



Pediatricians' Interventions Aimed to Reduce Overweight and Obesity in Children and Adolescents in Primary Healthcare in Poland. A Cross-sectional Study

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Abstract

Background: *Overweight and obesity in children and adolescents are associated with serious health problems and a higher risk of obesity in adults.*

Objectives: *This study aimed to determine how often pediatricians identify the condition of overweight and obesity in children and adolescents based on anthropometric measurements. The researchers also wanted to obtain information on counseling provided by pediatricians regarding diet and physical activity in patients.*

Material and methods: *In 2022, an observational, cross-sectional study was conducted with the participation of 55 pediatricians working in primary health care sector in the city of Lodz. An anonymous questionnaire consisted of sections regarding the characteristics of the treated patient population, barriers and improvements in the process of patient assessment, control, and management, as well as the health status and health behaviors of pediatricians.*

Results: *About 90.9% of the pediatricians declared that they measured body weight on a scale. Similarly, 89.1% of them measured body height. Among the surveyed doctors, 67.3% calculated waist circumference or the ratio of waist-to-hip ratio. All the pediatricians provided advice on diet/eating habits and physical activity to both healthy and overweight/obese patients. In most cases, the study participants indicated that this counseling was provided „often“ (83.6%). Only every tenth pediatrician provided detailed dietary advice and every sixth detailed advice on physical activity at each patient visit. A higher chance of providing dietary advice to children and adolescents was observed among pediatricians providing ≤ 100 patient visits during a routine work week (OR = 5.13; $p < 0.05$). Normal BMI (OR = 12.35; $p < 0.05$) and having ≤ 100 patient visits per week during a routine work week (OR = 8.28; $p < 0.05$) were significant correlates of physical activity advice.*

Conclusions: *Pediatricians should perform accurate anthropometric measurements to prevent obesity in children and adolescents. During each patient visit, the pediatrician should give advice on diet and physical activity.*

Key words: *obesity, overweight, primary healthcare, pediatrician*

Introduction

Overweight and obesity in children and adolescents are associated with serious health problems and a higher risk of obesity in adults, which also affects morbidity and mortality [1–3].

The incidence of childhood obesity has been on the rise for the last three decades. It results in an increased risk of development of many comorbidities – previously considered as adult-specific diseases – in children [4].

The growing prevalence of overweight and obesity in young individuals affects both developing and developed countries around the world [5].

Over the last 40 years, the incidence of overweight or obesity in children and adolescents aged 5–19 has more than quadrupled worldwide, rising from 4% to 18% [6]. The most considerable increase in the number of obese children and adolescents may be observed in East Asia, the Middle East, high-income English-speaking countries, and North Africa [7]. In 2016, over 340 million children and adolescents aged 5–19 were diagnosed with excess body weight, with 18% of girls and 19% of boys being overweight. One hundred twenty-four million children and adolescents in this group are obese [8]. In the World Health Organization (WHO) European region, almost one in three children (29% of boys and 27% of girls) is affected by overweight and obesity [9]. The highest prevalence of overweight among children was found in North Macedonia (23.7%), Spain (21.8%), and Greece (21.8%). As for obesity, it was Malta (26%) and England (24%). In Poland, 6.7% of children were overweight and 4.4% were obese [10]. The PITNUTS („The comprehensive evaluation of feeding practices in children aged 5 to 36 months – Polish Nationwide Study 2016”) study conducted in Poland (2016) shows that approximately 10% of children aged 1–3 are overweight or obese, and 18.4% are at risk of excessive body

weight [11, 12]. Whereas the COSI (Childhood Obesity Surveillance Initiative) study (2016) reveals that the problem of overweight and obesity affects almost every third eight-year-old [13]. The latest data from the COSI study (2020) indicate that 32% of Polish children aged 8 are overweight (including obesity). In total, excess body weight was recorded in 36% of boys and 29% of girls [14].

These data indicate that it is important to undertake early interventions in this age group due to comorbidities that often affect children and adolescents before they reach adulthood. This, in turn, leads to increased healthcare costs and requires greater caution in the assessment and treatment of these conditions [15–17].

Obesity worsens everyday quality of life and results in psychosocial complications (poor self-esteem, body dissatisfaction, anxiety, depression) [18, 19]. Overweight and obese children are more likely to face discrimination and be victims of bullying compared to their peers with normal weight [20]. Finally, they are more likely to become obese adults [21]. Although overweight and obesity represent health problems that are most easily identified, they are also among the most frequently undertreated diseases [22].

Pediatricians, family physicians, and other medical professionals in primary health care (PHC) perform a key role in the correct diagnosis and management of overweight and obesity, as well as in the prevention and treatment of the complications caused by the two diseases [23, 24]. Treatment of overweight and obesity in children is a complex challenge for primary healthcare providers [25]. Pediatricians are often the first people with whom children and adolescents come into contact. They see their patients regularly, observing them (and their families) from the very birth [23, 26, 27]. However, as for prevention and treatment of overweight and obesity in children, primary health care still remains an underutilized tool [28]. By recognizing risk factors early in a patient's life, primary care providers can support families in introducing positive changes that will help to control the child's weight [29]. In primary health care, basic preventive measures should include promotion of physical activity and healthy eating, as well as elimination of sedentary lifestyle, among others. Whereas early diagnosis of obesity by monitoring BMI (body mass index) in children should be implemented as part of secondary prevention [30].

According to the current guidelines developed by WHO and the International Obesity Task Force (IOTF), BMI based on percentile charts or tables appropriate for gender and age should be used for children and adolescents [31]. Overweight is diagnosed with a BMI ranging from 90 to 97 percentile, and obesity in the case of a BMI above 97 percentile (according to gender and age) [31].

Physical examination performed by a pediatrician should include the patient's family's dietary behaviors and assessment of the family's lifestyle (including how the child and parents spend their free time, and type(s) of preferred activity).

