

# Using Routine Growth Data to Determine Overweight and Obesity Prevalence Estimates in Preschool Children in the Capital Health Region of Alberta

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## ABSTRACT

**Background:** Overweight and obesity prevalence is increasing in Canadian children. In the Capital Health region of Alberta, there is a need to examine this public health issue and implement strategies to overcome it. Two growth references, one provided by the US Centers for Disease Control and Prevention (CDC), and the other by the International Obesity Task Force (IOTF), are available to assess individuals and screen populations for overweight and obesity. The prevalence can vary as a function of the reference used. The primary objective of this study is to determine prevalence estimates of overweight and obesity in 4-6 year olds in the Capital Health region. The secondary objective is to explore differences in estimates using both classification systems.

**Methods:** Anthropometric measurements were incorporated into regular preschool immunization visits. Body Mass Index (BMI), defined as the bodyweight in kilograms divided by height in metres squared was calculated for each record and percentiles for age and sex were determined using cut-offs from the IOTF and CDC. The prevalence estimates of overweight and obesity using both classification systems were determined and compared.

**Results:** Out of 7,369 children, 13.8% were overweight and 11.4% were obese according to the CDC reference. The IOTF reference classified 11.5% as overweight and 6.8% as obese. The two reference systems had moderate agreement (kappa 0.69,  $p < 0.01$ ).

**Conclusion:** The results indicate a lower prevalence estimate of overweight and obesity among young children in the Capital Health region compared to other parts of Canada. The IOTF reference provides more conservative estimates than the CDC reference, accounted for more by the difference in estimates of obesity than by the difference in estimates for overweight.

**Key words:** Overweight; obesity; child development; Body Mass Index (BMI); child, preschool

*La traduction du résumé se trouve à la fin de l'article.*

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The prevalence of overweight/obesity in Canadians is increasing at an alarming rate, particularly in children. Between 1981 and 1996, the prevalence of overweight in Canadian children aged 7-13 increased from 11% to 33% in boys and 13% to 27% in girls.<sup>1</sup> The corresponding increases for obesity were from 2% to 10% in boys and 2% to 9% in girls. Results from the 2004 nutrition-focused Canadian Community Health Survey (CCHS) state that 26% of 2 to 17 year olds were overweight or obese.<sup>2</sup> Although the rate of increase in overweight in the Prairie provinces, including Alberta, has been found to be somewhat lower than in the rest of Canada, the increase is still of concern.<sup>3</sup> Between 1981 and 1996, the prevalence of overweight in Alberta children aged 7-13 increased from 10% to 23%.<sup>3</sup> In contrast to the CCHS data mentioned above, which were based on measured height and weight, these data were based on reported height and weight measurements.

In the Capital Health region (Edmonton, AB and surrounding area: population approx. 1 million), there is a need to examine the extent of this epidemic and implement population-based intervention strategies to reduce and eventually reverse this trend. The challenge within the region is to obtain comprehensive regional baseline data on prevalence estimates of childhood overweight and obesity and to continue measuring in order to establish a systematic surveillance strategy to monitor secular trends.

In Capital Health, routine childhood immunizations and health assessment/counseling services, including height and weight assessments, are provided by Community Health nurses at local health centres from birth through to preschool. A high proportion of children in the region receive these services. In 2004, 74% of children were adequately immunized for DTaP-IPV (Diphtheria, Tetanus, Pertussis and Polio) before entering grade one (Leslie Warrick, RN, Communicable Disease Control, Public Health, Capital Health, March 21, 2006). This percentage offers a very conservative estimate of the total number of children who access the public health system, either on time or eventually. This contact offers a unique opportunity to determine estimates of the prevalence of overweight and obesity in young children.

Two growth references are available to assess and monitor individual children and

screen populations for overweight and obesity. According to a public policy statement based on expert opinion and released in the spring of 2004,<sup>4</sup> it is recommended that the 2000 CDC BMI-for-age charts<sup>5</sup> be used for monitoring the BMI of individual Canadian children age two and over. However, for comparing prevalence data of Canadian populations against other populations, the use of the International Obesity Task Force (IOTF) reference<sup>6</sup> is recommended. Some researchers comparing the two methods in children from the United States<sup>7,8</sup> and First Nations children in Canada<sup>9</sup> have found the IOTF reference provides more conservative estimates of overweight and obesity than the CDC reference. These studies demonstrate that prevalence can vary as a function of the reference used to classify weight status.

The primary objective of this study is to determine prevalence estimates of overweight and obesity in 4-6 year olds in the Capital Health region of Alberta. A secondary objective is to explore differences in those estimates using both classification systems.

