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Food insecurity in households of children receiving care at a paediatric obesity management clinic in Montreal: Overall prevalence and changes associated with the COVID-19 pandemic

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ABSTRACT

Objectives: Food insecurity and paediatric obesity are two major public health issues in Canada that may have been exacerbated by the COVID-19 pandemic. We assessed food insecurity and its correlates among households of children receiving care at a paediatric obesity management clinic in Montreal. We also assessed whether the prevalence of food insecurity among households of children who received care during the COVID-19 pandemic differed from those who received care before it.

Methods: This is a retrospective, cross-sectional analysis of medical records of children (2 to 17 years) who received care at a paediatric obesity management clinic in Montreal (Maison de santé prévention – Approche 180 [MSP-180]). Children's household food security status was assessed using Health Canada's Household Food Security Survey Module.

Results: Among the 253 children included in the study, 102 (40.3%) lived in households with moderate (n=89; 35.2%) or severe food insecurity (n=13; 5.1%). Food insecurity was more prevalent in households of children who were first- or second-generation immigrants compared with those who were third generation or more (48.3% versus 30.1%; P=0.03). Prevalence of food insecurity among households of children who received care during the COVID-19 pandemic was 5.5% higher than among those who received care before the pandemic, but the difference was not statistically significant (39.6% versus 45.1%; P=0.65).

Conclusions: Forty per cent of children treated at this paediatric obesity clinic lived in a food insecure household. This prevalence may have increased during the first year of the COVID-19 pandemic, but statistical power was insufficient to confirm it.

Keywords: COVID-19; Food insecurity; Paediatric obesity; Social vulnerability.

BACKGROUND

Household food insecurity refers to inadequate or insecure access to food because of financial constraints (1). In 2019, 10.6% of the Canadian population lived in food insecure households (2). Food insecurity is known to be correlated not only with sociodemographic factors such as family type, household income, education, place of residence, and immigration status, but also with chronic health outcomes (3–5). In Canada, household food insecurity has been associated with a higher risk of developing obesity among adults (6) but data remain sparse and outdated among children (7–9). Documenting this relationship is of crucial importance given the increasing prevalence of paediatric obesity in Canada (10,11). Indeed, as of 2017, 1/3 of Canadian youth had overweight, while 13%

had obesity—a number that has tripled over the past 50 years (12).

The COVID-19 pandemic exacerbated food insecurity globally (13,14). In 2020, amid the pandemic, the prevalence of Canadian households experiencing food insecurity drastically increased, reaching 14.6% (15). Besides, studies from Europe and Asia reported an increase in the prevalence of childhood overweight and obesity during the first lockdown (16–18). It is thus necessary to document the effects of the pandemic on food insecurity of households of children with overweight and obesity to address these concomitant public health issues.

The objective of this study was to provide an overview of the food security status among households of children receiving care at the *Maison de Santé Prévention - Approche 180* (MSP-180) clinic in Montreal (Quebec, Canada). MSP-180 (formerly *Clinique 180 de Montréal*) is a second-line paediatric care clinic providing lifestyle counselling emphasizing body weight management to children with overweight or obesity and their family. We also evaluated whether the prevalence of food insecurity among households of children who initiated care before and during the COVID-19 pandemic differed, and whether food insecurity was associated with children's body mass index (BMI).

METHODS

The protocol was reviewed and approved by the *Comité d'éthique de la recherche en sciences de la santé de l'Université Laval* and the *Commission d'accès à l'information du Québec.*

Study design and population

This is a retrospective, cross-sectional analysis of the medical record data of children who initiated care at MSP-180 between July 1, 2017 (opening date of the clinic) and March 31, 2021. The study leverages information collected during the baseline visit. During this visit, each child was accompanied by at least one parent or legal guardian. Children's body weight and height were measured using standard procedures. BMI z-score was calculated using the age- and sex-specific World Health Organization growth charts for Canada as reference (19) (WHO Anthroplus software, version 1.0.4). A nurse also collected sociodemographic information on children and their parents/legal guardians. Finally, parents/legal guardians were asked to complete Health Canada's Household Food Security Survey Module (HFSSM).

For this study, patients whose parents/legal guardians had not completed the HFSSM at their first visit at the clinic were not included.