The role physicians perform in nutritional counseling and dietary education is crucial for maintaining a healthy lifestyle [32]. Pediatricians can help prevent obesity by providing families with tips on a healthy lifestyle and physical activity, as well as by measuring body mass index in young patients at least once a year [27]. Pediatricians' screening efforts contribute to identification of at-risk children who may benefit from early lifestyle changes. Identification of overweight children also facilitates proper diagnosis of comorbidities [33]. Pediatricians should recognize potential risk factors (diet high in sugar and fat, sedentary lifestyle, genetic syndromes) and early symptoms of overweight and obesity [34]. Interventions focusing on parenting strategies and family habits are effective in prevention and treatment of childhood obesity [27, 35]. Physicians are the ideal group to help diagnose overweight and obesity; however, unfortunately many of them are not well-trained to discuss obesity with patients and their families. Standardized training initiatives for physicians in the prevention and management of obesity are needed [36]. Studies have shown that not only is obesity underdiagnosed but among physicians there is also a lack of knowledge and available resources about obesity in children [23].

Education in the field of a healthy lifestyle is important in prevention and building health awareness. Educational activities in the field of a healthy lifestyle should be carried out in parallel by the health service, school, and family. School is an important place that shapes a student's health-promoting attitude [37, 38]. It is important to develop healthy behaviors early on that can

be transferred into adult life. Providing information about health by teachers, shaping attitudes and developing skills are elements of preparing children and young people for a healthy lifestyle [37]. As part of health classes, a teacher should teach children and teenagers how to live a healthy life. These activities should not only refer to the student's own health, but also to that of those around them [37].

This study aimed to determine how often pediatricians identify the condition of overweight and obesity in children and adolescents based on anthropometric measurements (percentile charts). The researchers also wanted to obtain information on counseling provided by pediatricians regarding diet and physical activity in patients. Additionally, the study aimed to identify practices, challenges/barriers, and needs of pediatricians regarding the identification and treatment of obesity in children and adolescents.

Material and methods

Study design and population

In 2022, an observational, cross-sectional study was conducted with the participation of 55 pediatricians working in primary health care sector in the city of Lodz. The number of pediatricians in the Lodz province is 316 [39].

From the list of 211 primary care entities operating in 2022 in the city of Lodz, every fifth clinic was selected randomly. Thirty-four primary care facilities joined the study, and the questionnaires were distributed to all pediatricians working there. The study methodology has been described elsewhere [40].

Inclusion criterion: pediatricians working in primary care, providing services to patients under 18 years of age, who provided their voluntary and written consent to participate in the study. The study included 55 pediatricians out of 65 employed in 34 primary health care facilities that participated in it. Participation was voluntary and the respondents could withdraw from the study at any time.

The Bioethics Committee at the Medical University of Lodz issued a positive opinion on the study project (no. RNN/315/18/KE of 18 September 2018).

Study questionnaire

The research tool was an anonymous questionnaire developed by experts and validated in another study [41]. The questionnaire consisted of three sections. The first section concerned the characteristics of the population of treated patients (e.g., providing advice on a healthy diet and physical activity, assessing diet and physical activity). The second section included barriers to the process of patient assessment, control and management, as well as improvements that would help reduce health problems related to diet, physical activity and body weight in children and adolescents. The third section concerned the health status and health behaviors of pediatricians (subjective assessment of health status, subjective assessment of occurrence of overweight and obesity, occurrence of chronic diseases related to overweight and obesity, lifestyle features, such as consumption of fruit and vegetables, physical activity, smoking, passive exposure to tobacco, alcohol consumption). The survey questionnaire is described in detail elsewhere [42]. It also included socio-demographic data of pediatricians, such as gender and age, number of patient visits per work week (≤ 100 visits, > 100 visits), and place of work (public sector/private practice) (Table 1). The questionnaire also included the frequency of measuring body weight on a scale, measuring height, calculating BMI, measuring waist circumference or waist-to-hip ratio, and calculating the body weight-to-age ratio/height-to-age ratio, calculating the BMI-to-age index by the pediatricians: (a) at each routine visit, (b) once a year, (c) if clinically indicated, and (d) never (Table 2).

Table 1. The characteristics of the studied population of pediatricians

Characteristics	Total <i>n</i> = 55	%
Age (years)		
< 40	11	20.0
40–54	25	45.5
55+	19	34.5
Sex		
Male	7	12.7
Female	48	87.3

Characteristics	Total <i>n</i> = 55	%
Body mass index (BMI)		
< 25 kg/m ²	26	47.3
≥ 25 < 30 kg/m ²	22	40.0
≥ 30 kg/m ²	7	12.7
Subjective assessment of health status		
very good	15	27.3
good	23	41.8
sufficient/satisfactory	17	30.9
Number of chronic diseases		
0	16	29.1
1	14	25.5
2	7	12.7
≥ 3	18	32.7
Diseases occurring in the family		
Diabetes mellitus	22	40.0
Coronary artery disease	20	36.4
Neoplastic disease	23	41.8
Subjective assessment of being overweight or obese		
Yes	20	36.4
No	35	63.6
Weight loss intention		
Yes	36	65.5
No	19	34.5
Physical activity		
Yes	49	89.1
No	6	10.9
Diet		
Yes	47	85.5
No	8	14.5
Medical practice		
Private	23	41.8
Public	32	58.2
Exposure to secondhand smoke		
Yes	7	12.7
No	48	87.3
Number of patient visits during the routine working week		
≤ 100	44	80.0
>100	11	20.0
Lack of time as a barrier to counseling		
Yes	30	54.5
No	25	45.5

