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Maternal perceptions of under- and overweight for 6-8 year olds: Reporting weights, concerns, and conversations with healthcare providers

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Title: Maternal perceptions of under- and overweight for 6-8 year olds: Reporting weights, concerns, and conversations with healthcare providers

Running title: Maternal perceptions children's weight

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ABSTRACT

Objectives: There is an alarming increase in childhood obesity. The majority of mothers do not correctly identify their child's weight status. The reasons for the misperception are not well understood. This study objective was to describe maternal perceptions of their child's BMI and maternal report of weight concerns raised by a health professional.

Design: Prospective, community-based cohort

Participants: Data collection took place in 2010 with 450 mothers in a longitudinal birth cohort when children were 6-8 years old. Mothers reported the child's anthropometric measures, and BMI was categorized according to the World Health Organization Growth Charts adapted for Canada.

Results: 74% of children had a healthy BMI, 10 % were underweight, 9% were overweight, and 7% were obese. 80% of parents whose child was underweight believed their child was about the right weight and only 13% recalled a health professional recently raising concerns about their child being underweight. 89% of parents whose child was overweight believed their child was about the right weight and only 6% recalled a health professional recently raising concerns about their child being overweight. 62% of parents whose children were obese believed their child was about the right weight and only 18% recalled a health professional raising concerns about their child being overweight.

Conclusion: The majority of mothers with children at unhealthy weights misclassified and normalized their child's weight status, and did not recall a health professional raising concerns. The highest rates of child's body weight misclassification occur for overweight children. This suggests missed opportunities for knowledge exchange and early intervention to assist parents in supporting healthy weights for their children.

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ARTICLE SUMMARY: STRENGTHS AND LIMITATIONS OF THIS STUDY

The strengths of our study:

- 1. Questionnaire was pilot tested.
- 2. Reliability of the data collected.
- 3. Cohort is representative for the Canadian population.

Our study has limitations:

- 1. Child anthropometric measured were reported by mothers.
- 2. No information collected about health care providers' measurements of child

anthropometrics.

3. Small sample size.

DATA SHARING STATEMENT

No additional data available

INTRODUCTION

Increasing rates of childhood overweight are a societal concern given the trajectory of adverse health impacts into adulthood. Obesity in children and adolescents has been linked to sustained weight problems and related morbidities and mortalities throughout the life course including dyslipidemia, type 2 diabetes, metabolic syndrome, coronary heart disease, and hypertension (1-3). On the other hand, restrictive eating disorders, while at much lower rates of prevalence (2.6 out of 100,000 5-12 year olds), also have significant associated morbidities and mortalities of extreme low body weights (4). Children with unhealthy weights may also be at higher risk for bullying and exclusion from play with negative mental health outcomes(5-7). Effective weight management care is needed to help children achieve improved health and wellness, the family and the family-health professional relationship having a profound impact for pediatric weight management(8, 9). Families have identified a preference for health care providers to inform them about child related information(10).

Parents and families play a vital role in maintaining healthy weights for children (11, 12). Parents who report concerns about their children's weights are more likely to take action to improve weight status such as limiting screen time, increasing physical activity and improving children's diets (12). Family-based practices such as eating together as a family and spending less time at home alone after school have been shown to protect against high body mass index (BMI) (11).

Nevertheless, studies from the United Kingdom, Norway, Germany, Portugal, Italy, Israel, Australia, Mexico, the United States and Canada have demonstrated that parents have low recognition of unhealthy weights in their own children with the majority of studies reporting that

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between 50% and 94% of parents of overweight children fail to identify their child as overweight and 65% of parents of underweight children fail to identify their child as underweight (13-26). Less than 50% understood that there are physical and mental health problems associated with unhealthy weights (26, 27). Recognition of unhealthy body weights in children is an important first step in combatting and preventing obesity in families because proper understanding of weight status and potential health impact can help families address and follow-through with interventions to reduce unhealthy weight (12).

Few studies have examined the awareness of Canadian parents and their perceptions of interactions with the universal healthcare system around children's weight status. In Canada, overall childhood overweight and obesity rate for 5-11 year olds at the time of this study, between 2009-2011, was 32.8% using categories defined by the World Health Organization (28). Underweight prevalence in Canadian children 5-17 between 2009-2011 was reported at 2.2% (28). An Ontario study from 2000 revealed that 72% of parents with overweight or obese children inaccurately identified their children's weight status (17). This analysis reports on data about parental perception of BMI from a longitudinal study in Alberta, Canada of children between the ages of 6 and 8. Parent-report about their child's BMI and their ability to recall health provider information is critical to understanding how identification of health risks and knowledge exchange occurs in clinical care.

METHODS

The Community Perinatal Care (CPC) study recruited pregnant participants between 2001-2004 into a randomized control trial of prenatal care supports (29). Women were recruited from three

Page 7 of 28

BMJ Open

low risk maternity clinics in the urban centre of Calgary, Alberta, and were subsequently invited to participate in follow-up studies as their children turned 3 and 5 (30, 31). In 2009, mothers who had participated in the 3 year follow-up study were contacted and invited to participate in another follow-up study when their children were between 6 and 8 years of age. The study received ethics approval from the Conjoint Health Research Ethics Board at the University of Calgary. The questionnaire was pilot-tested with 10 women with children of similar age to the cohort and revised for unclear wording. Data collection began in January 2010, and questionnaires were mailed to 706 women. The final survey took approximately 20-25 minutes to complete and collected the height and weight of children through maternal self-report, in addition to other lifestyle, health and demographic information. Women were provided with a one-time recreation pass in appreciation for their time that was mailed with the questionnaire with a postage-paid envelope to facilitate return of the questionnaire. Data collection finished in June 2010 with 450 completed questionnaires returned to the study for a final response rate of 64% (Figure 1).

