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ORIGINAL ARTICLE

Evaluation of general practitioners' assessment of overweight among children attending the five-year preventive child health examination: A cross-sectional survey

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Abstract

Objective. To evaluate general practitioners' (GPs') assessment of potential overweight among children attending the five-year preventive child health examination (PCHE) by comparing their assessment of the children's weight-for-stature with overweight defined by body mass index (BMI) according to paediatric standard definitions. *Design.* A cross-sectional survey. Data were obtained from a questionnaire survey of children's health in general and their growth in particular. *Setting.* The five-year preventive child health examination (PCHE) in general practice in the Central Denmark Region. *Subjects.* Children attending the five-year PCHE in general practice, regardless of their weight status. *Main outcome measures.* Paediatric standard definitions for childhood overweight based on BMI were used as the gold standard for categorizing weight-for-stature. Identification of overweight was analysed with regard to sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the GPs' assessment of weight-for-stature. *Results.* A total of 165 GPs conducted 1138 PCHEs. GPs assessed that 171 children had a weight-for-stature above normal. Use of the Danish Standards (DS), i.e. the Danish national growth charts for BMI, as the gold standard yielded a sensitivity of 70.1% (95% CI 62.0–77.3) and a specificity of 92.4% (95% CI 90.6–93.9). The sensitivity was influenced by the GPs' use of BMI and the presence of previous notes regarding abnormal weight development. *Conclusion.* At the five-year PCHE almost one-third of overweight children were assessed to be normal weight by GPs. Use of BMI and presence of notes on abnormal weight in medical records were positively associated with a higher identification. Hence, utilization of medical record data and BMI charts may refine GPs' assessment of childhood overweight.

Key Words: *Assessment, children, Denmark, general practice, overweight, preventive child health examination*

Introduction

Obesity is frequent in children and early detection is a crucial initial step in overweight management [1,2]. In many countries general practitioners (GPs) conduct annual preventive child health examinations (PCHEs) and are supposed to play an important role in preventing, identifying, and managing overweight in children [3]. In Denmark, measurement of height and weight at all PCHEs is recommended [4]. Comparison of body mass index (BMI) with age- and sex-adjusted BMI percentiles is supposedly the method of choice for identifying childhood overweight [5–7]. However, even highly trained health professionals' subjective clinical assessments of patients' weight-for-stature are imprecise compared with objective assessment methods [8,9]. In two earlier studies paediatricians identified overweight in 28% of overweight children [10] and obesity in 53% of obese children [2,10]. Recognition of mild overweight was shown to improve during paediatric health checks when BMI was used [11].

Little is known about GPs' identification of overweight in children and the significance of using BMI in their assessment.

The aim of this study was to evaluate GPs' assessment of overweight among children attending

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Overweight is expected to be detected at the preventive child health examination in general practice.

- Almost one-third of overweight children were assessed as being normal weight by general practitioners.
- Utilization of available medical record data and standardized body mass index charts may improve general practitioners' assessment of overweight in children.

the five-year preventive child health examination (PCHE) by comparing their assessment of overweight and overweight defined by BMI and paediatric standard definitions.

Material and methods

We conducted a cross-sectional survey of children attending the five-year PCHE in general practice during 2009. Data were obtained from a questionnaire on children's health in general and their growth in particular. The questionnaire was completed by GPs in connection with the five-year PCHE.

More than 98% of the Danish population are registered with a GP and receive free medical care [12]. Until the age of five years, all Danish children are offered an annual PCHE by their GP and 83% of children participate in the five-year PCHE [13]. The aim of the PCHE is to prevent disease and to detect early signs of abnormal development. Weight and height are measured at almost all five-year PCHEs [14].

Data collection

In September 2008, we invited all GPs working in the Central Denmark Region (CDR) to participate in the study (see Figure 1). Data on the GPs were obtained from the General Practice Administrative Authorities in the CDR. Information on the number of five-year PCHEs conducted was available only for single-handed practices.

GPs were asked to fill in questionnaires on all children consecutively attending the five-year PCHE during or immediately after the PCHE.

The questionnaire themes were inspired by literature studies and preceding interviews with GPs. The phrasings regarding the contents of the five-year PCHE were inspired by existing questionnaires [14]. The GP interviews addressed the GPs' experiences with identification and management of children's overweight. The questionnaire was pilot-tested among 20 GPs in order to investigate the comprehensibility and the appropriateness of the response categories.

