Heliyon 8 (2022) e12473

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Obesity screening in the pediatric emergency department – A missed opportunity?

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HIGHLIGHTS

- There is a low rate of pediatric obesity screening in primary care.
- Pediatric emergency department (PED) visits are an excellent opportunity to identify children with obesity.
- Parents can be highly receptive to obesity screening and treatment referrals in the setting of the PED.
- A very low rate of addressing and documenting weight status was found in charts of children with obesity who visited the PED.
- The potential ability of the PED to address obesity in children is highly underutilized.

ARTICLE INFO

Keywords:
Documentation
Pediatric emergency department
Obesity
Screening

ABSTRACT

Objectives: There is a low rate of body mass index measurements and obesity screening in primary pediatric care. Pediatric emergency department (PED) visits, with their large volumes and routine weight measurements, provide a unique opportunity to identify and address obesity. The study objectives were to examine the rate of addressing obesity in the PED and to identify its predicting factors.

Methods: From electronic medical records of PED visits during 2010–2019, we extracted data on age, gender, weight, time, listed diagnoses, and discharge texts. The primary outcome was a listed diagnosis of "obesity" on discharge letters of children with obesity. Secondary outcomes were addressing weight in the discharge letter and written recommendations for obesity-related treatment. Mixed models were used to test for associations between each of the three outcomes and patient/visit characteristics.

Results: There were 150,250 PED visits by 88,253 different children and adolescents. Obesity was found in 10,691 children (12.1%). Among these, listed "obesity" diagnosis was present in only 240 (1.5%) visits. Text addressing overweight/obesity was recorded in 721 (4.4%) visits, and weight-related recommendations were documented in 716 (4.4%) visits. "Obesity" was documented in females more often than in males, in older children, in children with higher weights, and in visits conducted during the mornings.

Conclusions: The rate of obesity diagnosis in the PED was extremely low, hence the potential screening ability of the PED in this matter is highly under-utilized. PEDs could increase the recognition of obesity, thus assisting in the global efforts in tackling this disease.

1. Introduction

A dramatic increase in the prevalence of obesity in children and adolescents occurred during the last 4 decades [1]. The number of children and adolescents with obesity grew in every region of the world and increased 11-fold, from 11 million in 1975 to 124 million in 2016 [1]. The World Obesity Federation predicts that the number of children and adolescents with obesity will continue to rise, from 158 million in 2020, to 258 million by 2030 [2].

The main concern regarding the high rates of pediatric obesity stems from its numerous complications, in both younger and older age [3, 4, 5, 6, 7, 8]. These immediate and future comorbidities mandate ongoing

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https://doi.org/10.1016/j.heliyon.2022.e12473
Received 29 March 2022; Received in revised form 25 October 2022; Accepted 12 December 2022

treatment efforts to identify the children who have obesity is the evident first step. Routine measurements by healthcare providers of children's weight and height, with calculation of body mass index (BMI) and its percentiles, are the rightfully recommended mainstay for screening of obesity in youth [9, 10, 11, 12]. Yet in clinical practice, studies show a low rate of BMI measurements and obesity screening in primary pediatric care [13, 14, 15, 16, 17]. Pediatric obesity screening in primary care decreased further during the ongoing SARS-CoV-19 pandemic, as pediatrician in-office visits were minimized and telemedicine was preferred [18, 19].

The pediatric emergency department (PED) provides an opportunity to identify obesity and address it. This is due to the high volume of children who visit it, the time that families often have while waiting, the routine measurements of weight in every visit, and the written discharge notes given. Further, studies have shown that parents can be highly receptive to obesity screening and treatment referrals in this setting [20, 21, 22]. In order to combine the large potential of obesity screening in the PED with the readiness of parents to discuss and treat their children, PED staff should be aware of the weight status of the visiting children and address it, when applicable. The current rate of addressing the weight status of children and adolescents with obesity who visit the PED is unknown.

The aims of this study were 1) to examine the rate of documenting and addressing pediatric obesity in the PED of a large tertiary care center, and 2) to identify predicting factors for such documentation.