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Families were provided with tape measures and instructions for child anthropometric measurements at recruitment. BMIs were calculated from the maternal reports of child's height and weight and categorized according to World Health Organization Growth Charts for Canada for the appropriate gender and age ranges between 6 and 8 years old. Overweight BMIs were the 85-97th percentiles, obese BMIs were above the 97th percentile and underweight BMIs were below the 3rd percentile(32).

Mothers were asked if they thought their child should weigh less, was about the right weight or should weigh more. A second question asked if they recalled a health professional rising concerns about their child's weight. The proportions of correct identification of weight status

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were calculated among the total number of mothers whose children had unhealthy BMIs (underweight, overweight, and obese) and within each unhealthy category. Bivariate comparisons between the BMI variable and these variables were conducted using a chi-squared test. Statistical significance was set at p < 0.05. Data were analyzed using the SPSS statistical software program (Version 20.0).

RESULTS

Forty-nine percent of children in the study were male. The mean age for children was 7.4 years (SD= 0.6) and for mothers 38.9 years (SD= 4.5). Mothers were mostly married or living common-law (93.6%), had a household income above \$80,000 (63.5%), and had finished some level of post-secondary education (74.3%). Over half were employed (53.3%). Children were reported to be in very good to excellent health (87.8%), and 84.5% of mothers were satisfied or highly satisfied with their child's physical activity levels (Table 1).

Characteristics	N=450*				
Mothers	Mean	SD			
Age (years)	38.9	4.5			
	n	%			
Marital Status	421	93.6%			
Married/Common law	24	5.3%			
Divorced/Separated	5	1.1%			

Table 1. Characteristics of mothers and children who participated in the follow-up study

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Single/Widowed		
Main Activity		
Employed or self-employed	237	53.3%
Homemaker	188	42.2%
Other	20	4.5%
Household Income		
≤\$40,000	22	4.9%
\$40,000-\$79,999	85	18.9%
\$80,000-\$119,999	136	30.3%
\$120,000-\$159,999	65	14.5%
≥\$160,000	84	18.7%
Prefer not to answer	57	12.7%
Education		
High school or less	44	9.8%
Some college, trade or university	72	16.0%
College/trade	102	22.7%
University	171	38.0%
Post graduate studies	61	13.6%
Satisfaction with child's physical activity		
levels		
Satisfied or highly satisfied	376	84.5%
Substitution inging substitution	44	9.9%
Neutral	25	5.6%
Dissatisfied or highly dissatisfied		

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Mother concerns about child's weight		
Yes	53	11.8%
No	397	88.2%
Recall healthcare provider raising concerns		
about child's weight	10	4 20/
Yes	19	4.2%
No	429	95.8%
Children	Mean	SD
Age (years)	7.4	0.6
	n	%
Male	219	48.7%
Health Status		
Very good to excellent	394	87.8%
Good	47	10.4%
Fair to poor	8	1.8%
BMI Status	0.	
Underweight (<3 rd percentile)	39	9.7%
Normal weight $(3^{rd}-85^{th} percentile)$	297	74.1%
Overweight (>85 th -97 th percentile)	36	9.0%
Obese ($\geq 97^{th}$ percentile)	29	7.2%
Routine health exam with GP in last year		
Yes	338	75.1%
No	112	24.9%

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According to calculated BMI levels 25.9% of children had unhealthy BMIs, with 9% of children in the overweight category, 7.2% in the obese category and 9.7% in the underweight category, while the remaining 74.1% fell into the normal weight category (Table 1).

Overall, 88.2% of mothers thought their child was about the right weight and 11.8% had concerns about their child's weight. Over 95% reported having a regular family doctor or paediatrician, and 75% had seen them in the recent past. Approximately 4% of parents recalled a healthcare provider raising concerns about their child's weight. Although 25.9% of children had unhealthy BMIs, 95.8% of mothers reported that no concerns had been raised (Table 1).

Almost three quarters of mothers (72.8%, 292/401) correctly identified their child's weight status. However, among mothers of children with unhealthy weights, only 18.3% (19/104) correctly identified their child's weight status. Healthcare provider concerns were reported for only 12.5% of children with unhealthy weights. Among mothers of underweight children, 79.5% reported their child's weight to be about right and only 12.8% recalled healthcare providers raising concerns. Among the mothers with overweight children, 89% reported that their child was about the right weight and only 5.6% recalled a healthcare provider raising concerns. Among mothers of obese children, 62.1% thought their child was the right weight and 17.9% recalled a healthcare provider saying their child should weigh less (Table 2).