## METHODS

In Alberta, routine universal childhood immunizations are provided through the regional public health divisions. A surveillance component for height and weight was incorporated into the regular preschool immunization visit at community health centres. Before the study commenced, all weigh scales were calibrated and checked to ensure they met CDC standards.<sup>10</sup> Many of the health centres are located in older buildings with limited space for wall-mounted stadiometers, so vertical stadiometers attached to the weigh scales were utilized to ensure accuracy and reliability of height measurements. When necessary, new equipment was purchased to replace older equipment. Prior to data collection, health centre staff received an inservice program on childhood obesity issues, how to accurately collect anthropometric data, and health-promoting counseling strategies for families. Anthropometric data collected during health centre visits were entered into a centralized database.

The process for growth assessment during the preschool immunization visits was pilot tested in two health centres in March/April, 2004 to ensure consistency in measurements and to assess whether

**TABLE I**

**Body Mass Index (BMI) Cut-off Points Classifying Children as Overweight and Obese According to IOTF Reference**

Age	Overweight		Obese	
	Males	Females	Males	Females
4	17.55	17.28	19.29	19.15
4.5	17.47	17.19	19.26	19.12
5	17.42	17.15	19.30	19.17
5.5	17.45	17.20	19.47	19.34
6	17.55	17.34	19.78	19.65

**TABLE II**

**BMI-for-age Percentile Cut-off Points According to Centers for Disease Control (CDC)**

BMI-for-age Percentile	Classification
<5 <sup>th</sup>	Underweight
≥5 <sup>th</sup> - <85 <sup>th</sup>	Normal weight
≥85 <sup>th</sup> - <95 <sup>th</sup>	At-risk of overweight*
≥95 <sup>th</sup>	Overweight*

\* To avoid confusion in the text when comparing classification systems, the term 'overweight' is used to describe children who had an age- and sex-specific BMI percentile ≥85 and <95, while the term 'obese' is used to describe children who had an age- and sex-specific BMI percentile ≥95.

electronic data collection was feasible. After no major issues were encountered, the process was fully implemented in 14 health centres (covering 12 of 15 public health service areas) on May 1, 2004. Height and weight measurements for the study were taken between May 1, 2004 and April 30, 2005. Prior to commencement, approval was obtained from the Health Research Ethics Board at the University of Alberta.

For each record, BMI was calculated and weight categories were determined using both the IOTF and CDC methods. Table I displays the IOTF cut-offs used to classify children into weight categories based on pooled international data and linked to adult obesity cut-off points, while Table II shows the CDC cut-off points used to classify 4-6 year old children into weight categories based on their body mass index (BMI). The IOTF reference cut-offs are based on 6-month age groups (e.g., 4 years, 4.5 years, 5.0 years, etc.). Children were first assigned to one of five age groups surrounding these age points. For example, a child who was 4 years and 3 months of age (51 months) was assigned to age group #2 defined as 4.25 to 4.75 years old. The 4.5-year cut-off and the child's gender were then used to classify him/her accordingly. The CDC method is based on 1-month age groups. The CDC and IOTF use different terminology when classifying children into weight categories. When making comparisons, the same terms were applied to the results of each classification system. The

term 'overweight' was used to describe children who had an age- and sex-specific BMI percentile ≥85 and <95, as well as those above the stated BMI cut-offs in the IOTF reference. The term 'obese' was used to describe children who had an age- and sex-specific BMI percentile ≥95, and those above the stated BMI cut-offs in the IOTF reference. Due to differences between the two classification systems, comparisons were not made between groups other than 'overweight' and 'obese' categories. Specifically, the CDC growth charts categorize those with BMI percentiles <5 as 'underweight', whereas the IOTF reference contains no such grouping.

The Community Health nurses at the health centres referred any child classified as 'obese' or 'underweight' according to the CDC reference (age- and sex-specific BMI percentiles ≥95 or <5 respectively) to a physician. Physicians in the region were made aware that this would be occurring by an announcement in a regular newsletter circulated by the Public Health division. An information package sent out by the Alberta Medical Association was circulated around the same time and helped to further highlight the significance of childhood obesity.