We hypothesized that the rates of obesity documentation and treatment referrals would be low, and that these may be related to the magnitude of overweight, age, gender, season and time of day.

2. Methods

This study was designed as a retrospective chart review of electronic medical records of all PED visits over a recent ten-year period of 2010–2019. The study setting was the PED of The Edmond and Lily Safra Children's Hospital at Sheba Medical Center, a large tertiary-care medical center in central Israel, that regularly accepts infants, children and youth aged 0–18 years. The study was approved by the Institutional Review Board Ethics Committee of Sheba Medical Center, Tel Hashomer, Israel (SMC-20-6825). The study population included all children and adolescents aged 2–18 years who visited the PED during the study period.

The variables extracted from the electronic medical records were date and time of PED visit, age, gender, weight, listed diagnoses, and the complete texts of the Discussion and Recommendations sections of the discharge letters. Visit month was used to categorize the visit season to winter (from November to March) or summer (from April to October), in order to assess whether lighter or heavier clothing was associated with obesity documentation. Visit time was used to categorize the visit timing by morning (from 07:00), afternoon (from 15:00) or night (from 23:00) shifts, in order to examine whether the time of day was associated with obesity documentation. In our PED, different shifts are disproportionally staffed. The morning shift includes 3–4 senior pediatricians and 2–3 residents in pediatrics; the evening shift has 2 senior pediatricians and one resident in pediatrics, and the night shift includes only one resident.

In this PED, weight is regularly measured in each visit, in light clothing and following the removal of coats and other large garments. Since height is not routinely measured in the PED, we transformed the participants' weight to age- and sex-specific percentiles according to the Centers for Disease Control and Prevention 2000 growth charts. We previously showed, using data from 12,884 pediatric participants from the National Health and Nutrition Examination Surveys (NHANES) of 2005–2012, and 15,152 adolescents measured in primary care clinics, that weight percentiles discriminate very well between children with and without obesity (ROC area under the curve 0.977, $p < 0.001$) [23]. Moreover, we identified the 90th weight percentile as having a high sensitivity and negative predictive value in identifying participants with obesity (94% and 99%, respectively). For the purpose of this study, obesity was defined as a weight percentile $\geq$90, corresponding to a standard deviation score (SDS) of $\geq$1.28. We recently used this method to examine obesity prevalence changes during the COVID pandemic using data from PED visits [24], and found it highly acceptable; the rate of obesity as identified using weight percentiles was nearly identical to that using the traditional BMI cutoff. A weight-SDS above 4.0 was considered a typing error and unlikely (based on unpublished data of weight percentiles from ~100 adolescents who underwent bariatric surgery in our center), and such participants were excluded from analyses (n = 223).

The primary outcome was a listed diagnosis of "OBESITY" on the problem list of the discharge letters of children who were identified in the database as having obesity by weight measurements. Two secondary outcomes were 1) any physician notes addressing weight or obesity in the Discussion or Recommendations sections of the discharge letter, and 2) a written referral or recommendation for treatment of obesity in the discharge letter. For this purpose, the charts were screened for specific key words that corresponded with weight status or our center's lifestyle and obesity clinic, such as *weight, obesity, exercise, diet* and lifestyle by a computerized search of the text. Charts that included these words were then also manually reviewed by the study authors, to verify that the context of the identified keywords was indeed related to obesity (e.g., recommendation of a high-fiber *diet* for a child that visited the PED due to constipation, was not considered relevant to his overweight). A recommendation for obesity treatment was considered when the discharge letter included at least one of the following: a follow-up with the primary care physician to discuss obesity; advice regarding lifestyle changes (diet, physical activity); referral to a community-based dietitian; or referral to our hospital's designated lifestyle clinic.

2.1. Statistical analysis

Descriptive statistics and frequency distributions of patient characteristics at visits are presented as continuous and categorical variables, respectively. Groups were compared with the Wilcoxon rank-sum tests for continuous variables, and Chi square tests for categorical variables. Cohen's Kappa was used to assess for agreement between outcomes.