Table 2. Body mass index of child and concerns about child's we

Underweight	Healthy	Overweight	Obese
(<3 rd	(3 rd -85 th	(>85 th -97 th	(≥97 th
percentile)	percentile)	percentile)	percentile)
N=39	N=297	N=36	N=29

	n	%	n	%	n	%	n	%
Mother's opinion of child's								
weight:								
Should weigh more	7	17.9%	23	7.7%	1	2.8%	2	6.9%
About the right weight	31	79.5%	273	91.9%	32	88.9%	18	62.1
Should weigh less	1	2.6%	1	0.3%	3	8.3%	9	31.0
Concerns recently raised by a								
health professional:								
Child being underweight	5	12.8%	4	1.3%	1	2.8%	0	0.0%
No concerns	34	87.2%	291	98.0%	33	91.7%	23	82.1
Child being overweight	0	0.0%	2	0.7%	2	5.6%	5	17.9

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Accuracy of the concerns reported and recalled was also low. Although 11.8% (53/401) of mothers reported concerns about their child's weight, only 4.7% (19/401) were valid based on the child's having a BMI that was not in the normal range. Half of concerns were for normal weight children. Among the small number of mothers who reported their child should weigh less, 85.7% were correct. Among the small number of mothers who reported their child should weigh more, just 21.2% were correct as the majority of mothers reporting this concern had children already in the normal weight range. Overall, 4.2% of children had reported healthcare provider concerns, but only 3% (12/400) were accurate to BMI status and 1.8% (7/400) were inaccurate for a accuracy rate of 63% (12/19) (Table 3).

<u>_</u>	Accurate		Inaccurate	
	n	%	n	%
Mother's opinion of child's				
weight:		2		
Should weigh more	7	21.2%	26	78.8%
Should weigh less	12	85.7%	2	14.3%
Total	19	40.4%	28	59.6%
Concerns recently raised by a				
health professional:				
Child being underweight	5	50.0%	5	50.0%
Child being overweight	7	77.8%	2	22.2%

Total	12	63.2%	7	36.8%

DISCUSSION

BMIs between the ages of 6 and 8 are important predictors of adult obesity and associated health risks(1). Concern and awareness about a child's weight can motivate positive changes in families to address unhealthy weights. In this study, over a quarter of mothers reported weights and heights for their children that fell into unhealthy BMI categories; however, only approximately 5% of mothers correctly recognized this and less than 5% of mothers could recall healthcare providers raising weight concerns. In addition, 7% of mothers reported concerns about their child's weight that was incorrect for the calculated BMI, for example stating that a healthy or underweight child should weigh less. Overall accuracy of weight identification in this Alberta-based study (73%) was somewhat higher than the study in Ontario from 2000 which reported 62% accuracy, but among mothers of children with unhealthy weights, the Alberta study had a lower accuracy rate of 18% compared to 28% in the Ontario study (17).

Accurate identification of weight problems for children was low. Among mothers with an overweight or obese child, 82% did not recognize that their child had a BMI that was too high. Similarly, 82% of mothers with underweight children did not recognize that their child had a BMI that was too low. Mothers of overweight children had particular difficulties recognizing their child's unhealthy weight with 92% inaccurately saying their child was about the right weight. These findings suggest that maternal identification of overweight BMI is the most difficult. Half of mothers with concerns had children who were already a healthy weight. Among mothers with normal weight children who reported concerns, the majority thought their

child should weigh more. This pattern may reflect a shift in perceptions of higher weights as normal, with more parents inaccurately reporting their child should weigh more to be at a normal weight (13).

In this study recall of healthcare provider concerns about weight was very low. This suggests that healthcare providers may not be raising concerns about BMI in routine check-ups and other visits, or that concerns are not being communicated in ways that are salient and memorable to mothers (18). Previous studies suggest that paediatricians and physicians are a preferred source of weight-related information (18). Regular feedback on weight status has been shown to be positively received by the majority of parents from both schools and healthcare providers(18, 33, 34). However, such conversations can be difficult and time-consuming, and some parents can be defensive, defiant or in denial regarding this sensitive issue particularly when they have weight concerns of their own (35). Approaching the conversation with visual aids or more salient aspects of unhealthy BMIs such as decreased abilities for physical activity and fat folds along with information regarding potential physical and mental health effects may help make conversations about weight concerns more memorable (19, 26, 27, 35). Since parents will not seek out assistance for children's weight if they perceive it to be normal (24), Canada's universal health system provides an opportunity to have regular conversations with parents concerning weight status with a trusted source assessment. However, weight feedback should also include strategies to improve health behaviours such as having a family meal time, eating healthy, and reducing snacking and sedentary activities(36).

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Strengths and limitations

Our study has limitations. There was no information collected about whether health care providers measured the child during consultations. We have assumed that this has been done, as measurement of height and weight are standard clinical practice for child check up protocol in the Canadian practice. Also, we did not collect objective information as to whether the healthcare worker actually raised concerns about the child's weight gain during consultations. However, if mothers do not recall discussion concerning their child's body status could be assumed that either, the issue has not been raised or, if raised, was not memorable.

Another limitation of this study is that height and weight were self-reported by mothers. This introduces potential bias in the study as parent-reported measures for children under 11 often underestimate heights and result in overestimations of overweight and obese BMIs (37). Some unconcerned mothers who reported weights and heights in the overweight range may have children who are actually in the normal weight range. However, in this study the proportion of children with overweight or obese BMIs are well below national averages at the time of 13.1% obese, 19.7% overweight (37), consequently, overestimation of overweight in this study is likely to be low. The findings are best generalized to middle and high income families in urban settings. In addition, pilot testing of the survey showed the appropriateness of the questions to the target population and the reliability of our questionnaire.

