

Pediatric Residency Obesity and Overweight Training Curricula: A Systematic Review

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Abstract

Background. Pediatric obesity has become a significant public health concern. Pediatricians are the ideal group to help identify and treat this epidemic, but unfortunately, many pediatricians are not trained to discuss obesity with patients and their families. Standardized training initiatives for pediatric residents on prevention and/or management of obesity are needed to equip emerging pediatricians to combat the obesity epidemic. **Objectives.** This systematic literature review aims to examine the effectiveness of childhood obesity prevention/counseling resident training interventions. **Methods.** A comprehensive literature search was performed using preidentified search terms and limited to articles published prior to November 6, 2019. Articles were analyzed by 2 reviewers with a standardized evaluation tool. **Results.** A total of 698 articles were identified by the search. These were reduced to 111 articles after title review and 11 articles following abstract/full paper review. The 11 articles described 10 different obesity training interventions for residents. The articles varied in their size, length of training session, and study design. Despite these variations, all articles outlined positive outcomes, including an increase in physician confidence, positive changes in behavior, and/or improved electronic medical record documentation. **Conclusions.** With the continued increase in pediatric obesity, there is a need for practical, easy-to-implement, standardized trainings for pediatric residents on obesity prevention and treatment. More investigation needs to be done to look at long-term results of current interventions as well as other outcomes such as whether physicians are correctly identifying patients who are overweight or obese and whether there is improvement in patient follow-up.

Keywords

pediatric obesity, internship and residency, graduate education medical, continuing medical education, curriculum

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Introduction

Childhood obesity has increased significantly over the past few decades with almost 1 in 5 children meeting criteria for obesity.¹ Over the past 30 years, the prevalence of childhood obesity has more than doubled among children ages 2 to 5 and has practically tripled among children ages 6 to 19.² Children with obesity are more prone to be adults with obesity.³ The comorbidities of both childhood and adult obesity are vast, with medical and financial implications.⁴ They range from an increased risk of osteoarthritis to stroke and ultimately death.^{5,6} As of 2008, the medical care costs of obesity were estimated to be \$147 billion.⁷ Decreasing the number of children with obesity in the United States and worldwide would affect the health care of future adults

and, in turn, make vast improvements in the current national health care expenditure.

Given the frequency with which young children receive care in a clinical pediatric setting in the first 5 years of life, pediatricians are ideal individuals to target for training to prevent and identify overweight or obesity in childhood.⁸ Unfortunately, management and treatment of obesity is limited by appropriate diagnosis.⁹

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Trainees often find discussing obesity with a child and his or her family as one of the more challenging communication scenarios.¹⁰ Despite the frequency with which residents are expected to have these conversations with families, there is minimal standardization of training for pediatric residents on the prevention or management of obesity in pediatric patients. Less than a quarter of all accredited pediatric programs offer a structured teaching curriculum on the evaluation, management, and counseling of patients with overweight or obesity.¹¹ By improving training at the residency level, residents will graduate from their respective programs and bring with them the skills they obtained during training, thus affecting pediatric populations for decades to come.

A recent systematic review (published in 2019) examined obesity education training programs in medical schools as well as residency and fellowship programs.¹² It was not limited to pediatrics nor to the United States. Most of the 27 articles reviewed reported positive outcomes, but, given the broadness of the search, it is difficult to identify field-specific (ie, Pediatrics) or life stage-specific (ie, children) recommendations.¹² In order to inform pediatric obesity prevention/treatment educational best practices for US residency/fellowship programs treating pediatric patients, we conducted a systematic review of the current literature in order to (1) describe the design of training approaches that have been implemented and (2) examine how the impact of these training approaches have been measured. The primary goal was to identify the effect of the didactic training session on resident behavior and confidence in clinical settings to determine preferred training strategies for pediatric residency programs, and studies were evaluated based on if they demonstrated changes in resident physician confidence, in physician clinical behavior, in patient behavior changes, and in chart documentation. Findings from this review may be used to develop new or implement existing evidence-based approaches to obesity prevention/treatment in pediatric residency programs.