Household food security assessment

The HFSSM is an 18-item validated questionnaire that assesses the food security situation of adults and children within a household based on their experiences of food insecurity over the year preceding its completion (20). It categorizes food security in four levels: food security, and marginal, moderate, or severe food insecurity (20). The food security status of adult and child members of a household is based on 10 adult-referenced and 8 child-referenced items, respectively (**Supplementary Table S1**). If the food security status of the child and adult scales are

different, the household status is given the most severe classification (**Supplementary Table S2**) (20,21). For analyses, we used Health Canada classification, meaning that food security includes the categories of 'food security' and 'marginal food insecurity', and food insecurity includes the categories of 'moderate food insecurity' and 'severe food insecurity' (20).

For children in joint custody, if both parents completed the HFSSM, we used the HFSSM data from the parent's household with whom they lived most of the time. If they spent equal time in each parent household or if the time spent in each parent household was unknown, we used the HFSSM data from the parent with the most food insecure situation.

Sociodemographic information

Patients' ethnic origin, family type, household size (i.e., the number of individuals living in the household), and generation status were classified using Statistics Canada National Household Survey classification (22,23). For children in joint custody, we used the size of the parent's household where they lived most of the time. The neighbourhood of residence was determined by cross-referencing the first three digits of the patient's household's postal code with the Quebec postal code list. Maps were produced using ArcGIS (version 10.5).

Statistical analyses

Statistical analyses were performed using SAS software (version 9.4). All P values are two sided. Statistical significance was considered at $P<0.05$.

Comparisons of patient's characteristics according to the food security status of their household were conducted using analyses of variance followed by Tukey–Kramer's post hoc tests, Chi-squared tests, or Fisher's exact test. These analyses comprised all included unique patients, independent of the fact that there were siblings. The same statistical tests were used to compare characteristics of all unique households according to the food security status.

Comparison of food insecurity prevalence among households of patients who initiated care at MSP-180 before the COVID-19 pandemic (July 1, 2017 to March 12, 2020) and during the pandemic (March 13, 2020 to March 31, 2021) was conducted using Chi-squared tests. The health emergency was declared on March 13, 2020, in the province of Quebec.

The association between BMIz and the food security status was assessed using mixed linear models. Model 1 only included the food security status as the sole independent variable. Model 2 was adjusted for household type. Model 3 was further adjusted for generation status. Model 4 was further adjusted for the moment of the first appointment in regard to the COVID-19 pandemic (before versus during the pandemic). In the models, all independent variables were treated as fixed effects, but the household was treated as a random-effect covariate. The normality of the models was assessed using the distribution of the scaled residual values.

We performed sensitivity analyses to evaluate the robustness of our results. First, we repeated the main analyses using the food security status of the adult and child members of the households of the patients rather than the household food security status. We also repeated the main analyses using three
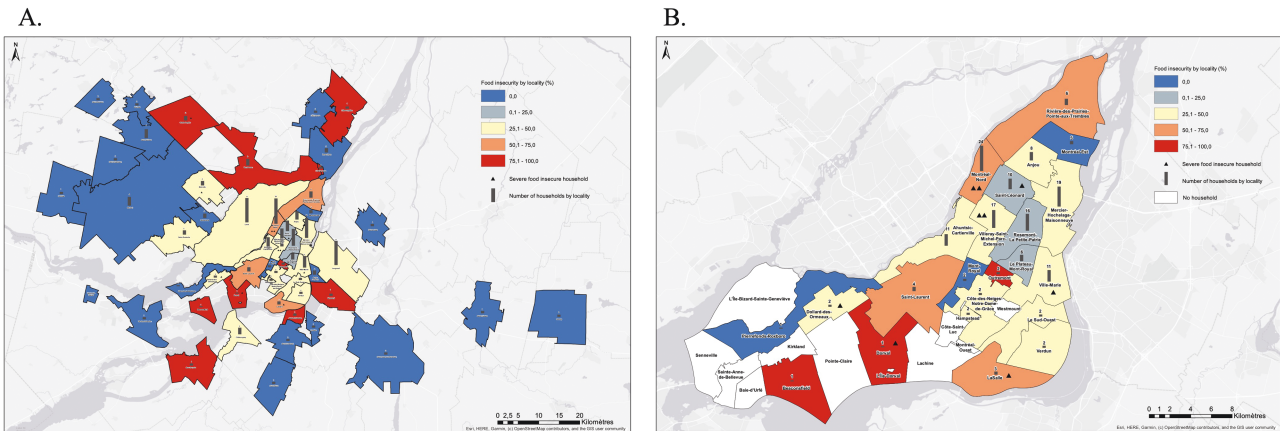
A.
B.