CONCLUSIONS

The majority of mothers with underweight, overweight or obese children did not correctly classify their child's weight status. Only 20% of mothers with an unhealthy weight child

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correctly identified the weight status of their 6 to 8-year-old child, with the highest rates of misclassification occurring for overweight children. Of note, when concerns were raised for normal weight children, mothers often thought their children should weigh more. Very few mothers with underweight, overweight or obese children could recall health providers raising concerns about their child's weight, and recall was particularly low if the child was overweight. The results suggest that there are opportunities for health care professionals to improve knowledge exchange with parents about the healthy BMI for their child. Raising and repeating concerns about BMI, and discussing patient specific strategies to improve weight, could support parents in implementing behaviour changes to improve child health. Results in the overweight category indicate that parents need extra support to clarify the distinction between healthy and overweight, especially as overweight status becomes normalized due to increasing prevalence (13).

CONFLICT OF INTEREST

No conflict of interest was declared.

AUTHOR CONTRIBUTIONS

ST was involved in the design and implementation of the Community Perinatal Care (CPC) study. SMD oversaw the implementation of the middle childhood follow-up as part of postdoctoral training, and oversaw the analysis of the study. HG wrote the initial draft of the paper. AV had the primary responsibility for the final content. All authors helped prepare the manuscript and approved the final version.

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Figure 1 legend

Figure1. Study flowchart mapping eligibility and recruitment of mothers who participated in the follow up study at 6 to 8 years

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title	
		or the abstract	
		(b) Provide in the abstract an informative and balanced summary of	Page
		what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation	Page
		being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	Page
			4
Methods			
Study design	4	Present key elements of study design early in the paper	Page
			5
Setting	5	Describe the setting, locations, and relevant dates, including periods of	Page
		recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and	Page
		methods of selection of participants. Describe methods of follow-up	5
		(b) Cohort study—For matched studies, give matching criteria and	N/A
		number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential	Page
		confounders, and effect modifiers. Give diagnostic criteria, if	5
		applicable	
Data sources/	8*	For each variable of interest, give sources of data and details of	N/A
measurement		methods of assessment (measurement). Describe comparability of	
		assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	Page
			5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If	
		applicable, describe which groupings were chosen and why	-
Statistical methods	12	(a) Describe all statistical methods, including those used to control for	Page
		confounding	5
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	27/4
		(<i>d</i>) Cohort study—If applicable, explain how loss to follow-up was	N/A
		addressed	
		(e) Describe any sensitivity analyses	

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Page 28 of 28

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Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Page 5
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and	Page 6 an
r		information on exposures and potential confounders	table1
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Cohort study—Summarise follow-up time (eg, average and total amount)	Page 5
Dutcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their	N/A
		precision (eg. 95% confidence interval). Make clear which confounders were adjusted for	
		and why they were included	
		(b) Report category boundaries when continuous variables were categorized	
Main results	16	(c) If relevant, consider translating estimates of relative risk into absolute risk for a	N/A
		meaningful time period	
		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity	N/A
		analyses	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a	N/A
		meaningful time period	
Other analyses	17	Summarise key results with reference to study objectives	
Discussion			
Discussion			
Av reculte	18	Give a cautious overall interpretation of results considering objectives limitations	Page 12
xey results	10	multiplicity of analyses, results from similar studies, and other relevant evidence	1 age 12-
imitations	10	Discuss the generalisability (external validity) of the study results	Page 13
Interpretation	20	Give a cautious overall interpretation of results considering objectives limitations	Page 13
interpretation	20	multiplicity of analyses results from similar studies, and other relevant evidence	
Ganaralisability	21	Give the source of funding and the role of the funders for the present study and if applicable	
Jeneralisability	21	for the original study on which the present article is based	
		for the original study on when the present affect is based	Page 15
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Maternal perceptions of under- and overweight for 6-8 year olds from a Canadian cohort: Reporting weights, concerns, and conversations with healthcare providers

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Title: Maternal perceptions of under- and overweight for 6-8 year olds from a Canadian cohort: Reporting weights, concerns, and conversations with healthcare providers

Running title: Maternal perceptions children's weight

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Keywords: child, body mass index, mothers, perception, primary health care

ABSTRACT

Objectives: The majority of mothers do not correctly identify their child's weight status. The reasons for the misperception are not well understood. This study's objective was to describe maternal perceptions of their child's BMI and maternal report of weight concerns raised by a health professional.

Design: Prospective, community-based cohort

Participants: Data was collected in 2010 from 450 mothers previously included in a longitudinal birth cohort. Mothers of children 6 to 8 years old reported the child's anthropometric measures and were surveyed concerning their opinion about their child's weight. They were also asked if a health care provider raised any concerns regarding their child's body weight. Child BMI was categorized according to the World Health Organization Growth Charts adapted for Canada. Descriptive statistics and bivariate analyses were used to evaluate mothers' ability to correctly identify their children's body habitus.

Results: 74% of children had a healthy BMI, 10 % were underweight, 9% were overweight, and 7% were obese. 80%, 89% and 62% of mothers with underweight, overweight and obese children, respectively, believed their child was the right weight. The proportion of mothers that recalled a health professional raising concerns about their child being underweight, overweight and, obese was low (12.5%).

Conclusion: The majority of mothers with children at unhealthy weights misclassified and normalized their child's weight status, and did not recall a health professional raising concerns regarding their child's weight. The highest rates of child body weight misclassification occurred in overweight children. This suggests there are missed opportunities for health care professionals

to improve knowledge exchange and early interventions to assist parents to recognize and support healthy weights for their children.

