obesity intervention, Armstrong et al.<sup>32</sup> observed no statistically significant effect of text messaging on attrition (experimental group:  $n = 8/47$  [17.0%]; control group:  $n = 11/54$  [20.4%]) over the course of the 3-month intervention period, although families in the experimental group attended more clinic visits than their peers in the control group (3.3 vs 2.1;  $P < .001$ ). Bean et al.<sup>34</sup> found no statistically significant group differences in attrition at either 3 (MI: 26.9%; control: 37.1%) or 6 months (MI: 51.9%; control: 65.8%), although attrition tended to be lower in the MI group. Conversely, the study by de Niet et al.<sup>35</sup> reported that children in the text messaging group were 3.25 times less likely (95% CI: 1.35, 7.86;  $P < .01$ ) to discontinue the intervention after 12 months compared to their peers who did not receive text message support.

### 3.4 | Quality appraisal

Quality assessment determined that the six included studies differed in quality. Four studies were assessed as good quality due to their use of randomization, concealed allocation, and proper analyses.<sup>32,33,35,37</sup> Two studies were assessed as poor quality due to a lack of reporting of randomization methods<sup>34</sup> and because of substantial loss to follow up.<sup>36</sup> Only two<sup>32,33</sup> of the studies were registered a priori in a public, online registry.

### 3.5 | Excluded articles

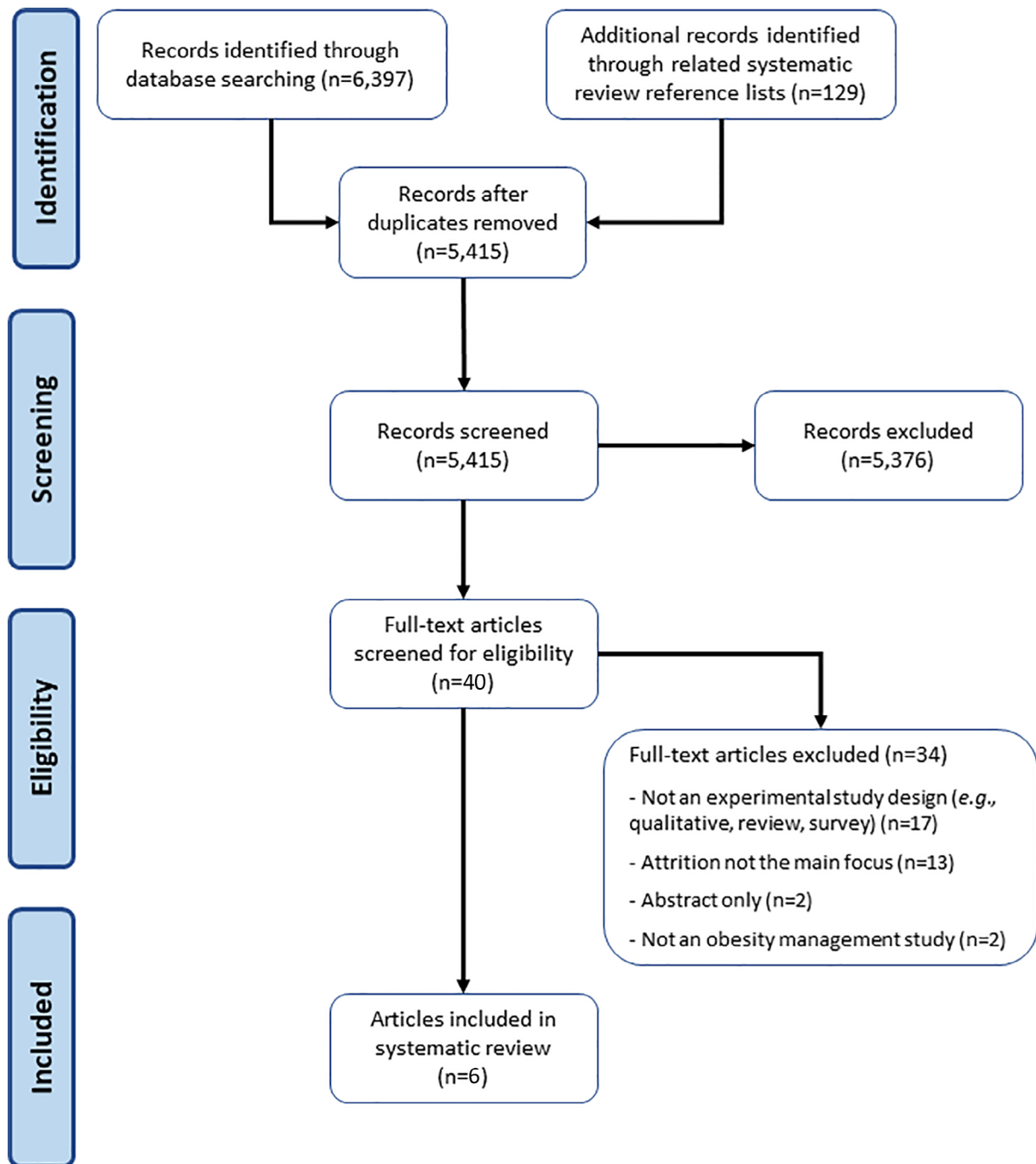
To complement the six articles included in our review, we summarized additional articles ( $n = 13$ ) that we excluded. These articles met some of our inclusion criteria but were rejected because they focused on engagement-related outcomes (eg, attendance, adherence) that differed conceptually from attrition (Table 2). It is noteworthy that some authors described their outcome data as attrition or drop out within their articles, but upon review, the outcomes were more accurately described as appointment attendance or behavioural adherence.