Characteristics	Total <i>n</i> = 55	%
Appropriate training to provide counseling on nutrition, physical activity, and weight management		
Yes	45	81.8
No	10	18.2
Making measurements of body weight, height, BMI		
Yes	50	90.9
No	5	9.1
Tobacco smoking		
Yes	2	3.6
No	53	96.4
Alcohol consumption		
Yes	34	61.8
No	21	38.2

Table 2. Frequency of measurement of body weight and other variables by a pediatrician in primary care

Variable	Total n = 55		
	n (%)	95% CI	p-value
Body weight measured on the scale			
at each routine visit	18 (32.7)	(20.32–45.12)	0.3273
once a year	13 (23.6)	(12.41–34.86)	0.2364
if clinically indicated	19 (34.6)	(21.98–47.11)	0.3454
never	5 (9.1)	(1.49–16.69)	0.0909
Body height measured in a doctor's office			
at each routine visit	12 (21.8)	(10.90–32.73)	0.2182
once a year	18 (32.7)	(20.32–45.12)	0.3273
if clinically indicated	19 (34.6)	(21.98–47.11)	0.3454
never	6 (10.9)	(2.67–19.15)	0.1091
Body mass index (BMI)			
at each routine visit	10 (18.2)	(7.99–28.38)	0.1818
once a year	16 (29.1)	(17.09–41.09)	0.2909
if clinically indicated	24 (43.6)	(30.53–56.74)	0.4364
never	5 (9.1)	(1.49–16.69)	0.0909
Waist circumference or waist-to-hip ratio			
at each routine visit	2 (3.6)	(-1.31–8.58)	0.0363*
once a year	9 (16.4)	(6.59–26.14)	0.1636
if clinically indicated	26 (47.3)	(34.08–60.47)	0.4727
never	18 (32.7)	(20.32–45.12)	0.3273
Body weight to age ratio using the percentile chart			
at each routine visit	13 (23.6)	(12.41–34.86)	0.2364
once a year	14 (25.5)	(13.94–36.97)	0.2545
if clinically indicated	22 (40.0)	(27.05–52.95)	0.4000
never	6 (10.9)	(2.67–19.15)	0.1091
Height-to-age ratio using a centile chart			
at each routine visit	10 (18.2)	(7.99–28.38)	0.1818
once a year	15 (27.3)	(15.50–39.04)	0.2727
if clinically indicated	24 (43.6)	(30.53–56.74)	0.4364
never	6 (10.9)	(2.67–19.15)	0.1091
BMI in relation to age using a percentile chart			
at each routine visit	11 (20.0)	(9.43–30.57)	0.2000
once a year	18 (32.7)	(20.32–45.12)	0.3273
if clinically indicated	20 (36.4)	(23.65–49.08)	0.3636
Never	6 (10.9)	(2.67–19.15)	0.1091

*p < 0.05

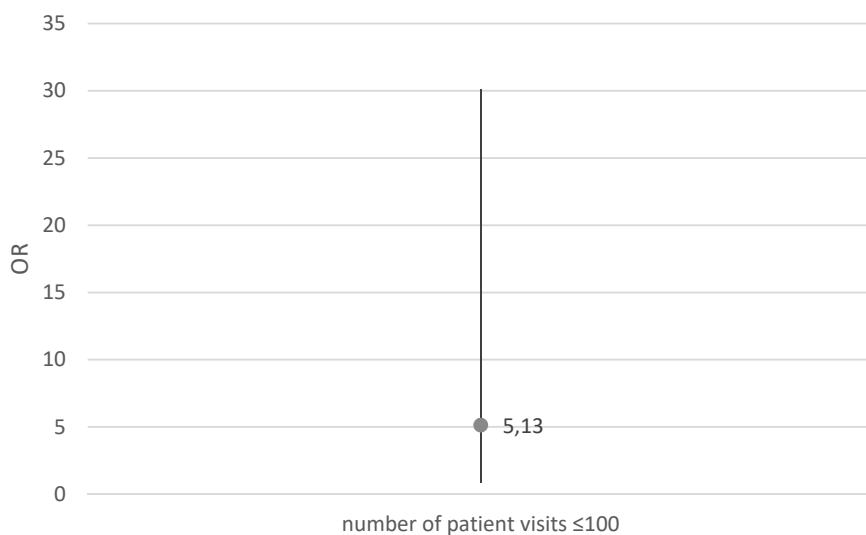


Figure 1. Correlates of diet advice ($p < 0.05$)

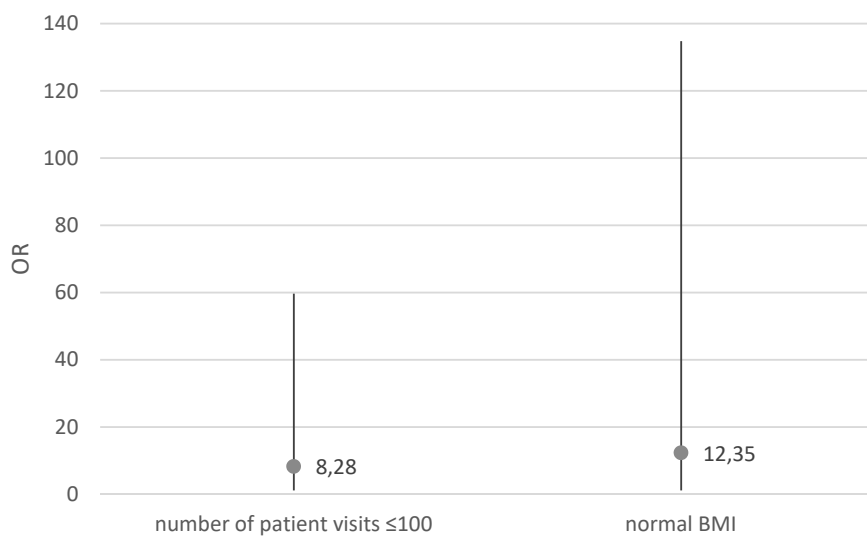


Figure 2. Correlates of physical activity advice ($p < 0.05$)

The frequency of pediatrician advice regarding a healthy diet and physical activity was determined based on the following questions: „How often does a pediatrician provide detailed advice on diet/nutrition“, and „How often does a pediatrician provide detailed advice on physical activity.“ The response „often“ indicated that advice was provided at 50% or more of visits, while „always“ indicated that advice was provided at every visit.