Methods

Search Strategy

We conducted a search using PubMed, Embase, Web of Science, and Scopus databases for studies using the search terms: (pediatric OR child/children/childhood) AND (obese/obesity/overweight) AND (resident/residency/trainee/internship) AND (residency OR medical education OR graduate education) AND (education OR curriculum OR train OR didactic OR lecture OR workshop).

Inclusion criteria for this review were that the study (1) addresses resident training on pediatric obesity; (2) describes a teaching modality or intervention targeted to improve obesity screening, diagnosis, treatment, or counseling among children and adolescents; (3) took place in the United States; (4) was published in English; and (5) published prior to November 6, 2019.

Article duplicates were automatically removed from the initial selection. The remaining article titles and abstracts were inspected for relevance by 2 reviewers (LW and MS). This resulted in 111 articles for full-text review for relevance. Articles were excluded if they did not include any characteristics described in Table 2. Articles that were not agreed on by both reviewers were evaluated by a third reviewer (RC) for inclusion criteria and discussed with all reviewers for consensus.

In order to address publication bias (published articles may not accurately reflect the breadth of current curricula), we also searched the Association of American Medical College's (AAMC) MedEdPortal for any curricula but did not find any additional articles discussing pediatric obesity training in residency programs. There was 1 relevant article that appeared in our search on the MedEdPortal, but it had already presented in our database searches.

A data extraction Microsoft Excel sheet was developed prior to the search by the study team. The reviewers independently completed the extraction sheet for all articles that met the search and inclusion criteria. Articles were reviewed for sample size, geographic area, study design, date range of data collection, residency program, patient age, type of intervention/training, measured outcomes, change in physician confidence, change in physician behavior, change in patient behavior, electronic medical record (EMR) changes implemented, and limitations noted of the study. This allowed for standardization of assessment of study quality and outcomes.

We included all studies in which an intervention was aimed at training a pediatric resident about methods for assessing and addressing childhood obesity. The primary outcomes identified the effects of the didactic training session on resident behavior and confidence in clinical settings to determine preferred training strategies for pediatric residency programs. Secondary outcomes included changes in patient behavior after trainings and changes implemented in EMRs documentation.

Studies that consisted of health care workers that did not include pediatric residents or family medicine residents caring for pediatric patients were excluded from this study. Further studies were excluded if they did not include didactic training interventions, measure outcomes after a training, or were review articles or abstract only.