## 4 | DISCUSSION

The purpose of our systematic review was to identify strategies to reduce attrition in managing paediatric obesity. In total, six individual studies met our inclusion criteria, which evaluated several strategies that were applied either before or added to obesity management interventions. Our results provide some limited evidence that attrition can be reduced; however, well-designed, prospective randomized controlled trials are needed to generate higher quality evidence to inform what, how, and for whom attrition-reduction strategies are effective in managing paediatric obesity.

Numerous studies have explored reasons for and predictors of attrition,<sup>11,12</sup> but our review showed that very few have yet to examine strategies designed specifically to reduce attrition. Expert





**FIGURE 1** PRISMA flow diagram illustrating article selection process

recommendations<sup>38</sup> encourage clinicians to assess families' readiness and motivation before enrolling in obesity management, an activity that was part of the orientation sessions described by Germann et al<sup>36</sup> and Zenlea et al<sup>37</sup> and the MI sessions tested by Bean et al.<sup>33</sup> The potential benefits of this assessment are 2-fold: (a) families receive feedback on whether their treatment motivation and expectations align with intervention requirements and probable treatment outcomes and (b) families who are unlikely to be ready, willing, or able to meet the time and effort required for obesity management will decline to enrol because of high intervention demands. In theory,

families that perceive a mismatch between their perceptions vs realities of obesity management will opt out before enrolling. This self-selection enables intervention providers to focus their time and resources on families that are best prepared to participate. The orientation sessions and obesity management interventions described by Germann et al<sup>36</sup> and Zenlea et al<sup>37</sup> had some similar characteristics (eg, discuss treatment readiness and intervention expectations, emphasize lifestyle and behavioural changes in families), but only Germann et al<sup>36</sup> reported a reduction in attrition. One possible explanation for this difference is the nature of the obesity management

**TABLE 2** Summary of excluded articles (n = 13) that were designed to address non-adherence, engagement-related constructs in managing paediatric obesity