The GP questionnaire comprised items on the children's weight and height, whether the GP calculated the child's BMI, whether the medical record contained notes on abnormal weight, the GP's familiarity with the family, the child's attendance frequency at the practice, and the GP's overall clinical assessment of each child's weight-for-stature distributed into five categories.

Statistical analysis

GP characteristics were compared by using standard (Pearson's) chi-squared test. A t-test was used for comparisons of continuous variables (Table I).

The children's weight-for-stature was categorized based on the Danish national growth charts for BMI (DS) [15] and international paediatric standard definitions (IS) established by Cole et al. [16]. DS were used as gold standard in the analysis. Analogous analyses were performed with IS as gold standard.

According to DS, overweight is defined as BMI above the 90th percentile, obesity as BMI above the 99th percentile. The corresponding cut-off points for overweight approximate 17.2 kg/m^2 for five-year old girls and 17.1 kg/m^2 for five-year old boys. Cut-off points for obesity approximate 19.2 kg/m^2 and 18.6 kg/m^2 for five-year old girls and boys, respectively.

According to the IS, the BMI cut-off points for overweight in five-year old children approximate BMI above 17.2 kg/m^2 for girls and 17.4 kg/m^2 for boys. The BMI cut-off points for obesity approximate a BMI above 19.2 kg/m^2 for girls and 19.3 kg/m^2 for boys.

The GPs' identification of overweight was analysed by estimating the sensitivity, the specificity, the positive predictive value (PPV), and the negative predictive value (NPV) of the GPs' assessments (example in Table II). As sensitivity and specificity are proportions they were compared between subgroups in the data using large sample tests for proportions (Table III).

Three different overweight variables formed the basis for the analyses:

1. GP assessed overweight: Children with a weight-for-stature assessed above normal/middle by GP ("Far above normal" and "Slightly above normal").
2. Overweight (DS): Overweight and obese children based on DS.
3. Overweight (IS): Overweight and obese children based on IS.

Table I. Characteristics of the source population of general practitioners in the Central Denmark Region.

	Participating GPs		Non-participating GPs		
	n	(%)	n	(%)	p-value
	165	(19)	700	(81)	
Gender:					
Male	66	(40)	451	62	<0.001
Female	99	(60)	230	38	
Age:					
Mean (range)	50.7	(35-65)	53.3	(34-70)	<0.001
Number of conducted five-year PCHEs per year:[1]					
Mean (range)	21	(4-104)	16	(1-80)	0.99
Type of practice:					
Solo practice	38	(23)	184	(26)	0.2
Partnership practice	127	(77)	493	(71)	0.2
Unknown[2]	0	(0)	23	(3)	
Number of children on list:[3]					
Mean (range)	938	78-3364	830	19-3364	0.99

Notes: [1]Number of conducted PCHEs was assessed on the basis of solo practices. [2]Type of practice not registered in data from the General Practice Administrative Authorities in the Central Denmark Region. [3]The number of children on the list was assessed on the basis of all types of practices.

The distribution of "GP assessed overweight" and "Overweight" according to DS is interpreted by the 2×2 table (see Table II).

We then analysed associations of certain factors and sensitivity of the GPs' assessment of children's weight-for-stature. The analyses were repeated for the subgroups: BMI used in the assessment, children with previous observations of abnormal weight development, the GP's familiarity with the family, and frequent visits in general practice. We used Stata statistical software version 10.0 for the analyses [17].

Ethics

The study was approved by the Danish Data Protection Agency (journal no 2008-41-3239).

All parents gave informed written consent to participation in the study.

Table II. 2×2 table illustrating the analysis founding the basis for results in Table III.

GP assessed overweight	"Overweight" (based on Danish BMI growth charts)		
	Yes	No	Total
Yes	103 (a)	68 (b)	171 (a + b)
No	44 (c)	920 (d)	964 (c + d)
	147 (a + c)	988 (b + d)	1,135 = N

Notes: Sensitivity = a/a + c = 103/147 = 0.70. Specificity = d/b + d = 920/988 = 0.93. PV = a/a + b = 103/171 = 0.6. NPV = d/c + d = 920/44 + 920 = 0.95.