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ARTICLE SUMMARY: STRENGTHS AND LIMITATIONS

- This study explored mothers' perceptions of child body status as well as their experiences with health care providers concerns regarding optimal child body weight.
- Pilot testing of the survey showed the appropriateness of the questions to the target population and the reliability of the questionnaire.
- The cohort is representative for the Canadian population and best generalized to middle and high income families in urban settings.
- Child anthropometric measures were reported by mothers; no objective measure of children's weight status was available.

DATA SHARING STATEMENT

No additional data available

INTRODUCTION

Increasing rates of childhood overweight, are a societal concern given the trajectory of adverse health impacts into adulthood. According to World Health Organization (WHO) standards, rates of overweight and obesity were estimated at 32. 8 % and underweight at 2.2% for Canadian children aged 5-11 between 2009-2011 (1). Obesity in children and adolescents has been linked to sustained weight problems and related morbidities and mortalities throughout the life course including dyslipidemia, type 2 diabetes, metabolic syndrome, coronary heart disease, and hypertension (2-4). On the other hand, restrictive eating disorders, while at much lower prevalence rates (2.6 out of 100,000 5-12 year olds), also have significant morbidities and mortalities associated with extreme low body weights (5, 6). Children who are overweight or obese may be at higher risk for bullying and exclusion from play with negative mental health outcomes (7-9). Effective weight management care is needed to help children achieve improved health and wellness, with the family and the family-health professional relationship having a profound impact for pediatric weight management (10, 11). Of note, families have identified a preference for health care providers to inform them about child-related health information (12).

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Parents and families play a vital role in supporting healthy weights for children (13, 14). Parents concerned about their children's weights are more likely to take action to improve weight status such as limiting screen time, increasing physical activity and improving children's diets and nutrition (14). Practices such as eating together as a family and limiting the time spent alone at home after school have been shown to protect against high body mass index (BMI) (13).

Nevertheless, studies from the United Kingdom, Norway, Germany, Portugal, Italy, Israel, Australia, Mexico, the United States and Canada have demonstrated that parents have low

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recognition of unhealthy weights in their own children with the majority of studies reporting that between 50% and 94% of parents of overweight children fail to identify their child as overweight, and 65% of parents of underweight children fail to identify their child as underweight (15-28). Less than 50% of parents understood that there are physical and mental health problems associated with unhealthy weights (28, 29). A recent systematic review concur that mothers have difficulty perceiving the nutritional status of their children. This finding indicates a need for additional studies that would firstly, elucidate how mothers perceive their child's body weight and secondly, how risk communication about weight, nutrition and heath is perceived (30) (14).

Few studies have examined the awareness of Canadian parents and their perceptions of interactions with the universal healthcare system related to their child's weight status. An Ontario study from 2007 revealed that 63% of parents with overweight or obese children inaccurately identified their child's weight status (19). Furthermore, since excess or suboptimal weight is under-recognized, parents may not receive evidence based strategies to address weights, and interventions to support children may not be identified. Given that mothers may not perceive their children's weight status, effective communication from health care providers is essential to improving parental health literacy (31). Health care providers need to determine child nutrition status and ascertain parents' perception of their child's body weight in order to provide specific parental counselling and education. Parental perception of children's BMI and their ability to recall health provider information is critical to understanding knowledge exchange occurs in clinical care.

BMJ Open

The objective of this study was to explore parental perception of their 6-8-year-old child's BMI and their report of concerns about weight raised by a health professional in a longitudinal cohort from Alberta, Canada.

METHODS

The Community Perinatal Care (CPC) study recruited pregnant participants between 2001-2004 into a randomized control trial of prenatal care supports (32, 33). Women were recruited from three low risk maternity clinics in the urban centre of Calgary, Alberta, Canada and were subsequently invited to participate in follow-up studies as their children turned 3 and 5 (33-35). In 2009, mothers who had participated in previous data collection waves were contacted and invited to participate in another follow-up study when their children were between 6 and 8 years of age. Data collection began in January 2010 and finished in June same year. Questionnaires were mailed to 706 women. Four hundred fifty completed questionnaires were returned for a final response rate of 64% (Figure 1).

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Measures

Families were provided with tape measures and instructions for taking their child's anthropometric measurements at survey mail-out. BMIs were calculated from the maternal reports of child's height and weight and categorized according to World Health Organization Growth Charts for Canada for the appropriate gender and age ranges between 6 and 8 years old. Overweight BMIs were the 85-97th percentiles, obese BMIs were above the 97th percentile and underweight BMIs were below the 3rd percentile (36).

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Mothers were asked if they thought their child should weigh less, was about the right weight or should weigh more. A second question asked if they recalled a health professional rising concerns about their child's weight. The questionnaire was pilot-tested with 10 women with children of similar age to the cohort and revised for unclear wording. The final survey took approximately 20-25 minutes to complete and collected the height and weight of children through maternal self-report, in addition to other lifestyle, health and demographic information. Women were provided with a one-time recreation pass in appreciation for their time that was mailed with the questionnaire with a postage-paid envelope to facilitate return of the questionnaire.

Data analysis

Descriptive analysis of participant characteristics, including demographics and health care utilization was undertaken. The proportion of mothers who correctly identified their child's weight status were calculated. The proportion of children who had BMI's outside the normal range was calculated. The proportions of 'correct' responses for each weight category were described. Finally, the proportion of those who recalled a conversation with a health care provider by child's BMI was described. Bivariate comparisons were conducted using Chi-squared test. Data were analyzed using the IBM SPSS statistical software program (Version 20.0).