Country & reference	Purpose; engagement-related outcomes	Study design & sample size	Experimental & control interventions	Effect on engagement-related outcomes
USA <sup>39</sup>	Examine the comparative efficacy of in-person and guided self-help family-based interventions; treatment completion (drop out) data collected	Quasi-experimental, non-randomized; n = 100	5-month family-based interventions, including (a) in-person and (b) guided self-help; delivery was non-contemporaneous	↔
USA <sup>40</sup>	Examine whether intervention session attendance and self-monitoring were related with treatment outcome	Single arm, Pre/Post; n = 234	2-y intervention with lifestyle change (weekly sessions for 6-8 mo), maintenance (biweekly sessions for 6-8 mo), and continuing care (monthly sessions for 1 y)	↔
Sweden <sup>41</sup>	Evaluate whether demographic factors were associated with treatment efficacy, including age at treatment onset (6-9, 10-13, 14-16 y); lost to follow-up data collected	Single arm, Pre/Post; n = 555	3-year lifestyle and behavioural intervention, including individual and group-based sessions	↑ (10-13 y & 14-16 y > 6-9 y)
Israel <sup>42</sup>	Examine the feasibility of a dual assessment/intervention program; attendance data collected	Single arm, Pre/Post; n = 15	3-month, multi-disciplinary assessment/intervention (cognitive behaviour therapy) designed to assess/prepare them for either bariatric surgery or psychosocial/behavioural intervention	↔
USA <sup>43</sup>	Increase average monthly attendance of patients seen at follow-up in a hospital-based paediatric weight management clinic by 10%	4 Pre/Post, Plan-Study-Do-Act [PDSA] cycles; n = 388 (clinic appointments)	PDSA1: Appointment reminders (phone calls, letters) PDSA2: Follow-up phone calls between scheduled visits PDSA3: Reminder phone calls before group-based classes <sup>42</sup> PDSA4: Clinic orientation information (brochure, website)	↑ ↔ ↔ ↔
USA <sup>44</sup>	Examine the optimal exercise intervention for reducing adiposity, improving free fat mass, and promoting physical activity adherence	RCT; n = 45	In phase I, which lasted 16 wk, three groups performed either (a) moderate-intensity resistance training (MRT), (b) high-intensity resistance training (HRT), or (c) aerobic training (AT). In phase II, all groups performed 6-wk AT exclusively	↑ (MRT/HRT > AT)
Germany <sup>45a</sup>	Compare efficacy and safety of a low-level psychological intervention vs standard care; attendance <sup>b</sup> data collected	RCT; n = 119	(a) Cognitive behavioural therapy + motivational interviewing (focus: coping with obesity and acceptance; delivered by Psych) or (b) multi-disciplinary obesity management (focus: weight loss; delivered by MD, RD, Psych, ES)	↔
USA <sup>46</sup>	(a) Test home- vs clinic-based behavioural skills interventions for weight management and (b) after 3 mo, non-responders were rerandomized to continue home-based behavioural skills intervention or contingency management; attendance data collected	SMART; n = 181	Phase 1: 3-month family-based weight management interventions delivered in (a) home or (b) clinic settings Phase 2: After 3 mo, families re-randomized to home-based intervention that included either (a) behaviour skills (BS) or (b) contingency management (CM)	↑ Phase 1: Home > Clinic ↑ Phase 2: CM > BS
UK <sup>47</sup>	(a) Culturally-adapt existing weight management intervention to Pakistani and Bangladeshi families	Cluster RCT; n = 243 families (n = 24 clusters)	6-wk lifestyle and behavioural intervention delivered by trained facilitators, included two versions:	↑

(Continues)



TABLE 2 (Continued)