Results

We invited a total of 865 GPs; 240 (28%) GPs accepted to participate in the study and 165 GPs (19%) returned questionnaires for a total of 1138 children attending the five-year PCHE. The participating GPs were statistically significantly younger than the non-participating GPs (see Table I). There were statistically significantly more female GPs among the participating GPs compared with the non-participating GPs. There was no significant difference in the number of PCHEs conducted between participating and non-participating GPs or between the numbers of children on their lists.

Weight and height were measured in 1136 of the 1138 PCHEs conducted. In three children, the GPs ticked off the value "Don't know" regarding their overall clinical assessment of the child's weight-for-stature. These three children were omitted from the analyses. The children had a mean weight of 19.9 kilos (range 13–o 34 kilos), a mean height of 113 cm (range 98 to 131 cm), and a mean BMI of 15.6 kg/m^2 (range 11.2 kg/m^2–23.4 kg/m^2).

The GPs assessed 153 children to have a weight-for-stature slightly above normal and 18 children to have a weight-for-stature far above normal. According to DS 147 children were overweight. The sensitivity of the GPs' assessment of overweight was 70.1% (95% CI 62.0–77.3) and the specificity was 92.4 (95% CI 90.6–93.9). According to IS, 133 children were overweight. The sensitivity of the GPs' assessment of overweight was 74% (95% CI

Table III. Factors influencing GPs' identification of overweight (n = 1135).

		Overweight										
		Frequency (%)	Sensitivity	95% CI	p-value[4]	Specificity	95% CI	p-value[4]	PPV	95% CI	NPV	95% CI
GP assessment:												
IS		11.9	73.0	64.7–80.2		92.9	91.1–94.4		58.5	50.7–66.0	96.2	94.8–97.2
DS		13.0	70.1	62.0–77.3		92.4	90.6–93.9		60.2	52.5–67.6	95.4	94.0–96.6
Plotted BMI:												
IS												
n = 714	Yes	12.0	77.9	67.7– 86.1	0.18	91.1	88.6–93.1	0.002	54.5	45.2–63.5	96.8	95.0–98.1
n = 417	No	11.8	67.3	52.5–80.0		96.2	93.7–97.9		70.2	55.1–82.7	95.7	93.1–97.5
DS	Yes	12.8	75.8	65.7–84.1	0.05	91.3	88.8–93.4	0.06	56.1	46.9–65.0	96.3	94.4–97.6
	No	13.4	60.7	46.8–73.5		96.4	93.9–98.0		72.3	57.4–84.3	94.1	91.1–96.2
Familiar:[1]												
IS												
n = 925	Yes	12.1	75.0	65.9–82.7	0.9	92.6	90.6–94.3	0.3	58.3	49.8–66.5	96.4	94.9–97.6
n = 201	No	11.0	68.2	45.1–86.1		95.0	90.7–97.7		62.5	40.6–81.2	96.0	92.0–98.4
DS	Yes	12.7	73.5	64.5–81.2	0.05	92.8	90.8–94.5	0.2	59.7	51.2–67.8	96.0	94.4–97.3
	No	14.4	55.2	35.7–73.6		95.3	91.0–98.0		66.7	44.7–84.4	92.7	87.8–96.0
Previous observations abnormal weight:												
IS												
n = 120	Yes	25.0[2]	93.3	77.9–99.2	0.03	85.6	76.6–92.1	0.003	68.3	51.9–81.9	97.5	91.2–99.7
n = 1003	No	10.5	68.6	58.8–77.3		93.9	92.1–95.3		56.7	47.6–65.5	96.2	94.7–97.4
DS	Yes	27.5[2]	90.9	75.67–98.1	0.003	87.4	78.5–93.5	0.02	73.2	57.1–85.7	96.2	89.3–99.2
	No	11.4	64.0	54.5–72.8		93.9	92.1–95.4		57.5	48.4–66.2	95.3	93.7–96.6
Frequent visitor:[3]												
IS												
n = 950	Yes	16.4	90.9	70.8–98.9	0.05	91.9	86.4–95.8	0.5	62.5	43.7–78.9	98.6	94.9–99.8
n = 171	No	15.1	70.5	61.2–78.8		93.3	91.4–94.9		58.5	49.7–66.9	96.0	94.4–97.2
DS	Yes	15.8	87.0	66.4–97.2	0.052	91.9	86.3–95.7	0.4	62.5	43.7–78.9	97.8	93.8–99.6
	No	13.5	66.7	57.6–74.9		93.6	91.7–95.2		60.7	52.0–69.0	95.0	93.2–96.4

Notes: [1]Familiar: Yes represents "Very familiar" or "Familiar". "No" represents "Less familiar" or "Unfamiliar". [2]P-value < 0.05. [3]Yes represents more than three visits during the past year. [4]Large sample tests for proportions.