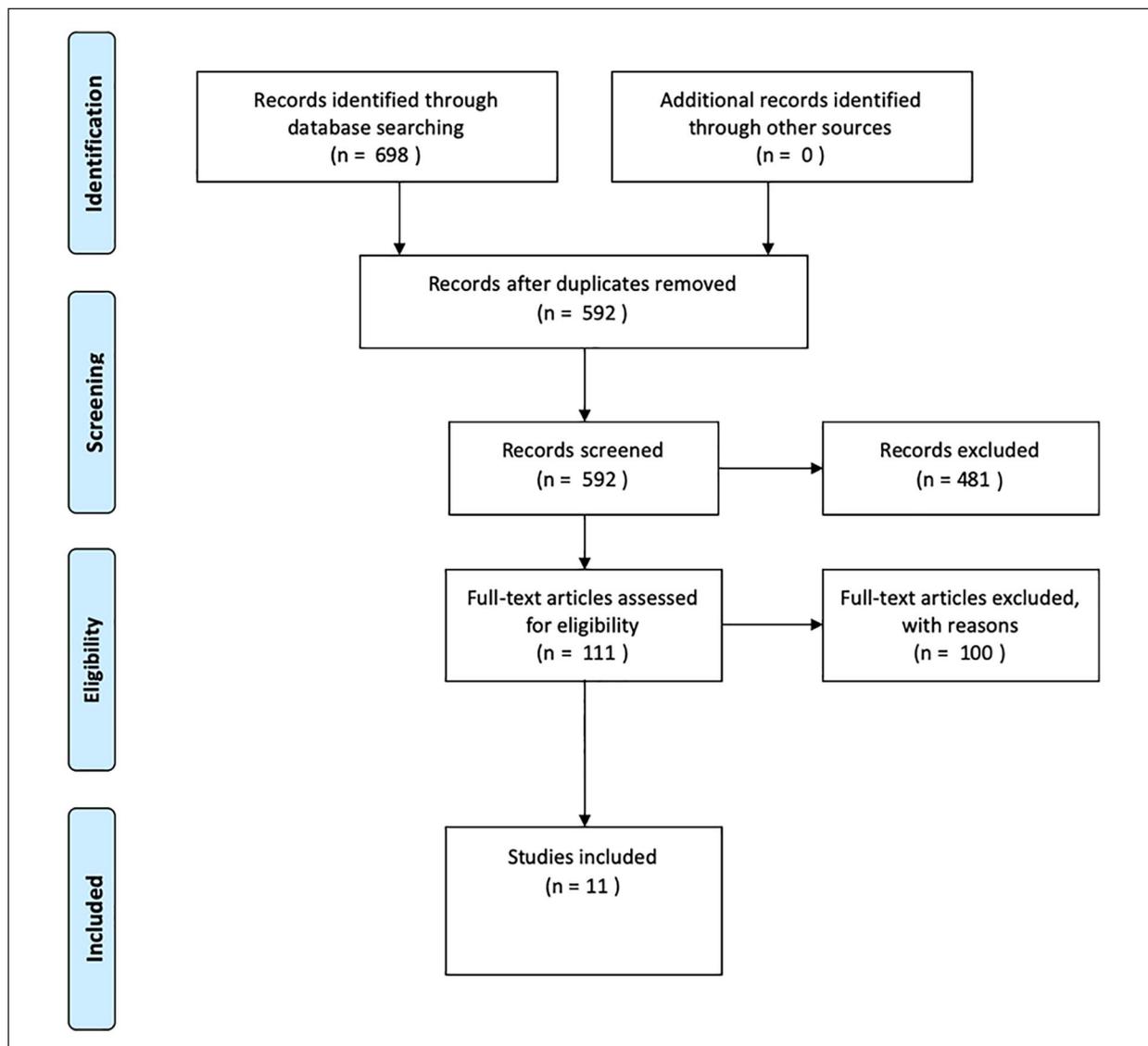


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for article eligibility.

Ethical Approval and Informed Consent

As this was a literature review, no ethical approval or informed consent was needed.

Results

A total of 698 articles were identified by initial searches in PubMed, Embase, Web of Science, and Scopus. A total of 592 unique articles were identified following de-duplication. These articles were then screened for relevance by 2 members of the research team. Of those, 111 articles met initial criteria by either reviewer and were followed by full-text reviews by each reviewer to determine eligibility. A total of 11 articles met criteria for inclusion in this review. There was no disagreement

between the 2 reviewers regarding article eligibility. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram illustrating the process can be seen in Figure 1.

Results are presented under the following headings: study characteristics, intervention implementation, and intervention outcome measures.

Study Characteristics: Setting, Number, and Training Recipients

The 11 articles that met eligibility criteria were published in a range of journals between 2006 and 2019, and all were conducted within the United States. The majority of the studies in this review were single-site

studies and were located specifically in an urban setting. Participants in the training included residents at all stages of training. Five of the studies were primarily pediatric residents,¹³⁻¹⁵ 3 included only family medicine residents,¹⁶⁻¹⁸ and 3 were a combination of pediatric residents with other specialties (internal medicine, internal medicine/pediatrics, pediatrics/child psychiatry/psychiatry).¹⁹⁻²¹ Four of the studies included attending physicians,^{10,15,16,20} one of which included community physicians and not just faculty physicians.¹⁰ Sample size ranged from 6 to 119 physician participants (Table 1).