Descriptive analysis on anthropometric data, including the number and percentage of male and female children in overweight and obese categories, were performed and cross-tabulated to quantify the extent of agreement between the IOTF and CDC references. Statistical comparisons were

TABLE III

**CDC BMI-for-age Percentile Distribution for Children (mean age = 5.0 ± 0.5 years) Attending Preschool Immunization Clinics in the Capital Health Region of Alberta (May 1, 2004-April 30, 2005)**

	Percentile	Males n (%)	Females n (%)	Total n (%)
Underweight	<5 <sup>th</sup>	197 (5.3)	188 (5.1)	385 (5.2)
Normal weight	≥5 <sup>th</sup> - 50 <sup>th</sup>	1235 (33.3)	1139 (31.2)	2374 (32.2)
	>50 <sup>th</sup> - 85 <sup>th</sup>	1336 (36.0)	1421 (38.9)	2757 (37.4)
Overweight	>85 <sup>th</sup> - <95 <sup>th</sup>	504 (13.6)	510 (13.9)	1014 (13.8)
Obese	≥95 <sup>th</sup>	442 (11.9)	397 (10.9)	839 (11.4)
Total		3714 (100.0)	3655 (100.0)	7369 (100.0)

TABLE IV

**Anthropometric Data and Proportion of Children 4-6 Years of Age in Relative Weight Categories Based on the IOTF and CDC References (mean ± standard deviation)**

	Males	Females	Total
N	3714	3655	7369
Age (mo)	59.6 ± 5.2	59.3 ± 5.3	59.4 ± 5.3
Height (cm)	110.5 ± 5.7	109.4 ± 5.6	110.0 ± 5.7
Weight (kg)	20.1 ± 4.6	19.5 ± 4.7	19.8 ± 4.7
BMI (kg/m <sup>2</sup> )	16.4 ± 3.2	16.2 ± 3.3	16.3 ± 3.2
Overweight (IOTF) n (%)	372 (10.0)	473 (12.9)	845 (11.5)
Overweight (CDC) n (%)	504 (13.6)	510 (13.9)	1014 (13.8)
Obese (IOTF) n (%)	241 (6.5)	259 (7.1)	500 (6.8)
Obese (CDC) n (%)	442 (11.9)	397 (10.9)	839 (11.4)

TABLE V

**Comparison of Agreement for Categorizing Weight Categories at 4-6 Years of Age Between the CDC and IOTF Reference Criteria**

IOTF		CDC			Total
		Not Overweight or Obese*	Overweight	Obese	
	Not Overweight or Obese	5516	508	0	6024
	Overweight	0	506	339	845
	Obese	0	0	500	500
	Total	5516	1014	839	7369

\* CDC 'underweight' and 'not overweight or obese' categories collapsed

carried out using Cohen's kappa measure, where 1 indicates perfect agreement and 0 indicates agreement no better than chance.

## RESULTS

We examined 7,466 records of children between four and six years of age, of which 7,369 or 98.7% (3,655 females and 3,714 males) had recorded height and weight measurements and were included in the study. The proportion of overweight and obesity according to CDC BMI-for-age percentile cut-off points are displayed in Table III.

Provided in Table IV are the anthropometric data for males and females and the proportion of 'overweight' and 'obese', according to both classification systems. Based on the CDC reference, 13.8% of children are overweight and 11.4% are obese. The IOTF reference classified 11.5% and 6.8% of children as overweight and obese, respectively. When categories are collapsed, 25.2% of children are either

overweight or obese according to the CDC, while 18.3% are obese or overweight according to the IOTF. Out of the total sample, 508 children (6.9%) were classified as not overweight or obese according to the IOTF reference, but overweight according to the CDC reference. As well, 339 children (4.6%) were classified as overweight according to the IOTF reference, but obese by the CDC reference. Overall, the two references had moderate agreement (kappa 0.69,  $p < 0.01$ ) (Table V).

## DISCUSSION

With increasing concern about the prevalence of obesity in children, it is important for the Capital Health region to establish accurate baseline measurements. The results obtained in this study indicate that the estimated proportion of young children who are overweight or obese in the region is lower than in other parts of Canada. A study published in 2004 examining 3-5 year old children in

Newfoundland and Labrador<sup>11</sup> using the IOTF reference reported a higher prevalence of overweight and obesity than we found using the same classification system (25.6% compared with 18.3%). A second study published the same year,<sup>12</sup> using the CDC classification system, also reported a higher prevalence estimate of overweight and obesity, citing that 30% of children aged 2-6 sampled in London, Ontario were either overweight or obese (compared to 25.2% found in our study). It is important to note that this sample was obtained from physician offices. More recently, a study examining 7,048 children ages 4-7 who presented for preschool vaccinations in the Calgary Health Region of Alberta<sup>13</sup> found prevalence estimates similar to ours. According to the CDC reference, they found that 15% of children were overweight, while 9% were obese compared to our 13.8% overweight and 11.4% obese.

Consistent with research mentioned previously, we found that the IOTF reference provided more conservative estimates of overweight and obesity than the CDC reference. With a total of 847 (11.5%) children classified in different CDC and IOTF weight categories, prevalence levels vary according to the reference being applied. Analogous to other studies, the difference seems to be accounted for more by the difference in estimates of obesity (6.8% IOTF vs. 11.4% CDC) than by the difference in estimates for overweight (11.5% IOTF vs. 13.8% CDC). Using the IOTF reference in a population would give rise to the potential for underestimating the problem and ultimately to insufficient commitment of human and financial resources for reducing childhood obesity. On the other hand, it is possible that using the CDC reference may lead to misclassifying healthy children as overweight or obese, leading to unnecessary intervention.