The survey also included questions about treatment of overweight and obese patients provided by the pediatricians: (1) „Systematically observes/tracks patients“ behavior or other measures of progress regarding diet, physical activity, and body weight“; (2) „Refers to these patients to another health professional or offers them participation in programs outside the practice“ with „Yes“ or „No“ answers (Table 3). Diet and physical activity in children and adolescents in the age group 2–17 years was assessed based on general questions regarding: 1) groups of food products (e.g., consumption of vegetables and fruits), 2) eating habits (e.g., consumption of fast food), 3) amount of physical activity, 4) amount of activities related to a sedentary lifestyle (e.g., watching TV), and asking detailed questions regarding: 1) intake of specific nutrients (e.g., calcium, proteins), 2) duration, intensity, and type of physical activity, with the two optional answers: „Yes“ or „No“ (Table 4).

Table 3. Advising patients who are overweight or at risk of weight-related chronic diseases

Variable	Total <i>n</i> = 55		
	n (%)	95% CI	p-value
Provided detailed advice on diet/nutrition			
Often	49 (89.1)	(80.85–97.33)	0.8909
Always	6 (10.9)	(2.67–19.15)	0.1091
Provides detailed advice on physical activity			
Often	46 (83.6)	(73.86–93.41)	0.8364
Always	9 (16.4)	(6.59–26.1)	0.1636
Provides detailed advice on weight control			
Often	46 (83.6)	(73.86–93.41)	0.8364
Always	9 (16.4)	(6.59–26.1)	0.1636
Refers to another health specialist or suggests participation in health programs			
Often	49 (89.1)	(80.85–97.33)	0.8909
Always	6 (10.9)	(2.67–19.15)	0.1091
Systematically observes/tracks patient behavior or other measures of progress regarding diet, physical activity, and body weight			
Often	49 (89.1)	(80.85–97.33)	0.8909
Always	6 (10.9)	(2.67–19.15)	0.1091

* $p < 0.05$

Table 4. Questions used by a pediatrician when assessing diet and physical activity in patients aged 2–17 years

Variable	Total n = 55		
	n (%)	95% CI	p-value
General questions about food groups (e.g., fruit and vegetable consumption)			
Yes	54 (98.2)	(94.65–94.65)	0.9818
No	1 (1.8)	(-1.71–5.35)	0.0182*
General questions about eating habits (e.g., fast food consumption)			
Yes	51 (92.7)	(85.86–99.59)	0.9272
No	4 (7.3)	(0.41–14.14)	0.0727
Detailed questions about the intake of specific nutrients (e.g., calcium, proteins)			
Yes	20 (36.4)	(23.65–49.08)	0.3636
No	35 (63.6)	(50.92–76.35)	0.6364
General questions about the amount of physical activity			
Yes	49 (89.1)	(80.85–97.33)	0.8909
No	6 (10.9)	(2.67–19.15)	0.1091
General questions about the number of sedentary activities (e.g., watching TV)			
Yes	48 (87.3)	(78.46–96.08)	0.8727
No	7 (12.7)	(3.92–21.54)	0.1273
Detailed questions about the duration, intensity, and type of physical activity			
Yes	33 (60.0)	(47.05–72.95)	0.6000
No	22 (40.0)	(27.05–52.95)	0.4000

*p < 0.05

The questionnaire included questions about pediatricians' opinions on their role as promoters of a healthy lifestyle (Table S2 supplementary material). Additionally, they were to indicate the three most important barriers in the process of assessing, controlling, and guiding the patient, as well as the three most important improvements that would help reduce health problems dependent on diet, physical activity, and body weight (Table S3 and Table S4 in the supplementary material).

Statistical analysis

The statistical analysis involved presenting categorical variables as frequencies and percentages. The relationship between variables was assessed using the Chi2 test. Binary logistic regression was used to examine the relationship between the dependent variable (counseling among children and adolescents) and the independent variables (e.g., gender, age, alcohol consumption, smoking). The unadjusted model used bivariable regression. In bivariable analysis, all variables were considered independently. For the adjusted model, only statistically significant variables in bivariable analysis were included. The odds ratio and 95% confidence intervals (OR and 95% CI) were applied to assess the strength of the associations. STATISTICA 13.3 software (StatSoft, Poland) was used. A p-value < 0.05 was considered statistically significant.

Results

Characteristics of the surveyed pediatricians

Table 1 shows the characteristics of the pediatricians surveyed. Fifty-five pediatricians took part in the study, the largest group of which were people aged 40–54 (45.5%). Most of them were women (87.3%). In a subjective assessment of their health, 41.8% of pediatricians considered their health as good. More than half of the respondents (52.7%) were overweight or obese. Approximately 36.4% of the study participants subjectively assessed themselves

as overweight or obese, and 65.5% of the respondents admitted they wanted to lose weight.

Every third pediatrician reported that they suffered from three or more chronic diseases.

In the study, 89.1% of the pediatricians indicated that they spent 75–150 minutes performing high-intensity physical activity or 15–300 minutes doing moderate-intensity physical activity per week, and 85.5% of pediatricians consumed an average of 400 grams of fruit and vegetables in their daily diet, being divided in at least five servings. Only 3.6% of the survey participants indicated that they smoked tobacco, 12.7% were exposed to passive smoking, and 61.8% consumed alcohol. Approximately 58.2% of the pediatricians were employed in the public medical sector, and 80% saw up to 100 patients per week. The majority of the pediatricians indicated that they had sufficient knowledge to advise their patients on diet and physical activity (81.8%) and measured weight, height, and BMI (90.9%) in children and adolescents.