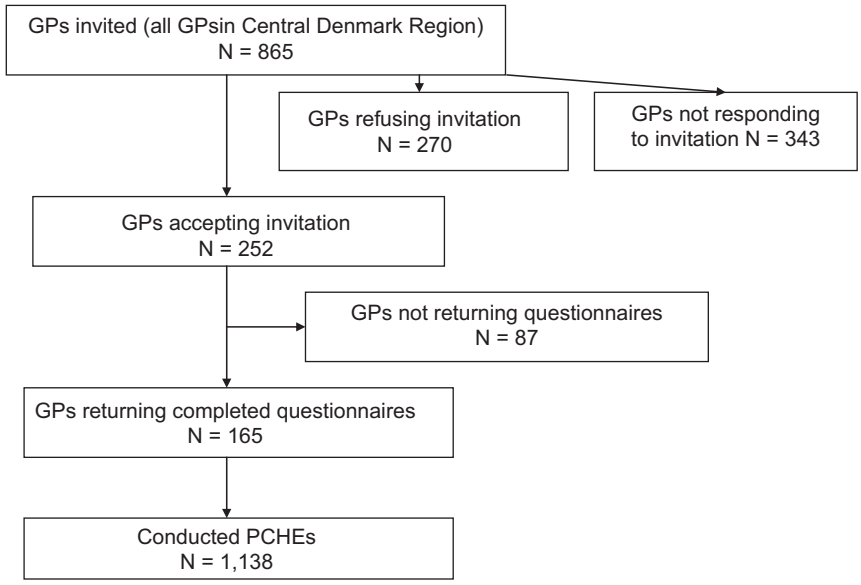

Figure 1. Flowchart of inclusion of general practitioners and children.

65.8–81.2) and the specificity was 93% (95% CI 91.1–94.4) (see Table III).

The sensitivity of the GPs' assessment tended to be statistically significantly higher ($p = 0.003$) among children with previous observations of abnormal weight development (90.9; 95% CI 75.7–98.1) than in children with no observations. (64.0; 95% CI 54.5–72.8). In order to control for obesity as a confounder, the obese children were excluded from sub-analysis. This entailed a sensitivity of 86.4% (95% CI 65.2–97.1) in children with previous observations compared with 62.0% (95% CI 51.7–71.5) children with no observations. The difference remained statistically significant ($p = 0.03$).

Sensitivity increased with more visits to practice and with BMI use. However, this increase did not reach a level of statistical significance ($p = 0.08$, $p = 0.05$, respectively).

The specificity of the GPs' assessment was 92.4 (DS) and was positively associated with BMI use (96.4, 95% CI 93.7–97.9) and with previous observations of abnormal weight (93.9, 95% CI 92.1–95.3).

Associations between the two variables "Familiarity" and "Attendance frequency" were statistically significant ($p < 0.01$).

Associations between the two variables "Familiarity" and "Previous observations of abnormal weight" showed statistical significance ($p = 0.01$).

There was no statistically significant association between the variables "Previous observations of abnormal weight" and "Attendance frequency" ($p = 0.42$).

Discussion

We found that 30% of overweight children attending the five-year PCHE were assessed to be normal weight by the GPs. The presence of previous notes on abnormal weight was associated with an increased sensitivity of the GPs' assessment. Moreover, a high frequency of visits to practice and use of BMI tended to be associated with a higher sensitivity. Specificity has traditionally been regarded as a factor of paramount importance in the diagnosis of childhood overweight [18]. The specificity was high in our study.