Country & reference	Purpose; engagement-related outcomes	Study design & sample size	Experimental & control interventions	Effect on engagement-related outcomes
	and (b) assess intervention feasibility and acceptability; attendance <sup>c</sup> data collected		(a) original and (b) adapted for Pakistani and Bangladeshi families	
USA <sup>48</sup>	(a) Examine acceptability and feasibility of a private social media group as an adjunct to weight management and (b) pilot test the use of social media to improve engagement and clinic attendance <sup>d</sup>	Single arm, Pre/Post; n = 13	12-wk private social media group; moderated by Psych, included content from MD, RD, ES (videos, challenges, updates); participants posted "likes," "comments," "shares" (measures of engagement)	↑ (engagement) ↔ (attendance)
UK <sup>49</sup>	Investigate enrollment into paediatric weight management in response to letters providing weight status feedback to parents; attendance data collected	Cluster RCT; n = 2642 parents (n = 283 clusters)	Intervention letters included (a) a visual tool to help weight status recognition, (b) a social norms statement, and for very overweight children, and (c) a pre-populated booking form for weight management services. Control letters included (a) children's anthropometry, (b) educational resources, and (c) an invitation to enrol in paediatric weight management	↑ (enrollment) ↔ (attendance)
USA <sup>9</sup>	Examine whether attendance and adherence to targeted behaviours in weight maintenance treatment predicted children's short- and long-term weight outcomes	RCT; n = 101	After a 20-wk family-based behavioural intervention, families were assigned to a (a) behaviourally-focused or (b) socially-focused 16-week weight maintenance intervention	↔
USA <sup>50</sup>	Assess the feasibility of a healthy eating and lifestyle intervention for parents; attendance data collected	RCT; n = 73	Over 12 mo, experimental intervention included six in-person, RN-led group sessions and a customized website; control group received annual well-child health check-up	↔

Abbreviations: ES, exercise specialist; MD, medical doctor; Psych, psychologist; RCT, randomized controlled trial; RD, registered dietitian; SMART, sequential multiple assignment randomization trials.

<sup>a</sup>Trial discontinued early due to high attrition; sample size goal not achieved, so may have been underpowered to detect group differences.

<sup>b</sup>Authors included intervention adherence (ie, attending ≥5 of 6 intervention sessions) as co-primary outcome; for comparability between studies, outcome characterized as attendance.

<sup>c</sup>Authors determined that ≥60% attendance at intervention sessions corresponded to successful completion; for comparability between studies, outcome characterized as attendance.

<sup>d</sup>Authors included attrition as a secondary outcome, which was operationalized as clinic attendance 12 weeks prior, during, and after the intervention; for comparability between studies, outcome characterized as attendance.

interventions themselves. Specifically, Germann et al<sup>33</sup> offered a year-long, group- and CBT-based obesity management intervention that included weekly sessions for children and parents. However, when provided with detailed information at orientation about high intervention intensity and demand, some families likely declined to enrol, leaving a subset of families who may be ready and motivated to participate in obesity management. Compared to the intervention offered by Germann et al,<sup>36</sup> the lower intensity obesity management intervention described by Zenlea et al<sup>37</sup> (ie, 1-on-1 appointments with multi-disciplinary team members every 1 to 3 months) was less demanding, which might have led a greater proportion of families to

enrol, even if they were hesitant or ambivalent about initiating treatment. The variety of activities and interactions between families and intervention providers throughout the obesity management interventions, combined with the non-randomized study designs, make it difficult to determine if any components of the orientation sessions influenced attrition. It is possible that orientation sessions reduce attrition, but these types of sessions are probably better suited to helping children and families decide about whether they should enroll in obesity management. Indeed, the data reported by Bean et al.<sup>33</sup> highlighted the potential to enhance treatment initiation using MI. In their trial, the first MI session (by phone) between parents and

research staff (psychology doctoral trainees) was offered after study screening and before baseline assessments were completed. This brief session led to greater family attendance at the baseline assessment visit compared with families in the control group who received a simple reminder phone call. A second MI session (in-person) was offered after baseline and before the intervention began but did not enhance treatment initiation or reduce attrition over time, suggesting that additional or a combination of strategies that extend beyond motivational factors are needed to optimize engagement.