Anthropometric measurements in children and adolescents

About 90.9% of the pediatricians declared that they measured body weight on a scale. Similarly, 89.1% of them measured body height. Among the surveyed doctors, 67.3% calculated waist circumference or waist-to-hip ratio. In the study group, 90.9% analyzed the weight-for-age ratio using a percentile chart, the height-for-age ratio using a percentile chart, and the BMI-for-age using a percentile chart. Most often, all these measurements were performed if clinically indicated (Table 2).

Pediatricians' advice on diet and physical activity

All the pediatricians provided advice on diet/eating habits and physical activity to both healthy and overweight/obese patients. In most cases, the study participants indicated that this counseling was provided „often” (83.6%). Only every tenth pediatrician provided detailed dietary advice and every sixth detailed advice on physical activity at each patient visit (Table 3).

Among the pediatricians surveyed, 98.2% made diet assessment based on general questions about food groups (e.g., fruit and vegetable consumption), and 92.7% based on general questions about eating habits (e.g., fast food consumption). Also, 89.1% of pediatricians assessed physical activity by asking general questions about its amount/frequency, 87.3% asked general questions about sedentary activities (e.g., watching TV) (Table 4).

Correlates of diet and physical activity advice

The relationship between the personal and health characteristics of pediatricians and the advice provided „often” in relation to diet and physical activity was based on logistic regression analyses. The unadjusted and adjusted odds ratios (OR) and 95% confidence intervals (95% CI) were calculated to identify the correlates of dietary and physical activity advice provided by pediatricians (Table S1 supplementary material). Variables statistically significant in the unadjusted analysis were included in the adjusted analysis.

A higher chance of providing dietary advice to children and adolescents was observed among pediatricians providing ≤ 100 patient visits during a routine work week (OR = 5.13; $p < 0.05$) (Figure 1). Normal BMI (OR = 12.35; $p < 0.05$) and having ≤ 100 patient visits during a routine work week (OR = 8.28; $p < 0.05$) were significant correlates of physical activity advice (Figure 2).

Opinions, barriers, and improvements indicated by pediatricians in the process of assessing, monitoring, and managing children and adolescents

Among the respondents, 98.2% believe that pediatricians should advise patients on a healthy lifestyle, and 81.8% believe that they have the knowledge and skills to provide such recommendations. Additionally, 94.5% of the study participants believe that healthy lifestyle counseling would be more effective if pediatricians themselves followed health recommendations. Approximately 71% of the surveyed doctors think that they effectively help children and adolescents lead a healthy lifestyle (Table S2 supplementary material).

The three most common barriers indicated by the study group in the process of assessment, monitoring, and management of children and adolescents were: patients not interested in improving their diet, physical activity, and weight loss (72.7%), patients who find it too difficult to change their current habits (61.8%), and a lack of time (54.5%) (Table S3 supplementary material).

The respondents believe that the three key improvements that would help reduce health problems related to diet, physical activity, and weight included: better tools to communicate information about diet, physical activity, or weight problems to patients or their families (61.8%), simple procedures and guidelines for patient monitoring (58.2%), more training in assessment and management of patient diet, physical activity, and weight management provided to healthcare workers (32.7%) (Table S4 supplementary material).

Discussion

According to the guidelines, pediatricians should conduct tests for obesity at least once a year by measuring body weight, and height, and calculating BMI [27]. Diagnosing overweight and obesity involves measurement of the patient's height and weight, calculating the BMI and analyzing the obtained values against the growth metrics, as well as discussing the diagnosis with the patient and documenting it in the medical records. Failure at any of these steps may result in poor identification of the overweight and obesity status [43].

In our study, nine out of ten pediatricians measured weight on a scale, body height, weight-for-age using a percentile chart, height-for-age using a percentile chart, and BMI-for-age using a percentile chart in their patients. These are higher results than those we obtained in the case of a study including family doctors in primary care, where one in ten participants performed anthropometric measurements on adult patients [42]. This is also confirmed by other studies in which pediatricians were more likely to identify children as overweight or obese than family medicine physicians [43]. The frequency of BMI use by pediatricians during well-child visits was 50% compared

to primary care physicians where the frequency was 22% [44]. Other studies show that all pediatricians perform at least weight and height measurements. Waist circumference is only measured by 42% [45].

Overweight children and adolescents are at high risk of developing obesity in childhood and adulthood [43]. Pediatricians should provide short advice and recommend weight control if a child is found to be at risk of being overweight or obese [27]. The low percentage of doctors correctly identifying overweight children means a missed opportunity to implement early obesity prevention strategies [43]. Interventions are needed to increase the identification of children who may benefit from receiving resources that encourage a healthy lifestyle and optimal weight maintenance [46]. In our study, all pediatricians provided diet and physical activity counseling to their patients. Our results are higher than those obtained in a Canadian study where over 85% of doctors provided dietary advice and 98% provided physical exercises to overweight or obese patients [47]. In a survey conducted among Georgian pediatricians, 88% advised patients on lifestyle changes and 50% monitored progress [48]. In other studies, doctors recommended physical activity, provided dietary advice or referral to a dietitian [49].

We obtained lower results in a study including family doctors, where every second respondent provided advice on diet and physical activity to adult patients [40].

Although all physicians in our study provided advice, most of them provided advice „often”, whereas only every tenth pediatrician provided advice at every visit.

The younger the child, the easier it is to introduce lifestyle changes. It has been demonstrated that motivational interviewing (MI) conducted by a pediatrician, a registered dietitian, and a nurse has a significant impact on the child's body mass index (BMI) [28].

Other cross-sectional studies indicate that over the years, pediatricians have intensified discussions with families about behaviors and their awareness and practices regarding obesity management [50].