From a public health perspective, in an area such as childhood obesity where practitioners rely on empirical research to design interventions, interpretation of the evidence must be guarded. Knowing that prevalence estimates differ depending upon the reference, it is important to apply the same reference when measuring obesity trends longitudinally.

This study has several strengths. First, the sample is large and believed to be reasonably representative. The estimate of pre-

resentation is based on the proportion of 4-6 year olds complete for one type of immunization before entering grade one. Approximately 9-15% of children are subsequently immunized throughout the school year, although they may be slightly older than the age range examined in this study. A small number of those not immunized may still be weighed and measured; therefore the number of children who do not access care at all is very small. Although not published, work within Capital Health has identified people with lower socio-economic status (SES) as less likely to access care. The reasons appear to be related to negative past experiences, a lack of information and material resources, access, time constraints and social barriers. Certainly there is evidence to suggest that lower SES translates to an increased risk of overweight/obesity in children.<sup>14-18</sup> The authors therefore acknowledge that a potential underestimation of overweight/obesity in this sample may exist without the inclusion of children whose families choose not to immunize, however with most families accessing public health care, this point of contact does represent a unique opportunity for estimating prevalence in small children. A second strength is that height and weight were directly measured, eliminating recall bias and any underestimation or overestimation associated with self-reported anthropometric data.

The process for collecting and entering anthropometric data electronically will continue and enable us to track growth patterns of preschool children prospectively. In addition to providing preschool immunizations, Community Health nurses provide hepatitis B and varicella vaccinations to Grade five students and DTaP (diphtheria, tetanus, acellular pertussis) boosters to Grade nine students through school programs. This presents future opportunities for longitudinal follow-up and will be the focus of future studies.

The increase of overweight and obesity in children is a serious public health issue and calls for coordinated efforts to assess the scope of the problem and implement interventions to reverse the trend. A greater understanding about the patterns of height and weight for children will help us to develop and target programs that support the healthy growth and development of children.

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## RÉSUMÉ

**Contexte :** La prévalence de l'embonpoint et de l'obésité est en hausse chez les enfants canadiens. Dans la région sanitaire d'Edmonton (Alberta), il a été jugé nécessaire d'examiner ce problème de santé publique et de mettre en œuvre des stratégies pour le surmonter. Deux graphiques de croissance sont disponibles pour analyser l'embonpoint et l'obésité individuellement et à l'échelle d'une population : celui des Centers for Disease Control and Prevention des États-Unis (CDC) et celui du groupe de travail international sur l'obésité (IOTF). La prévalence peut varier en fonction du graphique utilisé. L'objectif principal de notre étude était de calculer la prévalence estimative de l'embonpoint et de l'obésité chez les enfants de 4 à 6 ans dans la région sanitaire d'Edmonton. Le deuxième objectif était d'analyser les différences dans les estimations produits par les deux systèmes de classification.

**Méthode :** Des mesures anthropométriques ont été intégrées dans les visites de vaccination systématique au préscolaire. Nous avons calculé l'indice de masse corporelle (IMC) de chaque enfant (le poids corporel en kilogrammes divisé par la taille en mètres carrés) et déterminé les centiles d'âge et de sexe en utilisant les seuils de l'IOTF et des CDC. Nous avons ensuite déterminé et comparé les estimations de la prévalence de l'embonpoint et de l'obésité selon les deux systèmes de classification.

**Résultats :** Sur 7 369 enfants, 13,8 % faisaient de l'embonpoint et 11,4 % étaient obèses selon le graphique des CDC. Selon celui de l'IOTF, 11,5 % faisaient de l'embonpoint et 6,8 % étaient obèses. Les deux systèmes de classification affichaient un degré de concordance moyen (coefficient Kappa de 0,69,  $p < 0,01$ ).

**Conclusion :** Les résultats indiquent que la prévalence estimative de l'embonpoint et de l'obésité chez les jeunes enfants de la région sanitaire d'Edmonton est plus faible qu'ailleurs au Canada. Les estimations obtenues selon le graphique de l'IOTF sont plus prudentes que celles obtenues avec le graphique des CDC, ce qui s'explique davantage par les écarts dans les estimations de l'obésité que de l'embonpoint.

**Mots clés :** embonpoint; obésité; développement de l'enfant; indice de masse corporelle (IMC); enfant, préscolaire