Intervention Implementation

The trainings were mostly education-based, but 6 of the trainings included motivational interviewing techniques as well.^{10,13,16,17,19,21} Many of the training sessions were an hour,^{10,14,18} with the shortest training session being 15 minutes¹⁵ and the longest training session being a half day in clinic with a nutritionist.¹¹ In only 2 studies did a small portion of the participants receive repeat training.^{15,16} Six of the trainings occurred in the outpatient setting,^{11,15,16,18-20} 2 (same study but different articles) occurred during noon conference,^{10,14} and 2 occurred online.^{13,21} The trainings that were done in person were led by a variety of clinicians, ranging from psychology residents to nutritionists and board-certified pediatricians (Table 1). The details of 1 study (including the length of the training sessions, where the sessions were conducted, and who conducted the sessions) were not included in the article.¹⁷ Since the articles only provided a brief overview of each training and do not include details of the sessions, it is difficult to assess whether the trainings covered the National Academy of Medicine's Obesity Training Competencies.²² Most of the studies do not specifically address obesity training competencies. However, after reviewing the methods, the most frequently cited practices aligning with the competencies were demonstrating a working knowledge of the epidemiology of the obesity epidemic, using patient-centered communication when working with individuals with obesity, and utilizing evidence-based care/services for people with obesity.

Intervention Outcome Measures

To assess the efficacy of the training interventions, we looked at whether each of the 11 studies measured outcomes in the following 4 categories: physician confidence, physician clinical behavior, patient behavior changes, and chart documentation (Table 2). Limitations for each of the studies as described in the text of the individual studies is shown in Table 3.

Physician Confidence. Physician confidence in obesity counseling and identification skills has been examined, with the implication that increased physician confidence in specific patient care skills is more likely to increase utilization of those skills in clinical settings. Seven of the 11 studies reviewed evaluated physician confidence before and after the training session.^{10,11,13,15,17-19} All 7 found a significant increase in comfort and perceived competency with various aspects of obesity identification and counseling. Six of the 7 studies did not include a comparison group^{10,11,13,15,17,19}; however, one study specifically compared comfort and competence in a group that had received prior training versus a group of new trainees.¹⁸ The group that had received prior training had a significantly higher level of self-reported comfort and competence compared with the group of new trainees, but both groups did show improvement in every topic following training intervention.

Physician Clinical Behavior. Most of the studies (6 of 11) looked at clinical behavior changes in the physicians, specific to patient interactions.^{10,11,13,18-20} One study evaluated physician effectiveness at obesity prevention and healthy lifestyle counseling but did not comment on the results.¹¹ One study discussed subjective behavior changes; the residents self-reported "changes in delivery of care" including being more open-ended in questioning and making more specific recommendations.¹³ The remaining studies reported an increase in physician time spent discussing obesity; frequency of discussing diet, physical activity, and weight; and an increase in motivational interviewing techniques. These were evaluated by pre- and posttests, surveys, and chart reviews.

Patient Behavioral Changes. Assessment of patient behavioral changes refers to behavioral changes in the patients and their families regarding their health after the training sessions occurred, with the presumption that they are related to changes in physician management after the training session. Only 2 studies evaluated changes in patient behavior after the training intervention via surveys, and both reported an improvement in patients' attempts to lose weight via healthier eating, increased physical activity, and/or decreased television time.^{14,21}

Chart Documentation. Electronic medical record reviews provide a systematic method for evaluating whether new practices are being implemented by trainees but is dependent on proper reporting. Only 4 of the 11 studies looked, via chart review, at the effect of the obesity training sessions on EMR documentation.^{15-17,20} These studies did find improved documentation of body mass index, nutrition and physical activity history, and nutrition and

Table 1. Study Characteristics.

Study	Type of training	Location	Participants	Who delivered training	Length of training	Length of data collection
Burton et al ¹⁹	Education (obesity epidemic, obesity guidelines), motivational interviewing	University of Alabama	86 residents (52 internal medicine, 31 pediatrics, 3 medicine/pediatrics)	3 study authors (psychology graduate student and 2 faculty members)	3 hours	12 months
Carter et al ¹⁵	Education (obesity, BMI, nutrition and physical activity recommendation, Youth Physical Activity and Nutrition Assessment Form)	University of Maryland	35 residents (pediatrics, medicine/pediatrics, pediatrics/EM) and 6 attendings for first training, 37 residents and 7 attendings for second training	3 study authors (2 pediatric residents, 1 board-certified pediatric attending)	15-minute session (followed by repeat session 15 months later)	26 months
Dunlop et al ¹⁶	Education (obesity, expert committee recommendations, tools including BMI wheel), motivational interviewing (advise, identify, motivate model)	Emory University	38 providers including 17 family medicine and pediatric physicians, 2 nurse practitioners, and 19 family medicine residents	Board-certified pediatrician	Two 1-hour sessions (followed by distribution of tools 3 months later)	9 months
Essel et al ³	Education (home visiting, nutrition, and social determinants of health), motivational interviewing	Children's National Health System	22 pediatric residents (13 interviewed)	Online modules	4 online modules and 2 home visits	36 months
Gonzalez and Gilmer ¹¹	Education (childhood and adolescent obesity)	University of Texas (Galveston)	6 second-year pediatric residents	Written lecture, readings, registered dietitians	20-minute lecture, 1 half day in obesity clinic with nutritionist, 1-hour small group counseling with nutritionist	NR
Perrin et al ¹⁴	Education (childhood overweight, instructions on delivering interventions with BMI charts and healthy weight toolkit)	University of North Carolina Chapel Hill	49 pediatric residents	NR	1 hour	16 months