All patient visits were used for analyses, including recurring ones. Multivariable logistic mixed models with random effects of patient were used to test for associations between each of the three outcomes and patient characteristics. A subgroup analysis was performed for children with obesity and repeated PED visits who did not have a documentation or addressing of obesity in all their visits, in order to better identify predictors of documentation using different visits by the same child. A two-sided p value < 0.05 was considered significant for all analyses, all of which were performed using SAS© version 9.

3. Results

During the study period, there were 150,250 PED visits in our center by 88,253 different children and adolescents. A weight-SDS defining obesity was found in 10,691 children and adolescents (12.1%), who visited the PED for a total of 16,413 visits.

A listed OBESITY diagnosis was noted in only 240 visits (1.5%) of 225 different children with obesity. Text addressing overweight/obesity was recorded in 721 visits (4.4%) of 639 children with obesity. Active recommendations to treat overweight/obesity were documented in only 716 (4.4%) of visits by children with obesity.

Table 1 presents clinical and demographic characteristics of the study participants with obesity, and when separated by obesity documentation status. Regarding age, the highest and lowest rates of OBESITY documentation were observed in children aged 12–15.9 years (2.7%) and 2–5.9 years (0.3%), respectively ($p < 0.0001$). OBESITY was documented in females more often than in males, in children with significantly higher weight and weight-SDS, and in visits that were conducted during morning shifts.

Table 1. Demographic and clinical characteristics of children with obesity in the study, and by OBESITY documentation status. Data are presented as median (interquartile range) or n (%).

Characteristic	Category	OBESITY documentation (n = 240)	No OBESITY documentation (n = 16,173)	All participants (n = 16,413)	p value*
Age (years)	-	12.9 (10.0–15.2)	9.3 (5.3–13.4)	9.4 (5.3–13.5)	<.0001
Age category (years)	2–5.9	12 (0.3)	4,715 (99.7)	4,727 (28.8)	<.0001
	6–11.9	86 (1.4)	6,055 (98.6)	6,141 (37.4)	
	12–15.9	109 (2.7)	3,983 (97.3)	4,092 (24.9)	
	16+	33 (2.3)	1,420 (97.7)	1,453 (8.9)	
Gender	Male	116 (1.2)	9,451 (98.8)	9,567 (58.3)	0.0016
	Female	124 (1.8)	6,722 (98.2)	6,846 (41.7)	
Weight (kg)	-	78 (58–95)	45 (25–71)	45 (26–72)	<.0001
Weight SDS	-	2.3 (2.0–2.7)	1.7 (1.5–2.1)	1.7 (1.5–2.1)	<.0001
Season	Winter	108 (1.5)	7,110 (98.5)	7,218 (44.0)	0.7478
	Summer	132 (1.4)	9,063 (98.6)	9,195 (56.0)	
Shift	Morning	116 (1.8)	6,464 (98.2)	6,580 (40.1)	0.0214
	Evening	95 (1.3)	7,064 (98.7)	7,159 (43.6)	
	Night	29 (1.1)	2,645 (98.9)	2,674 (16.3)	

SDS – standard deviation score.
* p value for difference between groups of OBESITY documentation status.

There was a low level of agreement between OBESITY documentation and text documentation, with only 40.4% of visits with OBESITY documentation having both (Kappa = 0.28, 95% confidence interval (CI) 0.24–0.32). The agreement between a treatment recommendation and OBESITY or text documentation was very low (0.16, CI 0.11–0.21) and none (0.01, CI 0.00–0.03), respectively. Only 45% of visits with an OBESITY documentation also had a written recommendation for weight-related treatment.

Table 2 presents the results of the logistic mixed model analyses. Children aged 2–5.9 years had the lowest odds of OBESITY diagnosis and text documentations, as were males and visits conducted during the evening/night shifts. Weight-SDS was a significant predictor of both OBESITY diagnosis documentation, text documentation and treatment recommendations. When combining all significant predictors for OBESITY documentation, the highest probability of such documentation in a female, aged 12–15.9, that visited the PED during a morning shift, and with a very high weight-SDS of 3.9 – was only 63%. A patient with the same demographic parameters but with a weight-SDS of 1.7 (the median in our sample) had a predicted probability of only 2% for OBESITY documentation.