Figure 1. Maps of the patients' households according to the locality they live in and food security status of their household. (A) Households located in the Montreal Metropolitan Area (n=221). (B) Households located on the Island of Montreal (n=155). The food security status was determined according to the Household Food Security Survey Module. The bars represent the total number of patients' households per locality. Shading represents the percent of food insecure patients' households (i.e., moderate or severe food insecurity) per locality. The triangles represent the number of severe food insecure patients' households per locality. A total of seven patients' households are not shown on the map. These households were located outside of the Montreal Metropolitan Area (Crabtree (n=2), Hull (n=1), Saint-Calixte (n=1), Sainte-Julienne (n=2), Trois-Rivières (n=1)).

levels of food security (food security versus moderate food insecurity versus severe food insecurity). Finally, for analyses on the relationship between BMIz and the food security status, we repeated models 2, 3, and 4 adjusting for household size rather than household type.

RESULTS

Of the 468 patients treated at MSP-180 between July 1, 2017, and March 31, 2021, our study sample comprised 253 patients living in 228 unique households (**Supplementary Figure S1**). Differences in characteristics of included and nonincluded patients are presented in **Supplementary Table S3**.

Supplementary Table S4 presents characteristics of the 128 girls and 125 boys included in the study. Most patients were immigrants of first (16.2%) or second generation (41.1%) and 32.8% were of third generation or more. Among the 228 unique households, there were 140 intact two-parent families (61.4%), 17 stepfamilies (7.5%) and 67 lone-parent families (29.4%). A total of 155 households (68.0%) were located on the Island of Montreal (**Figure 1A**). Food insecurity was particularly prevalent among those located in the boroughs of Montréal-Nord (16/24 households) and Villeray – Saint-Michel – Parc-Extension (7/17 households) (**Figure 1B**).

Of the 253 children, 151 (59.7%) lived in food secure households (including 50 children (19.8%) living in households with marginal food insecurity), while 102 children (40.3%) lived in moderate (n=89; 35.2%) or severe food insecure households (n=13; 5.1%) (**Figure 2**). **Supplementary Figure S2** shows the distribution of the affirmative responses to the HFSSM.

Children who were immigrants of first or second generation were more likely to live in a food insecure household than those who were immigrants of third generation or more (P=0.03) (**Table 1**). Similarly, food secure households were more prevalent among children in the ethnic origin category 'Other north American' (38.4%), who were mostly immigrants of third generation or more (**Table 1**). These observations were corroborated in sensitivity analyses comparing children's characteristics according to the food security status of adult members and child members of the households separately (**Supplementary Table S5**). However, when we discriminated between moderate and severe food insecurity, the association between household food security and the generation status was weaker (P=0.07; **Supplementary Table S6**).

A total of 222 (87.8%) and 31 (12.3%) children had their first appointment before and during the COVID-19 pandemic, respectively. The proportion of patients with available HFSSM data was higher before the COVID-19 pandemic (**Supplementary Figure S1**). Patients who had their first appointment during the pandemic were more likely to be immigrants of first or second generation compared with those who initiated care before (89.3% versus 60.0%; P=0.005; **Supplementary Table S7**). Before and during the pandemic, the prevalence of household food insecurity was of 39.6% and 45.1%, respectively (**Table 2**). This increment of 5.5% was not statistically different (P=0.65).

We found no evidence of differences in children's BMIz according to the food security status of the household, but children's BMIz appeared the lowest among food insecure households (P=0.12) (**Table 3** and **Supplementary Table S8**). When we discriminated between moderate and severe food insecurity, these trends remained unchanged with the exception that children's BMIz appeared the highest when the child members of the household were severely food insecure (**Supplementary Table S9**).