(continued)

Table 1. (continued)

Study	Type of training	Location	Participants	Who delivered training	Length of training	Length of data collection
Perrin et al ¹⁰	Education (obesity, how to interpret BMI with BMI charts), transtheoretical model, and motivational interviewing (how to improve physician-parent communication)	University of North Carolina Chapel Hill	49 pediatric residents and 18 community pediatricians	Coinvestigator and study team member (for community pediatrician training)	1 hour	16 months
Rhee et al ²⁰	Education (obesity knowledge; measuring body fat; calculating, plotting, interpreting BMI)	Urban Rhode Island	44 pediatric or psychiatry/child psychiatry/pediatric residents, 12 attendings	Board-certified pediatrician	20 minutes	11 months
Shue et al ¹⁷	Education (American Academy of Family Physicians practice guidelines for clinical management of childhood obesity), motivational interviewing	Ball State University	24 family medicine residents	NR	NR	10 months
Stahl et al ²¹	Education (obesity knowledge, dietary and physical activity recommendations, serving sizes, strategies for talking to parents and teens), motivational interviewing	University of Illinois at Chicago	119 residents (only 113 completed posttraining test, only 109 collected contact cards)	Web-based designed by attending physician coinvestigators	<60 minutes	Approximately 6 months
Wislo et al ¹⁸	Education (childhood obesity epidemiology, discussion barriers, expert recommendations, calculating BMI, using Fitwits flashcards and games guidance and practice)	University of Pittsburgh	31 family medicine controls, 55 family medicine physicians in intervention group (34 previously trained)—86 completed presurvey, 84 completed post-1 survey, 19/21 completed post 2 survey	Fitwits team residents	1 hour (20 minutes if done on own time)	Approximately 36 months

Abbreviations: BMI, body mass index; EM, emergency medicine; NR, not reported.

Table 2. Study Implementation and Outcomes.

Study	Measured outcomes	Confidence change assessed	Physician clinical behavior assessed	Patient behavioral change assessed	Chart review
Burton et al ¹⁹	1. Pre- and post-survey assessment (knowledge, attitudes) 2. Evaluated pre- and post-motivational interviewing with standardized patients	Yes—significant increase in self-efficacy using Perceived Competence for Obesity Counseling scale	Yes—significant increase in motivational interviewing technique (specifically open-ended questions, reflections, adherent statements)	NR	NR
Carter et al ¹⁵	1. Pre- and posttraining confidence assessments 2. Medical record documentation	Yes—improved confidence in ability to define, screen, and manage patients who are overweight or obese but no increased confidence in ability to provide information to patients	NR	NR	Yes—initial increase in overweight/obesity identification/documentation in EMR and appropriate follow-up documented (declined with booster)
Dunlop et al ¹⁶	Medical record documentation	NR	NR	NR	Yes—increased documentation of BMI, nutrition activity history, and nutrition activity counseling after 6 months (not significant after 3 months)
Essel et al ¹³	Postintervention interviews	Yes—report enhanced understanding of home and community life, awareness of personal biases and assumptions, challenges of losing control and not being intrusive, deeper relationship and enhanced empathy with patient and family, changes in delivery of care	Yes—self-reported “changes in delivery of care” including being more open-ended in questioning and making more specific recommendations	NR	NR
Gonzalez and Gilmer ¹¹	1. Attitudinal questionnaire assessing the individual learner’s comfort and confidence in nutrition counseling 2. Multiple-choice nutrition and obesity knowledge examination	Yes—significantly higher level of comfort and perceived competency in nutrition counseling and weight management of patients who are or are not at risk of being overweight, obese, adolescents, and their parents	Yes—unknown outcome but physicians evaluated on effectiveness of obesity prevention and healthy lifestyle education counseling	NR	NR