Of note, there were no clinically meaningful differences between those randomized to the prenatal care supports and controls in the original trial, so the analysis did not control for intervention group. In addition, the intervention ended at delivery, and further engagement was identical for all participants and entailed completion of a questionnaire.

Ethics

The study received ethics approval from the Conjoint Health Research Ethics Board at the University of Calgary. Informed consent was obtained from the study participants at the time of recruitment.

RESULTS

Forty-nine percent of children in the study were male. The mean age for children was 7.4 years (SD= 0.6) and for mothers 38.9 years (SD= 4.5). According to calculated BMI levels, 25.9% of children had unhealthy BMIs, with 9% of children in the overweight category, 7.2% in the obese category and 9.7% in the underweight category, while the remaining 74.1% fell into the normal weight category. (Table 1)

Mothers were mostly married or living common-law (93.6%), had a household income above \$80,000 (63.5%), and had finished some level of post-secondary education (74.3%). Over half were employed (53.3%). (Table 1)

Table 1. Characteristics of study participants

Table 1. Characteristics of study participants		
Characteristics	N=450*	
Children		
	n	%
Age (years) (mean \pm SD)	7.4 ± 0.6	
Gender male	219	48.7%
BMI Status		

Page 10 of 30

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Underweight (<3 rd percentile)	39	9.7%
Normal weight $(3^{rd}-85^{th} percentile)$	297	74.1%
Overweight (>85 th -97 th percentile)	36	9.0%
Obese ($\geq 97^{th}$ percentile)	29	7.2%
Mothers		
	n	%
Age (years) (mean \pm SD)	38.9	4.5
Marital Status		
Married/Common law	421	93.6%
Divorced/Separated	24	5.3%
Single/Widowed	5	1.1%
Main Activity		
Employed or self-employed	237	53.3%
Homemaker	188	42.2%
Other	20	4.5%
Household Income		
≤\$40,000	22	4.9%
\$40,000-\$79,999	85	18.9%
\$80,000-\$119,999	136	30.3%
\$120,000-\$159,999	65	14.5%
≥\$160,000	84	18.7%
Prefer not to answer	57	12.7%
Education		
High school or less	44	9.8%
Some college, trade or university	72	16.0%
College/trade	102	22.7%
University	171	38.0%

Page 11 of 30

Post graduate studies	61	13.6
Post graduate studies * denominator varies due to missing data	61	13.6

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Table 2 summarizes the survey data on parental perceptions of their child's heath. More than 87 % of children were reported to be in very good to excellent health and 84.5% of mothers were satisfied or highly satisfied with their child's physical activity levels. Overall, 88.2% of mothers thought their child was about the right weight and 11.8% had concerns about their child's weight. Over 95% reported having a regular family doctor or paediatrician, and 75% had seen them in the recent past. Approximately 4% of parents recalled a healthcare provider raising concerns about their child's weight. Although 25.9% of children had unhealthy BMIs, 95.8% of mothers reported that no concerns had been raised (Table 2).

 Table 2. Parental perceptions of children's health (N=450)

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	n	%
Health Status		
Very good to excellent	394	87.8%
Good	47	10.4%
Fair to poor	8	1.8%
Satisfaction with child's physical activity levels		
Satisfied or highly satisfied		
Neutral	376	84.5%
Dissatisfied or highly dissatisfied	44	9.9%
	25	5.6%
Mother concerns about child's weight		
Yes	53	11.8%
No	397	88.2%
Recall healthcare provider raising concerns abo weight	ut child's	
Yes	19	4.2%
No	429	95.8%
Routine health exam with GP in last year	4	
Yes	338	75.1%
No	112	24.9%
* denominator varies due to missing data	- 2	

As shown in Table 3, almost three quarters of mothers (72.8%, 292/401) correctly identified their child's weight status. However, among mothers of children with unhealthy weights, only 18.3% (19/104) correctly identified their child's unhealthy weight status. Healthcare provider concerns were reported for only 12.5% of children with unhealthy weights. Among mothers of underweight children, 79.5% reported their child's weight to be about right and only 12.8%

recalled healthcare providers raising concerns. Among the mothers with overweight children, 89% reported that their child was about the right weight and only 5.6% recalled a healthcare provider raising concerns. Among mothers of obese children, 62.1% thought their child was the right weight and 17.9% recalled a healthcare provider saying their child should weigh less. Finally, among mothers of children deemed to have a healthy weight, 2 % (n=6) recalled that concerns were raised, of which the majority (67%) were related to the child being underweight. (Table 3).

	Unde	erweight	He	ealthy	Ove	rweight	C	Dbese
	(<3 rd	(3 ^r	^{-d} -85 th	(>8	5 th -97 th	(≥97 th
	pero	centile)	pere	centile)	per	centile)	per	centile)
	Ň	1=39	Ν	=297	Γ	N=36	ľ	N=29
	n	%	n	%	n	%	n	%
Mother's opinion of child's								
weight:				2				
Should weigh more	7	17.9%	23	7.7%		2.8%	2	6.9%
About the right weight	31	79.5%	273	91.9%	32	88.9%	18	62.1%
Should weigh less	1	2.6%	1	0.3%	3	8.3%	9	31.0%
Concerns recently raised by a								
health professional:								
Child being underweight	5	12.8%	4	1.3%	1	2.8%	0	0.0%
No concerns	34	87.2%	291	98.0%	33	91.7%	23	82.1%

Fable 3.]	Body	mass	index	of	child	and	concerns	about	child	's	weight
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Page 15 of 30