To our knowledge, no published reports have examined whether orientation sessions enhance treatment enrollment. Perez et al<sup>51</sup> showed that children were less likely to enroll in multi-disciplinary obesity management as the length of time increased between their orientation session date and initial clinic appointment. Unfortunately, their analyses did not extend into the intervention period to examine longer term effects on attrition. Because orientation sessions are common in multi-disciplinary obesity management clinics and interventions,<sup>36,37,51,52</sup> research is needed to determine their value and impact on different engagement-related constructs (eg, enrollment, adherence, attrition).<sup>13</sup>

Several studies have documented the role that logistical factors play in families' decision to discontinue obesity management.<sup>19,53-55</sup> Transportation and parking costs, limited flexibility in clinic schedules, and work/school commitments have all proved challenging issues for families to overcome. Given these observations, we were surprised that our search did not yield any studies designed to help families overcome these practical issues. In adults, Pirotta et al<sup>27</sup> found that financial incentives reduced attrition, which may have (at least in part) made it easier for some adults to participate in obesity management if incentives were used to offset expenses related to practical issues such as transportation and parking. Because many families face barriers to attending in-person appointments, obesity management interventions can be delivered in different ways to make it easier for families to participate. For example, families view home-based<sup>56</sup> and digital/online interventions<sup>57</sup> favourably and these modalities have the potential to improve accessibility to obesity management. The emergence of COVID-19 has required clinicians and health care systems to embrace the virtual delivery of health services care out of necessity due to social distancing measures.<sup>58</sup> As the pandemic evolves over time, virtual care may persist as a common mode of delivering obesity management care, which highlights the opportunity for research in this area. There are limited data that support the effectiveness of treatments delivered virtually,<sup>59</sup> but these modalities have the potential to reduce the impact of logistical factors that can lead to attrition as either standalone or adjuncts to in-person interventions.

Interpersonal and social factors are often cited by families as reasons for attrition.<sup>18</sup> A lack of social support to continue obesity management can make it difficult for children and parents to persevere, especially when lifestyle changes influence the lives of family members who are not motivated to make changes or who wish to maintain current lifestyle habits.<sup>60</sup> This resistance can be discouraging, highlighting the important role that intervention providers can play in providing social support for children with obesity and their families.<sup>61</sup>

In this way, the text messaging strategies reported in two of our included articles provided parents with motivational prompts to enhance goal setting (in the Armstrong et al<sup>32</sup> study) and a structured mechanism for children to track and share their diet and physical activity habits (in the de Neit et al<sup>35</sup>) with research staff. In both studies, participants had the opportunity to receive ongoing positive feedback and encouragement.

Self-monitoring (eg, tracking lifestyle habits and body weight) strategies were one of the main themes identified by Pirotta et al<sup>27</sup> that reduced attrition in obesity management for adults. This activity enhances awareness of lifestyle habits over time, can inform goal setting, and build rapport, all of which might be beneficial regarding attrition. Self-monitoring has a potentially important role to play in reducing attrition in paediatric obesity management, although additional data are needed to confirm the independent and synergistic roles of self-monitoring in the context of other strategies (eg, social support, frequency of contact with intervention staff) that can also impact attrition.

A positive and supportive relationship between families and professionals can play a valuable role to increase children's and parents' motivation and participation (eg, attendance, goal setting) in obesity management.<sup>61</sup> Regular, ongoing, and affirming communication between children and parents and intervention providers in the Armstrong et al<sup>32</sup> and de Neit et al<sup>35</sup> studies represent positive and validating interactions, which contrast with the weight bias and stigma that many individuals with obesity experience in the healthcare system.<sup>62</sup> We are not aware of any research linking attrition with families' perceptions of weight bias and stigma, but it is possible that training and education to reduce the presence of weight bias and stigma among obesity management intervention providers could have a positive influence on attrition.<sup>63</sup>

Many children and their parents choose to persist in paediatric obesity management interventions for a variety of reasons. For instance, families have reported positive interactions with clinicians, practical and hands-on educational sessions, and a family-centred approach to care as reasons for continued participation.<sup>18,64</sup> Continued attendance has also been the result of parental concern for their child's health, anticipated and actual benefits from treatment, and high quality of care, including tailored health services.<sup>18,65,66</sup> Ongoing attendance is supported by flexible work schedules, choice of appointment times, adequate family financial resources, and children's motivation.<sup>65</sup> A detailed assessment of family expectations and potential barriers to treatment at treatment onset can help clinicians to align their services with family preferences and needs,<sup>67-69</sup> but prospective data are limited regarding how this assessment might reduce attrition.