Of the 225 children with OBESITY documentation, 136 (60.4%) had at least one additional visit without such documentation. Weight-SDS was the only significant predictor for OBESITY documentation (OR = 1.5, CI 1.0–2.2) in these participants with recurring visits. Visit season, time, age or gender were not found to independently predict an OBESITY listed diagnosis in recurring visits. Of 639 children with text documentation, 329 (51.5%) had an additional visit without text documentation. Weight-SDS was also a significant predictor for text documentation (OR = 1.9, CI 1.4–2.4), as was age ≥6 years (OR of 3.3–4.4 in the three older age groups, compared with the youngest age group <6 years).

4. Discussion

The aims of this study were to examine the addressing of obesity in the PED, and to identify predicting factors for its documentation in the medical charts and discharge letters. The rate of listing an OBESITY diagnosis in children and adolescents with obesity in the PED was extremely low, only 1.5%. Text addressing weight status, or referrals/recommendations concerning obesity treatment, was found in only 4.4% of PED charts of children with obesity. Hence, the weight status of children with obesity who visit the PED is seldom reflected in their medical records.

We identified several factors that were associated with a higher chance of OBESITY documentation or addressing: older age, female gender, higher weight SDS, and visiting the PED during the morning hours. Yet even when combining all these significant predictors for OBESITY documentation, the probability remained low and mainly dependent on weight-SDS. In children with obesity that visited the PED several times, higher weight-SDS and older age were the only factors that differentiated between visits with or without documentation – coinciding

Table 2. Odds ratios for OBESITY documentation, text documentation and treatment recommendation for each of the participant characteristics.

Characteristic	Category	OBESITY documentation		Text documentation		Treatment recommendation	
		OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Age category (yrs)	2–5.9	(reference)	<.0001	(reference)	<.0001	(reference)	0.128
	6–11.9	6.4 (3.5–12.0)		6.0 (4.2–8.5)		0.9 (0.4–1.92)	
	12–15.9	12.3 (6.7–22.8)		11.9 (8.3–17.0)		0.6 (0.3–1.4)	
	16+	11.2 (5.7–22.0)		13.6 (9.2–20.1)		0.5 (0.2–1.2)	
Gender	Female	(reference)	<.0001	(reference)	<.0001	(reference)	0.903
	Male	0.5 (0.4–0.7)		0.6 (0.5–0.7)		1.0 (0.7–1.4)	
SDS weight (Per 1 SD)		7.2 (5.7–9.1)	<.0001	5.6 (4.8–6.5)	<.0001	1.4 (1.1–1.9)	0.019
Shift	Morning	(reference)	0.0433	(reference)	0.0118	(reference)	0.349
	Evening	0.8 (0.6–1.0)		0.8 (0.6–0.9)		0.8 (0.6–1.1)	
	Night	0.6 (0.4–0.9)		0.8 (0.7–1.1)		1.1 (0.7–1.4)	

OR – odds ratio; SDS – standard deviation score.

with the high odds ratios and large contributions of these two factors in OBESITY documentation in the total cohort. Previous studies also found that a higher BMI was associated with increased odds of obesity documentation in both children [17] and adults [25]. Collectively, it seems that the potential of the PED to identify and address obesity in visiting children is extremely under-utilized.

There are several potential explanations to the frequent disregarding of obesity in the PED. Primarily, most emergency department visits are of acute, sometimes urgent medical disorders, with limited durations and sometimes limited resources. It is known that this unique environment of the emergency department results in imperfect chart documentation [26, 27]. The morning shifts in our center are usually less busy and with larger staffs, so more time can be devoted to other chronic problems – hence the higher chance of obesity discussion found during the morning hours in this study.