The PPV in our study was 60.2%, implying that only 60.2% of children assessed to be overweight by their GPs were overweight according to DS. The contrast between the relatively high specificity and the low PPV can be explained by the relatively low prevalence of overweight in the population. The NPV of the GPs' assessment implies that most of the children who were assessed to be normal weight by their GPs were also normal weight according to the DS. PPV and NPV relate to the studied population and thereby account for the problems of misclassification.

The GPs' assessments fell short of correctly identifying all cases of overweight, yet they remain a valuable tool in detecting childhood overweight.

The GPs' identification of overweight was higher than in medical record review studies of paediatric clinicians, documenting overweight in 28% [10] and 31% [19] of overweight children and obesity in 53% of obese children [2]. The shared design of

these studies was a retrospective review of medical record diagnoses. Hence, the physicians may not have paid particular attention to weight.

We used DS as gold standard for defining overweight and obesity in our cohort. Although BMI works fairly well at the population level, this measure cannot determine the composition of body mass, and thus cannot discriminate between lean body mass and fat-containing body mass [20] and caution is warranted when predicting an individual's content/distribution of body fat [21]. Hence, use of BMI carries the risk that someone with a low level of body fat and very large muscle mass may be misclassified as overweight due to a high BMI. This may to some extent explain the discrepancies between the GPs' assessment and BMI defined overweight.

Analyses were made using IS [16] and DS [15] in order to be able to compare with international studies. Differences in prevalence due to the two standards may be explained by differences in overweight prevalence in the populations founding the basis for these standards.

Recall bias may be reduced because of the survey's relation to a concrete PCHE. Second, the study captured the GPs' clinical assessment of actual children attending their clinics as opposed to previous studies using body images to evaluate physicians' identification of overweight [8]. Hence, we believe that this study provides a high-quality evaluation of GPs' clinical assessment of childhood overweight.

The participating GPs were younger than non-participating GPs and female GPs were over-represented compared with non-participating GPs. Further, it is likely that the GPs in our study had a particular interest in the subject and we may therefore expect our results to overestimate identification of overweight in children. Selection bias due to overweight may be suspected because of the lower prevalence of overweight in the cohort compared with the background population (15.9% and 11.6% for six-year-old girls and boys, respectively) [22]. This selection may partly be explained by the absence of socioeconomically less privileged families from the PCHEs [13], for instance bilingual children [23].

Notably, the lacking validation of the GPs' weight-for-stature assessment scale prompts limitations. We aimed at targeting all children with a weight-for-stature somewhat above normal. We therefore provided the GPs with a five-point assessment scale. It is, however, uncertain whether the GPs would have categorized children with a weight-for-stature above normal as overweight in the absence of such a scale.

There seemed to be some statistical association between the surveyed variables "Attendance frequency" and "Familiarity". However, both variables were included in the analysis in order to deal with situations where the PCHE was conducted by a doctor less familiar with the child and its family, e.g. GP trainees.

The variables "Familiarity" and "Previous observations of abnormal weight" seemed to be associated. Whether familiarity in itself gives rise to more observations of abnormal weight is not known.

The GPs' assessment of overweight may be influenced by the socioeconomic status of the children. Unfortunately, our data did not permit analysis of such associations.

As GPs measure weight and height in most children until the age of five at the PCHEs [14], this clinical setting provides an opportunity for early identification of overweight. Our study shows a gap between GPs' assessment of overweight and BMI-defined overweight. More explanations may be likely. As childhood overweight is a relatively new phenomenon in Denmark, there may remain doubt about overweight definitions. The widely used growth charts for height and weight may be insufficient for diagnosing overweight. Earlier studies emphasized perceived lack of professional success and management opportunities as barriers for health professionals [24,25].

Overweight in childhood is associated with overweight in adulthood [26,27] and with multiple ensuing health problems [28–32]. Failure to identify childhood overweight may impair prevention of adult overweight and disease. A qualitative study of obese adults revealed that restricted attention to obesity could lead to neglect of patients' problems [33]. Further research is needed to form the basis for better tools for identification of children at high risk of developing permanent overweight and ensuing health problems.

Conclusion

At the five-year PCHE, almost one-third of overweight children were assessed to be normal weight by GPs. Use of BMI and presence of notes on abnormal weight in medical records, were positively associated with a higher identification. Hence, utilization of medical record data and BMI charts may improve GPs' assessment of childhood overweight.

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Conflicts of interest

The authors declare no conflicts of interests.

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