Pediatricians should pay attention to parents' perception of their child's weight and ask about lifestyle and eating habits [51]. The effectiveness

of obesity treatment in children will be achieved if parents and guardians recognize the problem and establish a trust-based relationship based with the pediatrician [52].

It has also been shown that the prevalence of overweight depends on the parents' education and is higher among children whose parents have a low level of education compared to children with high parental education [14].

Pediatricians are more likely to discuss family behaviors related to the consumption of sugar-sweetened beverages, screen time [48, 50], and fruit and vegetable consumption [48]. They should encourage a sedentary lifestyle, limited television, and daily moderate to vigorous physical activity [53]. Interventions targeting specific lifestyle habits, such as fruit and vegetable consumption and reducing sedentary behavior, are effective [54]. The key to prevent the development of obesity is to reduce sedentary lifestyle and increase physical activity [27]. The results show that pediatricians have incorporated weight management counseling into their practice; however, these efforts still need to be strengthened by targeting the well-known high-risk behaviors [48]. Recommendations concerning childhood obesity prevention encourage providers to advise parents and their children on healthy diet and activity behaviors [55].

More than 80% of the pediatricians in our study believe they have the knowledge and skills to advise patients on a healthy lifestyle. Pediatric medical professionals know how to treat childhood obesity; however, they require motivation training [52]. Other studies indicate that physicians lack resources and knowledge about childhood obesity [23]. The study found that the physicians felt they had low self-efficacy in treating obesity, were not confident in their ability to counsel, and had negative feelings about treating the condition. There is a need to educate primary care physicians to improve their self-efficacy in treatment of childhood obesity [48, 49].

In our study, among the three barriers indicated by the respondents in the process of assessment, monitoring and management of children and adolescents was a lack of time. Weight counseling is not typically incorporated into routine pediatric practice due to time and training constraints [56–58].

This is confirmed by numerous studies [47, 59–62]. The declared number of patients in a primary health care facility was negatively and linearly correlated with the pressure and pace of work, open communication, as well as the issue of patient safety and quality [62].

Barriers indicated by our study participants also included: patients' lack of interest in improving their diet, physical activity, and weight loss, as well as their difficulties in changing their current habits. In other studies, barriers to the prevention and treatment of obesity indicated by pediatricians were: lack of motivation of the parent and lack of motivation of the child, overweight parents, families eating fast food, watching too much television, and not doing enough physical activity [63]. The most common barriers resulted from the social environment: easy access to and advertising of certain food and drink products, lack of parental involvement, and lack of awareness of the weight problem among children and parents [64]. In other studies, the barrier was low effectiveness of obesity prevention activities perceived by pediatricians. Most respondents agreed with the lack of reimbursement of consultation costs [59]. Key obstacles to managing pediatric patients were too few government-funded dietitians, as well as training limitations [47]. The healthcare system continues to be a barrier to the activities taken by pediatric staff [52]. With regard to efforts aimed at identification or management of childhood obesity, pediatricians point to the need for system-level changes [47]. Barriers to the implementation of integrated health care include lack of motivation and knowledge among parents, reluctance to discuss the issue, financial constraints, and lack of a structured multidisciplinary approach [65]. Primary care physicians must initiate, coordinate, and participate in obesity prevention initiatives. It seems that multidisciplinary treatment involving pediatricians, family doctors, and dietitians is the way to counteract the problem [49].

The expected support would also be to introduce a health educator to the office who would conduct a short behavioral intervention [58].

In Poland, the health care system has not developed standards or solutions ensuring comprehensive care for children and adolescents with excessive body weight [66]. Currently, the primary care physician is responsible for diagnosing obesity as a disease, as well as providing assistance in the form of appropriate

prevention and selecting the appropriate treatment. However, this does not bring the desired results [66].

In studies, the pediatricians showed less effort and favorable attitude about physical activity compared to other primary care disciplines [67]. Age-appropriate nutritional counseling is important to promote healthy diet. Pediatricians should provide age-appropriate nutrition and physical activity advice aimed at reducing the risk of overweight and obesity [68].

Therefore, there is a need for a comprehensive approach, with a clear implementation strategy coordinated across sectors [69]. Collaboration among all providers of pediatric primary health care, guided by pediatricians, is critical to the accuracy, maximal efficiency, and effectiveness of the care of the family, the patient, the population, and the community [70]. However, to improve the prevention and treatment of overweight and obesity in children, existing systemic barriers must be eliminated [71, 72].

The study highlights the need to raise awareness among children, adolescents, and their families about a healthy lifestyle. In addition to parents and teachers, pediatricians should also be involved in these activities. A pediatrician should promote a healthy lifestyle and diagnose overweight and obesity. Children and adolescents diagnosed with overweight and obesity should be educated to increase physical activity and change eating habits. To reduce a child's weight, comprehensive specialist care and the involvement of the family and the environment are necessary. It is necessary to implement a nationwide, comprehensive plan for the prevention of overweight and obesity among children and adolescents, including, among others: nutritional education. Governments should increase financial resources for health education provided in primary health care entities and educational institutions.

Conclusion

Pediatricians should perform accurate anthropometric measurements in their patients and shape appropriate lifestyle habits in children and their families. During each patient visit, the pediatrician should provide advice on diet

and physical activity, and monitor the implementation and effectiveness of the recommendations.

Training for pediatricians needs to be increased to equip them with the knowledge and skills to prevent and manage the obesity epidemic.

The barriers and needs identified in this study can be used to define strategies to improve the implementation of an integrated healthcare standard for overweight and obese children in Poland.

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Supplementary material: Table S1-S4.