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1 2 3 4 5	Child being overweight	0	0.0%	2	0.7%	2	5.6%	5	17.9%
6 7 8 9 10 11 12 3 14 5 16 7 8 9 10 11 12 3 14 5 16 7 8 9 20 21 22 3 24 25 26 27 28 9 30 132 33 4 35 36 37 8 9 0 41 42 43 44 56 57 55 55 55 55 55 55 55 55 55 55 55 55									
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Among the 47 mothers who identified that their child should weigh either more or less, only 4.7% (19/401) were correct based on the child's having a BMI that was not in the normal range. Half of concerns were for normal weight children. Among the 14 mothers who reported their child should weigh less, 85.7% were correct. Among the 33 mothers who reported their child should weigh more, just 21.2% were correct as the majority of mothers reporting this concern had children already in the normal weight range. Nineteen (4.2%) mothers reported conversations with the healthcare provider about child's weight. Among the small number of mothers who recalled a health care provider conversation about their child's body weight, almost 78% accurately recalled that the conversation was about their child being overweight and approximately 37% inaccurately recalled the discussion about the child's weight status (Table 4).

0	Acc	urate	Ina	accurate
	n	%	n	º/ ₀
Mother's opinion of child's weight:				
Should weigh more	7	21.2%	26	78.8%
Should weigh less	12	85.7%	2	14.3%
Total	19	40.4%	28	59.6%
Mothers recall of concerns recently raised by a				
health professional:				
Child being underweight	5	50.0%	5	50.0%
Child being overweight	7	77.8%	2	22.2%

Table 4. Accuracy of concerns about child's weight

Total	12	63.2%	7	36.8%

DISCUSSION

In this study, parents of children aged 6 to 8 years old were asked about their child's body weight and to recall if they remembered a health care provider raising concerns. Our findings suggest that those mothers with normal weight children were most likely to identify their child as a 'healthy' weight. Of note, when concerns were raised for normal weight children, mothers often thought their children should weigh more. However, between 62% and 89% of mothers with children who were obese or overweight respectively, incorrectly identified their child as 'about the right weight'. The highest rate of misclassification occurred for overweight children. Furthermore, less than 18% of mothers with children in the underweight, overweight or obese category for BMI recalled having a conversation with a health care provider about their child's weight. and recall was particularly low if the child was overweight.

Obesity is prevalent in children of all ages, in North America and other developed countries. Evidence shows that BMIs between the ages of 6 and 8 are important predictors of adult obesity and associated health risks (1). High rates of maternal misperceptions of their child's unhealthy body weight status have been reported in several studies (30).

Overall accuracy of weight identification in this Alberta-based study (73%) was somewhat higher than the 2007 study in Ontario, which reported 62% accuracy, yet both studies show that parents have misperceptions regarding their children's weight status. Discrepancies could be due different definitions and methodologies (19). Similar findings were found in a study of 223 children aged 2 to 17, attending pediatric practices in Chicago, USA (37). Accurate identification

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of weight problems for children who were underweight, overweight or obese was also low. Among mothers with an overweight or obese child, 82% did not recognize that their child had a BMI that was too high. Similarly, 82% of mothers with underweight children did not recognize that their child had a BMI that was too low (37). Mothers of overweight children, in particular, had difficulties recognizing their child's unhealthy weight, with 89% inaccurately saying their child was about the right weight. These findings suggest that maternal identification of overweight BMI is the most difficult. Half of mothers with concerns had children who were already a healthy weight. Among mothers with normal weight children who reported concerns, the majority thought their child should weigh more. This pattern may reflect a shift in perceptions of higher weights as normal, with more parents inaccurately reporting their child should weigh more to be at a normal weight (15).

In the present study recall of healthcare provider concerns about weight was very low. This suggests that healthcare providers may not be raising concerns about BMI in routine check-ups and other visits, or that concerns are not being communicated in ways that are salient and memorable to mothers (20). Previous studies suggest that paediatricians and physicians are a preferred source of weight-related information (20). Regular feedback on weight status from both schools and healthcare providers has been shown to be positively received by the majority of parents (20, 38, 39). However, such conversations can be difficult and time-consuming, and some parents can be defensive, defiant or in denial regarding this sensitive issue particularly when they have weight concerns of their own (40). Approaching the conversation with visual aids or more salient aspects of unhealthy BMIs such as decreased abilities for physical activity and fat folds along with information regarding potential physical and mental health effects may help make conversations about weight concerns more memorable (21, 28, 29, 40). Since parents

will not seek out assistance for children's weight if they perceive it to be normal (26), Canada's universal health system which includes annual child growth and health assessment provides an opportunity to have regular conversations with parents concerning weight status with a trusted source assessment. However, weight feedback should also include strategies shown to improve health behaviours such as having a family meal time, healthy eating, and reducing snacking and sedentary activities (41).

Study limitations

Our study has limitations. There was no information collected about whether health care providers measured the child's BMI during consultations, however, measurement of height and weight are standard clinical practice for child check up protocol in the Canadian practice. Maternal reports on doctor visits have included both routine follow ups and visits for acute illnesses and it is likely that doctors would raise concerns about weight status when the child is acutely ill. Also, we did not collect objective information as to whether the healthcare worker actually raised concerns about the child's weight gain during consultations. However, if mothers do not recall discussion concerning their child's body status could be assumed that either, the issue has not been raised or, if raised, was not memorable.