Another potential explanation to the infrequent documentation of obesity in the PED can be that obesity is seldom regarded as a serious medical condition that warrants addressing in the PED. We are unaware of studies that examined the documentation of other chronic health conditions in PEDs, for comparison with the obesity documentation in our study. However, we can use data from primary care to compare the documentation of obesity vs another prevalent chronic condition, such as attention-deficit/hyperactivity disorder. In outpatient medical records, pediatric overweight or obesity was documented in only 34% [16], 20% [17] or 18% [28] of children with these conditions. In high contrast, attention-deficit/hyperactivity disorder was found to be documented in 97% of electronic medical records of children who have it [29]. Hence, it is apparent that obesity specifically is under-documented in relation to other chronic conditions as well, even in outpatient and primary care clinics.

Despite the acute nature of PED visits, several studies had shown that parents can be highly receptive to obesity screening and treatment referrals in the PED [20, 21, 22]. Vaughn et al. [20], using a survey of 213 parents that visited the PED with children aged 4–16 years, concluded that parents wanted counseling on obesity prevention and screening in the PED. Haber et al. [21] assessed the feasibility of the PED as a place for obesity education using a brief audio-visual presentation, followed by a parent survey of their impression of the PED as a place to receive obesity education and initiate intervention. Most of the participants stated that the PED should promote obesity education, and that following the intervention they intended to make a change in their child's lifestyle. Knight et al. [22] designed a referral pathway of children with overweight and obesity identified in the PED to a designated clinic. Nearly half of the referred families accepted the recommendations and turned to treatment. Collectively, it is apparent that parents are generally interested in obesity treatment recommendations and/or referrals, even in the acute setting of the PED. Identifying children with obesity in the PED is therefore expected to result in some lifestyle changes and initiation of treatment if such is offered.

We acknowledge that our study has limitations. Firstly, we relied on written text in the discharge letters, and do not know if any weight-related verbal discussion occurred. However, a written diagnosis of obesity was specifically shown in adults to promote weight-related treatment [25, 30]. If only verbal weight-related suggestions were made, we do not truly expect that parents who were just discharged from the PED, with recommendations specific to the acute medical issue, would remember to act regarding their child's obesity. Secondly, we have no information on the reasons for the PED visits and their urgency, nor on how busy were the PED or the treating physician. These factors could all affect chart documentation [26]. Indeed, in the morning hours, a higher chance of OBESITY documentation was noted, reflecting how a more relaxed working condition may result in improved obesity addressing by the discharging physician. Finally, as height measurements are not available in the PED, we could not formally diagnose obesity using BMI cutoffs. We therefore utilized a validated surrogate marker, a weight percentile above 90, that has a very high sensitivity (94%) in identifying children and adolescents with obesity [23]. The prevalence of obesity found in our sample using this method, of 12.1%, is very similar to the World Obesity Federation's estimated prevalence of obesity in 2–18-year-old in Israel of 2010–2013, namely 12.3%–12.6% (unpublished data from personal communications). We therefore trust that most children with obesity were captured in our sample.

Our study also has several strengths, which are utilizing a large electronic database of over 150,000 PED visits, using nurse-measured and not reported body weight, the computerized search for any type of weight-related discussion in the medical charts, and the manual review of chart texts for verification.

In conclusion, this study showed that one of eight children who visited our PED during the study period had obesity, yet there was an extremely low probability of documenting or addressing it in the discharge letters. It is clear that the potential ability of the PED to identify children with obesity is highly under-utilized. Since all children have their weight measured in the PED, using the 90th weight-for-age percentile [23] as a cutoff for initial screening could be a simple, quick and even automated method. Given the enduring need to identify and treat children with obesity, we suggest that PEDs merely increase their detection of obesity in visiting children and refer then to proper, multi-disciplinary treatment. Increased awareness can be achieved by presentations given to PED staff, handouts, posters, or automatic text inserted to discharge letters in children with appropriate weight percentiles.

Declarations

Author contribution statement

NF and GDR conceived and designed the experiments, performed the experiments, analyzed and interpreted the data, wrote the paper.

OEG and AI performed the experiments and analysed and interpreted the data.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no competing interests.

Additional information

No additional information is available for this paper.

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