(continued)

Table 2. (continued)

Study	Measured outcomes	Confidence change assessed	Physician clinical behavior assessed	Patient behavioral change assessed	Chart review
Perrin et al ¹⁴	Pre- and post-survey assessments (parental accuracy of weight status, dietary and physical activity behavior changes; including 1 month and 3 months after intervention)	NR	NR	Yes 1. Increased consumption of fruits and vegetables, decreased consumption of sugary drinks and unhealthy snacks, and lower fat milk consumption (more in children who are overweight) at 1 month and more so at 3 months 2. Children who are overweight are more likely to show a decrease in eating out 3. Significant decrease in hours of screen time per day 4. Significantly greater percentage of parents reported discussions of weight at 1 month (not asked at 3 months) 5. Significant increase in accurate parental perception at 3 months of their child's overweight status	NR
Perrin et al ¹⁰	Pre- and post-survey assessments (reported mean confidence, ease, and frequency of dietary, physical activity, and weight status counseling) (Post-survey also asked about helpfulness of BMI color-coded charts, "Starting The Conversation" (STC) instrument, and the effect on time spent during well child check for each of those)	Yes—confidence was significantly improved on all measures (nutrition, physical activity, patient weight, counseling behaviors), ease of counseling significantly increased	Yes—frequency of discussing dietary, physical activity, and weight status counseling significantly increased	NR	NR
Rhee et al ²⁰	Medical record documentation	NR	Yes 1. Significant increase in counseling on nutrition and screen time	NR	Yes 1. Significant increase in the rate of BMI calculation and plotting pre- and posttraining

(continued)

Table 2. (continued)

Study	Measured outcomes	Confidence change assessed	Physician clinical behavior assessed	Patient behavioral change assessed	Chart review
Shue et al ¹⁷	<ol style="list-style-type: none"> 1. Pre- and posttraining confidence assessments 2. Medical record documentation 	Yes—report improvement in persuasion, motivational interviewing, and obesity counseling	<ol style="list-style-type: none"> 2. Relationship identified between BMI and laboratory tests ordered 3. BMI recognition related to greater odds of discussing dietary behaviors, physical activity behaviors, making follow-up appointments, and referring to subspecialist 	<ol style="list-style-type: none"> 2. Significant increase in documentation of counseling on nutrition and screen time, physical activity behaviors, making follow-up appointments, and referring to subspecialist 3. Increase in laboratory tests ordered if obesity was recognized 	<ol style="list-style-type: none"> 1. Sustained improvement in documentation of vitals 2. Unsustained improvement in addition of obesity or overweight to problem list 3. Improvement in documentation of physical activity, diet, and weight; however, rates trended down toward end of initiatives
Stahl et al ²¹	<ol style="list-style-type: none"> 1. Parental interview 1 month after clinic visit (change in 5-4-3-2-1 behaviors) 2. Pre- and posttests to physicians of knowledge of recommended daily serving numbers and sizes, physical, and sedentary activity times 	NR	NR	<ol style="list-style-type: none"> 1. Improved plans and carrying out of plans 2. Significant difference in eating/drinking habits (increased fruits/vegetables, increased water) 3. Increased physical activity 4. Decreased screen time 	NR
Wislo et al ¹⁸	Pre- and post-survey assessments (rates of discussion, comfort, and competence discussing childhood obesity, prevention and treatment, nutrition, exercise, portion size, BMI, and the term “obesity”)	Yes—existing trainees exceeded comfort and competence levels in discussing obesity prevention, portion size, BMI, and “obesity.” New trainees demonstrated improvements in comfort and competence across every topic. (maintained in post 1 and post 2 surveys.)	Yes—increased physician time spent discussing obesity, whether certain topics were addressed (obesity prevention, obesity treatment, nutrition, exercise, etc)	NR	NR

Abbreviations: NR, not reported; EMR, electronic medical record; BMI, body mass index.