Table Legends

Table 1. The characteristics of the studied population of pediatricians

Table 2. Frequency of measurement of body weight and other variables by a pediatrician in primary care

Table 3. Advising patients who are overweight or at risk of weight-related chronic diseases

Table 4. Questions used by a pediatrician when assessing diet and physical activity in patients aged 2–17 years

Supplemental materials

Table S1. Correlates of advice provided by a pediatrician

Table S2. Opinions on the role of a pediatrician as a promoter of a healthy lifestyle

Table S3. Barriers in the process of assessing, controlling, and guiding the patient indicated by the pediatrician

Table S4. Improvements that would help reduce health problems dependent on diet, physical activity, and body weight indicated by the pediatrician

Figure Legends

Figure 1. Correlates of diet advice

Figure 2. Correlates of physical activity advice

Table S1. Correlates of advice provided by a pediatrician

Variables	Diet/ nutrition advice conducted often (N = 55)				Advice on physical activity conducted often (N = 55)				Advice on weight management conducted often (N = 55)				
	Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		
	N = 49 (%)	OR	95% CI	OR	95% CI	n = 46 (%)	OR	95% CI	OR	95% CI	n = 46 (%)	OR	95% CI
Age (years)													
< 40	11 (90.9)	1.00	Ref.			8 (72.7)	1.00	Ref.			9 (81.8)	1.00	Ref.
40–54	25 (21 (84.0)	0.52	(0.05–5.33)			21 (84.0)	1.97	(0.36–10.82)			20 (80.0)	0.89	(0.14–5.48)
55+	19 (18 (94.7)	1.80	(0.10–31.98)			17 (89.5)	3.19	(0.44–23.01)			17 (89.5)	1.89	(0.23–15.73)
Body mass index (BMI)													
< 25 kg/m ²	26 (24 (92.3)	2.00	(0.15–25.91)			23 (88.5)	5.75	(0.84–39.24) *	12.35	(1.13–134.8) *	22 (84.6)	2.20	(0.31–15.55)
≥ 25 < 30 kg/m ²	22 (19 (86.4)	1.06	(0.09–12.14)			19 (86.4)	4.75	(0.69–32.71)	5.03	(0.61–41.33)	19 (86.4)	2.53	(0.33–19.53)
≥ 30 kg/m ²	7 (6 (85.7)	1.00	Ref.			4 (57.1)	1.00	Ref.	1.00	Ref.	5 (71.4)	1.00	Ref.
Sex													
Male	7 (6 (85.7)	1.00	Ref.			5 (71.4)	1.00	Ref.			6 (85.7)	0.83	(0.09–7.90)
Female	48 (43 (89.6)	1.43	(0.14–14.45)			41 (85.4)	2.34	(0.38–14.53)			40 (83.3)	1.00	Ref.
Number of chronic diseases													
0	16 (15 (93.8)	1.00	Ref.			14 (87.5)	1.00	Ref.			13 (81.3)	1.00	Ref.
1	14 (13 (92.9)	0.87	(0.05–15.28)			13 (92.9)	1.86	(0.15–22.99)			12 (85.7)	1.39	(0.20–9.77)
≥ 2	25 (21 (84.0)	0.35	(0.04–3.45)			7 (100.0)	0.45	(0.08–2.58)			7 (100.0)	1.21	(0.23–6.30)

Variables	Diet/ nutrition advice conducted often (N = 55)				Advice on physical activity conducted often (N = 55)				Advice on weight management conducted often (N = 55)					
	Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		Unadjusted model		Adjusted model			
	N	n = 49 (%)	OR	95% CI	n = 46 (%)	OR	95% CI	n = 46 (%)	OR	95% CI	n	OR	95% CI	
Subjective assessment of health status														
very good	15	14 (93.3)	0.88	(0.05–15.32)	12	(80.0)	0.53	(0.08–3.72)			12	(80.0)	0.53	(0.08–3.72)
good	23	19 (82.6)	0.30	(0.03–2.93)	19	(82.6)	0.63	(0.10–3.94)			19	(82.6)	0.63	(0.10–3.94)
sufficient/satisfactory	17	16 (94.1)	1.00	Ref.	15	(88.2)	1.00	Ref.			15	(88.2)	1.00	Ref.
Diseases occurring in the family														
Diabetes mellitus														
Yes	22	18 (81.8)	0.29	(0.05–1.75)	17	(77.3)	0.47	(0.11–1.99)			17	(77.3)	0.47	(0.11–1.99)
No	33	31 (93.9)	1.00	Ref.	29	(87.9)	1.00	Ref.			29	(87.9)	1.00	Ref.
Coronary artery disease														
Yes	20	18 (90.0)	1.16	(0.19–6.98)	16	(80.0)	0.67	(0.16–2.84)			15	(75.0)	0.39	(0.09–1.65)
No	35	31 (88.6)	1.00	Ref.	30	(85.7)	1.00	Ref.			31	(88.6)	1.00	Ref.
Neoplastic disease														
Yes	23	21 (91.3)	1.50	(0.25–8.98)	19	(82.6)	0.88	(0.21–3.71)			20	(87.0)	1.54	(0.34–6.92)
No	32	28 (87.5)	1.00	Ref.	27	(84.4)	1.00	Ref.			26	(81.3)	1.00	Ref.
Subjective assessment of being overweight or obese														
Yes	20	17 (85.0)	0.53	(0.97–2.92)	15	(75.0)	0.39	(0.09–1.65)			16	(80.0)	0.67	(0.16–2.84)
No	35	32 (91.4)	1.00	Ref.	31	(88.6)	1.00	Ref.			30	(85.7)	1.00	Ref.

