

### Severe obesity and global developmental delay in preschool children

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### Background

Approximately one in three Canadian childrensieither overweight or obese, with published levels of obesity in *preschool children* at 6%.<sup>2</sup> United States-based reports suggest the total proportion of children with obesity has plateaued,<sup>3,4</sup> but the number of preschool children with severe obesity has increased over the past 15 years. Severe obesity (SO) is defined by the World Health Organization as body mass index >99.9%.<sup>5</sup> Currently, approximately1 to 2% of preschool children in the United States have SO, a level that is expected to increase by about 130% by 2030.<sup>6</sup> Unfortunately, there are no available estimates of SO in Canadian children.<sup>7</sup> Children less than 4 years of age are excluded from Canadian surveys (e.g., Canadian Health Measures Survey) and sample sizes in slightly older children are small.<sup>3-8</sup>

Global developmental delay (GDD) is defined as a significant delay in two or more developmental domains, including gross motor, fine motor, speech/language, cognitive,



social/personal, or delay in activities of daily living.<sup>9</sup> GDD is present in 1 to 2% of children in the United States population<sup>10</sup>; however, as is the case for SO in Canada, the incidence of GDD in preschool children in Canada is unknown.

Existing evidence suggests that SO and GDD may be related. For instance, a large birth cohort study in the United Kingdom demonstrated that by 3 years of age, children with developmental delay were more likely to have obesity than their typically developing peers (odds ratio [OR] 1.30, 95% confidence interval [CI]: 1.01–1.67); and these odds increased to 1.80 (95% CI: 1.23–2.54) by 5 years of age.<sup>11</sup> Similarly, an Australian study demonstrated a greater risk of obesity in children with GDD (15%) *compared* to national data (6%).<sup>12</sup>

There is very limited research into risk factors related to SO and GDD.<sup>13</sup> A recent study in the United States showed that maternal SO in the pre-pregnancy period was associated with developmental delay in children at 2 years of age.<sup>14</sup> These data led to more questions than answers, including: Are there shared risk factors for SO and GDD? What diagnostic tests are needed in this population, and what interventions will meet the needs of families? Assessment and treatment programs for children with each of SO and GDD are intensive and expensive, and likely do not address unique needs of children with these conditions together. Understanding incidence, risk factors, and health care needs of young children with SO and GDD is needed to inform the development of targeted and tailored interventions and policies that allow practitioners to 'contextualize' their treatment to reflect the particular developmental and health care needs. For example, using non-food related rewards in behavioural interventions for development.

To date, no studies in Canada have examined the incidence of SO and GDD in the paediatric years. As paediatricians are among the only group of physicians who see these problems in their day-to-day practices, it is critically important to gain a better understanding of the incidence and risk factors of SO and GDD to direct appropriate investigations and management strategies.

### Methods

Through the established methodology of the CPSP, over 2,700 paediatricians and paediatric subspecialists will be actively surveyed on a monthly basis for new cases of SO and GDD. Some children with obesity and global delay will receive care from specialized obesity, development, or genetics clinics. The large multi-speciality and multi-disciplinary co-investigator team includes representation from general paediatricians, dieticians, developmental paediatricians, endocrinologists, obesity specialists, and geneticists, and will work to ensure case capture and avoid duplicate reporting.

### **Case definition**

Report any new case of a child  $\leq 5$  years of age with:

- Severe obesity, defined as body mass index ≥99.9th percentile according to references developed by the World Health Organization and the Canadian Pediatric Endocrine Group. The absolute cut-offs by age and sex are shown in Table 1. AND
- 2. Global developmental delay, defined as a significant delay in two or more developmental domains, including:



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- Gross motor
- Fine motor
- Speech/language
- Cognitive
- Social/personal
- Delay in activities of daily living<sup>9</sup>

### **O**bjectives

- 1) Determine the minimum incidence of co-morbid SO and GDD in preschool children in Canada
- 2) Determine the age of onset and risk factors associated with SO and GDD
- 3) Determine the current use of health care services, including investigations and referrals to obesity and developmental treatment programs, in preschool children
- 4) Improve child health care providers' awareness of SO and GDD in Canadian preschoolers

### Duration

February 1, 2018 to January 31, 2020

### Expected number of cases

Approximately 500 cases over two years are expected to be identified based on the estimated incidence of SO (1 to 2%) and GDD (1%). There are no known cohorts of young children with SO; therefore, other approaches, including examining GDD incidence in this high-risk population, are not possible.

### **Study Limitations**

As with any voluntary reporting surveillance system, the Canadian Paediatric Surveillance Program (CPSP) recognizes that reporting on minimum diagnosed incidence rates can have limitations, such as under-representation of the disease in the population. It is possible that some groups of children will be missed, for example, those who live in remote areas (e.g., children living in northern communities) who may not have access to some medical services. However, surveillance still serves a very important purpose and provides rich clinical data that allow us to better understand the specific characteristics of a disease and inform various treatment and prevention approaches.

### **Ethical approval**

The Hospital for Sick Children Research Ethics Board University of Alberta Research Ethics Board Health Canada and the Public Health Agency of Canada's Research Board

### Analysis and publication

The minimum incidence of SO associated with GDD in young children ( $\leq$ 5 years old) will be calculated using rates and a 95% confidence interval. Descriptive statistics will be used to determine age of onset and risk factors. Final results will be published in a peer-reviewed journal and presented at conferences.



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### Table 1: Age- and sex-specific cut-offs for severe obesity using World Health Organization Growth Standards\*

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Organization Growth Standards*		
AGE (years)	BOYS BMI ≥99.9 <sup>th</sup> percentile	GIRLS BMI ≥99.9 <sup>th</sup> percentile
6 months	22.3	22.3
1	21.6	21.6
2	20.6	20.6
3	20.0	20.3
4	19.9	20.6
5	20.3	21.1

\*de Onis M, Garza C, Victora CG, Onyango AW, Frongillo EA, Martines J. The WHO Multicentre Growth Reference Study: planning, study design, and methodology. Food Nutr Bull 2004; 25(1 Suppl):S15–26.