Table 3. Limitations of Included Studies (as Noted by Study Authors).

Study	Limitations
Burton et al ¹⁹	<ol style="list-style-type: none"> 1. Lack of control group 2. Small sample size 3. Outcomes only proven in short term 4. Need instructors trained in motivational interviewing 5. No assessment of patient outcomes 6. No refresher session 7. Hard to implement in other programs
Carter et al ¹⁵	<ol style="list-style-type: none"> 1. Inability to trend individual patient patterns 2. No identifiers for physicians to trend their responses after training 3. Identification in EMR does not equal identification in real life
Dunlop et al ¹⁶	<ol style="list-style-type: none"> 1. Lack of control group 2. Unable to determine whether the observed improvements were attributable to effect of utilization of the tools or their reminder effect by being present in chart template 3. Only looked at documentation, might have had behavior changes without documentation 4. Did not break down by type of practitioner
Essel et al ¹³	<ol style="list-style-type: none"> 1. Small number of participants with limited variability in gender 2. Potential bias from the research team
Gonzalez and Gilmer ¹¹	<ol style="list-style-type: none"> 1. Lack of control group 2. Small sample size 3. No proven change in patients' behavior 4. No report on observational component of study 5. Full intervention requires month long rotation 6. No tracking of change over time
Perrin et al ¹⁴	<ol style="list-style-type: none"> 1. Lack of control group 2. Small sample size (only English speaking at 1 clinic) 3. Very specific patient population 4. Residents received a reminder prompt at time of visit—not natural for clinical practice 5. "Starting the conversation" (STC) instrument not previously validated 6. Results could easily be secondary to social desirability or reporting bias 7. Changes are short term
Perrin et al ¹⁰	<ol style="list-style-type: none"> 1. Lack of control group 2. The number of encounters and duration of intervention varied between resident and community physicians 3. Just 1 residency, small group of community physicians 4. Possible desirability bias 5. Statistical significance may not translate into clinical significance 6. Only assesses short-term confidence change
Rhee et al ²⁰	<ol style="list-style-type: none"> 1. Lack of control group 2. Only 1 academic clinical setting 3. Clinic A had 12 triple-board residents, which clinic B did not 4. Unsure if impact of intervention was secondary to education or receipt of BMI calculating tool 5. Dependent on provider documentation
Shue et al ¹⁷	<ol style="list-style-type: none"> 1. Looked at charts only from beginning of month 2. Knowledge tests only assessed short-term gains and did not evaluate how the training was enacted 3. Limited by physicians charting skills and cannot measure quality of conversations 4. Focused only on 1 family medicine residency clinic
Stahl et al ²¹	<ol style="list-style-type: none"> 1. Patients were not randomized to intervention or control groups 2. May have had selection bias 3. Impossible to quantitate missed counseling opportunities 4. Did not assess resident fidelity to the counseling technique 5. Did not assess the relationship of the short-term changes with changes in BMI 6. Unclear if sustained effort 7. Intervention may be confounded by community efforts
Wislo et al ¹⁸	<ol style="list-style-type: none"> 1. Narrower, older age group 2. Only the new trainee group experience was extended 3 months 3. No goal setting 4. Asking about comfort and competence is leading 5. Unclear if effect in patients 6. Did not include any pediatricians 7. Limited setting

Abbreviations: EMR, electronic medical record; BMI, body mass index.

physical activity counseling. Two studies also noted an increase in frequency of follow-up appointments.^{15,20} Only one study noted an increase in referrals to subspecialists and laboratory tests ordered if obesity was recognized.²⁰

Discussion

Despite increasing childhood obesity rates over the past 3 decades, the first reports identified by this systemic literature review of obesity training curricula for resident physicians was not published until 2006, and less than one fourth of all Accreditation Council for Graduate Medical Education (ACGME)-accredited pediatric programs currently offer a structured curriculum on pediatric obesity.⁸ This systematic review sought to illuminate the various published strategies utilized for training resident physicians on methods for addressing childhood obesity in the clinical setting, and to evaluate which training methods demonstrated improvements in confidence, physician clinical behavior, patient behavioral changes, and/or changes in documentation. Eleven articles were identified, and the training approach, outcomes, and limitations were described.