Another limitation of this study is that height and weight were self-reported by mothers. This introduces potential bias in the study as parent-reported measures for children under 11 often underestimate heights and result in overestimations of overweight and obese BMIs (42). Some unconcerned mothers who reported weights and heights in the overweight range may have children who are actually in the normal weight range. However, in this study the proportion of children with overweight or obese BMIs are well below national averages at the time, of 13.1%

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obese and 19.7% overweight (42). Consequently, overestimation of overweight in this study is likely to be low. Although the socio-demographic characteristics are representative for the population in this study are similar to the Canadian parenting population, the findings from this study are best generalized to middle and high income families in urban settings. In addition, pilot testing of the survey showed the appropriateness of the questions to the target population and the reliability of our questionnaire.

CONCLUSIONS

This study suggests that mothers have difficulty in perceiving their children's weight status, particularly when their child is overweight, and few mothers recall health care providers raising concerns about their child's weight. These findings highlight the need for further research to understand parental misperceptions of child growth and risk communication from health care providers about child weight (43). These results suggest that there are opportunities for health care professionals to improve knowledge exchange with parents about the healthy BMI for their child. Raising and repeating concerns about BMI, and discussing patient specific strategies to improve weight, could support parents in implementing behaviour changes to improve child health. Results in the overweight category indicate that parents need extra support to clarify the distinction between healthy and overweight, especially as overweight status becomes normalized due to increasing prevalence (15).

CONFLICT OF INTEREST

No conflict of interest was declared.

AUTHOR CONTRIBUTIONS

SCT was involved in the design and implementation of the Community Perinatal Care (CPC) study. SMD oversaw the implementation of the middle childhood follow-up as part of postdoctoral training, and oversaw the analysis of the study. HKG wrote the initial draft of the paper. AEV had the primary responsibility for the final content and performed all revisions of the manuscript. All authors approved the final version.

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Figure 1 legend

Figure1. Study flowchart mapping eligibility and recruitment of mothers who participated in the follow up study at 6 to 8 years

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Figure1. Study flowchart mapping eligibility and recruitment of mothers who participated in the follow up study at 6 to 8 years Figure 1

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STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation	
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title	
		or the abstract	
		(b) Provide in the abstract an informative and balanced summary of	Page
		what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation	Page
		being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	Page
			4
Methods			
Study design	4	Present key elements of study design early in the paper	Page
			5
Setting	5	Describe the setting, locations, and relevant dates, including periods of	Page
		recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and	Page
		methods of selection of participants. Describe methods of follow-up	5
		(b) Cohort study—For matched studies, give matching criteria and	N/A
		number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential	Page
		confounders, and effect modifiers. Give diagnostic criteria, if	5
		applicable	
Data sources/	8*	For each variable of interest, give sources of data and details of	N/A
measurement		methods of assessment (measurement). Describe comparability of	
		assessment methods if there is more than one group	
Bias	9	Describe any efforts to address potential sources of bias	
Study size	10	Explain how the study size was arrived at	Page
			5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If	
		applicable, describe which groupings were chosen and why	-
Statistical methods	12	(a) Describe all statistical methods, including those used to control for	Page
		confounding	5
		(b) Describe any methods used to examine subgroups and interactions	N/A
		(c) Explain how missing data were addressed	27/4
		(<i>d</i>) Cohort study—If applicable, explain how loss to follow-up was	N/A
		addressed	
		(e) Describe any sensitivity analyses	

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Page 30 of 30

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Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and	Page 5	
		(h) Cive recease for non-norticipation at each stope		
		(c) Consider use of a flow diagram	Eigung 1	
Descriptive data	1.4.*	(c) Consider use of a flow diagram	Figure I	7
Jescriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and	Page 6 al	lipote
		(b) Indicate number of norticinante with missing data for each variable of interest	table1	čte
		(b) Indicate number of participants with missing data for each variable of interest	D 5	ğ
	1.5.4	(c) Cohort study—Summarise follow-up time (eg, average and total amount)	Page 5	<u>×</u>
Jutcome data	15*	Cohort study—Report numbers of outcome events or summary measures over time		8
		(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their	N/A	rig
		precision (eg, 95% confidence interval). Make clear which confounders were adjusted for		ht, i
		and why they were included		İnçi
		(b) Report category boundaries when continuous variables were categorized		ludi
Aain results	16	(c) If relevant, consider translating estimates of relative risk into absolute risk for a	N/A	bg
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		Report other analyses done-eg analyses of subgroups and interactions, and sensitivity	N/A	use !
		analyses		, Si
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a	N/A	elat
		meaningful time period		ied
Other analyses	17	Summarise key results with reference to study objectives		to t
Discussion				ext
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av regulte	18	Give a cautious overall interpretation of results considering objectives limitations	Daga 12	dd
ccy results	10	multiplicity of analysis, results from similar studies, and other relevant evidence.	1 age 12-	ata ?
imitationa	10	Discuss the constalisability (systemal validity) of the study results	13 Dama 12	<u>n</u> ii
limitations	19	Discuss the generalisability (external validity) of the study results	Page 13	
nterpretation	20	Give a cautious overall interpretation of results considering objectives, limitations,	Page 13	, ►
		multiplicity of analyses, results from similar studies, and other relevant evidence		t
Generalisability	21	Give the source of funding and the role of the funders for the present study and, if applicable,		ini
		for the original study on which the present article is based		<u>ĝ</u>
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Give information	n sepai	ately for cases and controls in case-control studies and, if applicable, for exposed and		lar
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