Variables	Diet/ nutrition advice conducted often (N = 55)				Advice on physical activity conducted often (N = 55)				Advice on weight management conducted often (N = 55)				
	Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		
	N = 49 (%)	OR	95% CI	OR	95% CI	n = 46 (%)	OR	95% CI	n = 46 (%)	OR	95% CI		
Weight loss intention													
Yes	36 (32 (88.9))	0.94	(0.16–5.67)			29 (80.6)	0.49	(0.09–2.62)			29 (80.6)	0.49	(0.09–2.62)
No	19 (17 (89.5))	1.00	Ref.			17 (89.5)	1.00	Ref.			17 (89.5)	1.00	Ref.
Physical activity													
Yes	49 (43 (87.8))	-	-			41 (83.7)	1.03	(0.11–9.99)			40 (81.6)	-	-
No	6 (100.0)	1.00	Ref.			5 (83.3)	1.00	Ref.			6 (100.0)	1.00	Ref.
Diet													
Yes	47 (41 (87.2))	-	-			38 (80.9)	-	-			39 (83.0)	0.70	(0.07–6.47)
No	8 (100.0)	1.00	Ref.			8 (100.0)	1.00	Ref.			7 (87.5)	1.00	Ref.
Medical practice													
Private	23 (20 (87.0))	0.69	(0.13–3.77)			17 (73.9)	0.29	(0.06–1.33)			18 (78.3)	0.51	(0.12–2.17)
Public	32 (29 (90.6))	1.00	Ref.			29 (90.6)	1.00	Ref.			28 (87.5)	1.00	Ref.
Exposure to secondhand smoking													
Yes	7 (6 (85.7))	0.70	(0.69–7.03)			6 (85.7)	1.2	(0.13–11.37)			6 (85.7)	1.2	(0.13–11.37)
No	48 (43 (89.6))	1.00	Ref.			40 (83.3)	1.00	Ref.			40 (83.3)	1.00	Ref.
Number of patient visits during the routine working week													
≤ 100	44 (41 (93.2))	5.13	(0.87–30.1) *	5.13	(0.87–30.1) *	39 (88.6)	4.46	(0.95–20.82) *	8.28	(1.14–59.69) *	38 (86.4)	2.38	(0.49–11.55)
> 100	11 (8 (72.7))	1.00	Ref.	1.00	Ref.	7 (63.6)	1.00	Ref.	1.00	Ref.	8 (72.7)	1.00	Ref.

Variables	Diet/ nutrition advice conducted often (N = 55)				Advice on physical activity conducted often (N = 55)				Advice on weight management conducted often (N = 55)				
	Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		Unadjusted model		Adjusted model		
	N	n (%)	OR	95% CI	n	OR	95% CI	OR	95% CI	n	OR	95% CI	
Lack of time as a barrier to counseling													
Yes	30	27 (90.0)	2.25	(0.48–10.53)	25	(83.3)	0.95	(0.23–4.01)		25	(83.3)	0.95	(0.23–4.01)
No	25	20 (80.0)	1.00	Ref.	21	(84.0)	1.00	Ref.		21	(84.0)	1.00	Ref.
Appropriate training to provide counseling on nutrition, physical activity, and weight management													
Yes	45	40 (88.9)	0.89	(0.09–8.56)	38	(84.4)	1.36	(0.24–7.78)		36	(80.0)	-	-
No	10	9 (90.0)	1.00	Ref.	8	(80.0)	1.00	Ref.		10	(100.0)	1.00	Ref.
Making measurements of body weight, height, BMI													
Yes	50	44 (88.0)	-	-	41	(82.0)	-	-		42	(84.0)	1.31	(0.13–13.33)
No	5	5 (100.0)	1.00	Ref.	5	(100.0)	1.00	Ref.		4	(80.0)	1.00	Ref.
Tobacco smoking													
Yes	2	2 (100.0)	-	-	2	(100.0)	-	-		2	(100.0)	-	-
No	53	47 (88.7)	1.00	Ref.	44	(83.0)	1.00	Ref.		44	(83.0)	1.00	Ref.
Alcohol consumption													
Yes	34	28 (82.3)	-	-	27	(79.4)	0.41	(0.07–2.17)		27	(79.4)	0.41	(0.07–2.17)
No	21	21 (100.0)	1.00	Ref.	19	(90.5)	1.00	Ref.		19	(90.5)	1.00	Ref.

* p < 0.05, ** p < 0.01, *** p < 0.001; Fully-adjusted model, including all statistically significant characteristics. Ref – reference; CI – confidence interval

Table S2. Opinions on the role of a pediatrician as a promoter of a healthy lifestyle

Opinion	Total <i>n</i> = 55 (%)
A pediatrician is obliged to provide counseling on a healthy lifestyle among patients	
Yes	54 (98.2)
No	1 (1.8)
Patients are more likely to make lifestyle changes after receiving expert counseling from a pediatrician	
Yes	41 (74.5)
No	14 (25.5)
There are effective strategies and tools designed to help patients with a healthy lifestyle	
Yes	29 (52.7)
No	26 (47.3)
I have sufficient knowledge and skills to advise patients on a healthy lifestyle	
Yes	45 (81.8)
No	10 (18.2)
I am effective in helping my patients to lead a healthy lifestyle	
Yes	39 (70.9)
No	16 (29.1)
Healthy lifestyle counseling will be more effective if a pediatrician follows the health recommendations	
Yes	52 (94.5)
No	3 (5.5)

Table S3. Barriers in the process of assessing, controlling, and guiding the patient indicated by the pediatrician

Characteristics	Total <i>n</i> = 55 (%)
Patients are not interested in improving their diet, physical activity, and weight loss	40 (72.7)
Patients find it too difficult to change their current habits	34 (61.8)
Lack of time	30 (54.5)

Table S4. Improvements that would help reduce health problems dependent on diet, physical activity, and body weight indicated by the pediatrician

Characteristics	Total <i>n</i> = 55 (%)
Better tools to communicate information about diet, physical activity, or weight problems to patients or their families	34 (61.8)
Simple procedures and guidelines for patient monitoring	32 (58.2)
More training for healthcare workers in assessing and managing patient diet, physical activity, and weight management	18 (32.7)