The training approach and content used within the 11 articles varied; however, most focused on obesity identification and treatment topics, with little emphasis on prevention. Given that a primary goal of pediatric care is based around anticipatory guidance and prevention, this review identified surprisingly few studies on the implementation of preventative strategies in the primary care setting to decrease the rising rates of overweight and obesity. Future training programs should consider incorporating and evaluating obesity prevention strategies in residency training programs.

This review focused on both physician and patient outcomes, including physician confidence, clinical behaviors, and changes in documentation, in addition to patient behavior changes based on parent surveys. Most studies evaluated physician and/or patient outcomes pre-/posttraining, with no comparison group. Given the nuances of residency training, including variability of experience and years of training, a control group would be challenging but needed to account for the differences in skill sets between residents. In addition, most surveys included small sample sizes and were limited geographically to single training programs. Outcome measures varied but included surveys, observation, interviews, and chart review. The majority of the studies found that training residents in childhood obesity prevention/treatment is able to produce an increase in confidence in their counseling skills, in resident satisfaction with these visits, in body mass index recognition and classification, obesity

and overweight knowledge, and in weight counseling techniques related to motivational interviewing. Few studies focused on patient outcomes, and none demonstrated long-term weight changes in patients identified as obese. Our home institution used the findings from our initial literature search to institute a new obesity training curriculum for pediatric residents in the outpatient setting. The article analyzing our results is included in the literature review above and aimed to include initially identified gaps in the training outcome evaluations.

Future studies should hone in on the most effective approach to training pediatric residents in pediatric obesity prevention and treatment, including the content/approach, type of training platform (need for refresher sessions or repeat sessions), duration of training most effective, and duration of sustainable effects. There were only 6 published trainings that occurred in 1 hour or less of training time, despite evidence that direct, simple training tools are overall more useful for resident education and comfort in obesity-related counseling in comparison to longer tutorial sessions.^{10,14,15,18,20,21,23} Given this, an examination of training duration, specifically whether brief training sessions can sustain this efficacy and demonstrate reproducible benefits, is needed. Additionally, only 2 studies documented improvement in expected follow-up visits,^{15,20} and none investigated the time frame and follow through for these visits to determine if closer evaluations and management took place as a result of these interventions. Finally, it is notable that few studies examine whether, after these trainings, there was correct identification of overweight/obesity based on standard criteria.

Limitations of the review articles include difficulty in interpretation with inconsistency of outcome measures across the studies. This could be addressed in future research with a standardized outcome measure such as a simulated patient or standard documentation practices that could be evaluated on chart review. Such changes, however, would be expensive, time-consuming, and may be difficult to implement across various institutions. Additionally, each study had small sample sizes and were geographically limited at single study sites. Future studies should consider a multisite study, with a goal of larger sample sizes and longer term follow-up evaluations, including postgraduation review. Overall, the heterogeneity of the studies makes generalizability difficult.

Conclusion

With demonstrated increasing rates of childhood obesity, it is necessary to equip pediatric resident physicians with knowledge and skills to help prevent and

manage this epidemic. This review demonstrates that childhood obesity educational interventions can be implemented within residency training and leads to improved confidence in obesity counseling, positive physician clinical behavior changes, improved documentation, and positive patient behavioral changes. Further studies on resident training in obesity counseling and intervention are needed to determine whether such interventions lead to improved care and patient-related outcomes, as well as long-term, sustainable changes in physician practices. The ultimate goal should be a standardized evidence-based curriculum for obesity prevention and counseling that can be implemented in pediatric training programs nationwide.

Author Contributions

MS conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

LW conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

SS conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

YW conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

EH conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

RC conceptualized and designed the study, assisted in analysis and interpretation of the data, drafted the initial manuscript and approved the final manuscript as submitted.

Declaration of Conflicting Interests

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