Patient- and family-centred strategies that attend to multiple factors (eg, logistical, interpersonal, healthcare system) that are related to attrition have been evaluated in other areas of health care delivery. For instance, individuals with chronic diseases (eg, cancer, diabetes) can experience difficulty navigating the healthcare system; challenges can include accessing community-based services,<sup>70</sup> attending in-person medical appointments,<sup>71</sup> overcoming communication and information barriers,<sup>72</sup> receiving in-home support and education,<sup>73</sup>

and transitioning from paediatric to adult care.<sup>74</sup> Such experiences have catalysed research examining the impact of patient navigators on improving treatment access and outcomes.<sup>75</sup> Navigators could potentially serve supportive roles for children with obesity and their families during the course of obesity management, empowering families to access resources and services (eg, mental health support, community-based sport/recreation) that optimize intervention impact, both within and beyond clinical settings. Navigators can also help families to achieve a more detailed and thorough understanding of complex health issues and treatment regimens for obesity management, which can be overwhelming for some families. Based on evidence from related fields, there is value in determining the potential benefits of navigators in reducing attrition in managing paediatric obesity.

We acknowledge that our review was not without limitations. First, the different study designs and variability in how attrition data were reported prevented us from quantifying the overall extent to which strategies can be expected to reduce attrition. Unfortunately, the data were not amenable to conducting a meta-analysis. Recently, heterogeneity in how attrition-related research is reported led us to propose a universal approach for documenting and evaluating attrition in managing paediatric obesity,<sup>76</sup> which may help to standardize documentation and enable meaningful data syntheses in the future. Second, none of the studies included in our review documented reasons for attrition. A common underlying assumption in attrition-related research is that individuals discontinue obesity management because they are unhappy or dissatisfied (eg, unhappy with lack of improved weight or health, intervention failed to meet expectations, family members' priorities changed over time, motivation to participate decreased). However, some families discontinue obesity management because they were satisfied and received the care and support they desired,<sup>53</sup> indicating that attrition should not be viewed universally as a negative outcome. This lack of resolution in the main outcome of interest suggests the true impact of the attrition-reduction strategies tested in the included studies remains unknown. Finally, the studies included in our review evaluated strategies that focused on practical issues, which presents some limitations. From an academic perspective, to better understand the impact of attrition-reduction strategies, the application of relevant theories and frameworks (eg, self-determination theory,<sup>77</sup> behaviour change wheel,<sup>78</sup> family systems theory<sup>79</sup>) have the potential to inform and improve strategy design, implementation, evaluation, and dissemination. This approach also has the potential to help identify for whom and in what settings attrition-reduction strategies are effective.

## 5 | CONCLUSION

Attrition in managing paediatric obesity is a common occurrence, but our findings provide some evidence that attrition has the potential to be reduced. The heterogeneity of approaches tested, small number of studies, sub-optimal study quality, and variable responses highlight the imperative for experimental studies to test the efficacy and

effectiveness of evidence-based, theory-informed strategies designed to reduce attrition in managing paediatric obesity.

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## CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

## AUTHORS' CONTRIBUTION

Geoff D. C. Ball conceived the study, interpreted the results, and wrote the first draft of the complete manuscript. Meghan Sebastianski conceived the study, screened articles, assessed article quality, and wrote the first draft of the methods section. Jessica Wijesundera screened articles and assessed article quality. Diana Keto-Lambert developed, refined, and implemented the literature search strategy. Josephine Ho conceived the study and interpreted the results. Ian Zenlea conceived the study and interpreted the results. Arnaldo Perez conceived the study and interpreted the results. James Nobles conceived the study and interpreted the results. Joseph A. Skelton conceived the study and interpreted the results. All authors reviewed, edited, and approved the final submitted manuscript.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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