DISCUSSION

In this study, we observed that 40.3% of MSP-180 patients lived in a food insecure household. Household food insecurity was 5.5% higher during the pandemic compared with before,
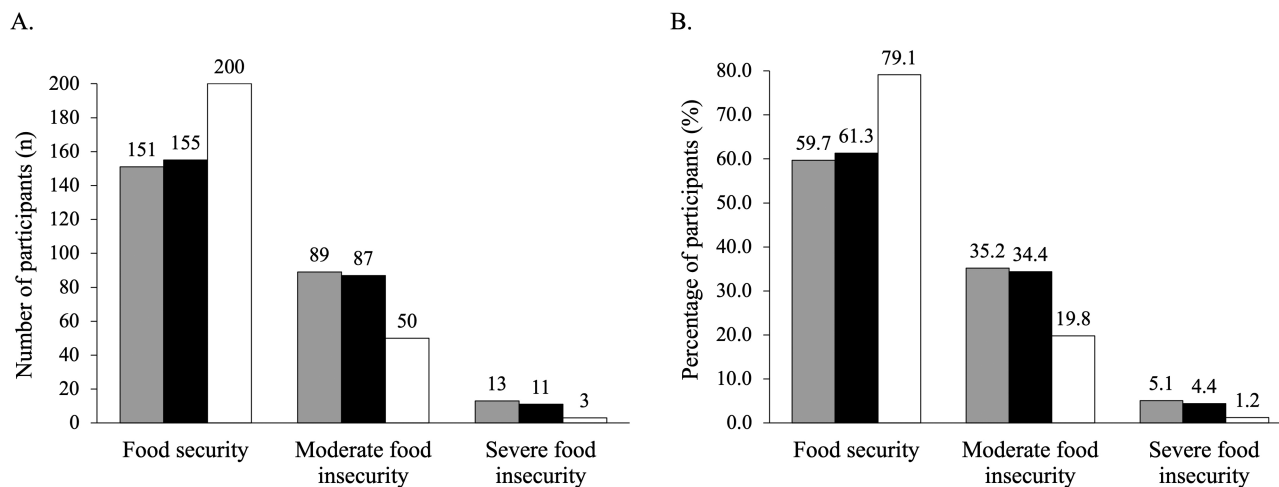
A.

B.

Figure 2. Distribution of the 253 children according to the food security status of their household, the food security status of the adult members living in their households, and the food security status of the child members living in their household (panel A: count; panel B: percent). The food security status was determined according to the Household Food Security Survey Module. Food security includes food security and marginal food insecurity. Gray bars: food security status of the household; black bars: food security status of the adult members of the household; white bars: food security status of the child members of the household.

Table 1. Differences in characteristics of the children (n=253) according to the food security status of their household[*]

Characteristics	Food security[†] (n=151)	Food insecurity[‡] (n=102)	P value
Age, years	11.2 (10.7, 11.7)	11.4 (10.8, 12.0)	0.61
Sex			0.68
Female	78 (51.7)	50 (49.0)	
Male	73 (48.3)	52 (51.0)	
Generation status[§]			0.03
First	22 (16.5)	19 (20.0)	
Second	53 (39.9)	51 (53.7)	
Third or more	58 (43.6)	25 (26.3)	
Ethnic origin[‖]			0.04
African	22 (14.6)	13 (12.9)	
Asian	3 (2.0)	9 (8.9)	
Caribbean	14 (9.3)	19 (18.8)	
European	8 (5.3)	3 (4.0)	
Latin, Central or South American	12 (8.0)	8 (7.9)	
Other North American	58 (38.4)	26 (25.7)	
Multiple	34 (22.5)	22 (21.8)	

[*]Data are presented as mean (95% confidence interval) or n (%).
[†]Food security includes food secure and marginally food insecure households.
[‡]Food insecurity includes moderate food insecure and severe food insecure households.
[§]Generation status information available in n=228/253 (food security, n=133; food insecurity, n=95).
[‖]Ethnic origin information available in n=252/253 (food security, n=151; food insecurity, n=101).

but this difference was not statistically significant. Finally, we found no evidence of a relationship between food insecurity and BMIz.

With a prevalence of 40.3%, household food insecurity was drastically more prevalent in MSP-180 patients' households compared with the general population in Canada (10.6%), Quebec (7.1%), and even Montreal (11.9%) ([2],[5]). Besides, MSP-180 children who were born or have parents born outside of Canada and those who identified as members of ethnic minorities were more likely to face food insecurity, reflecting known correlates of this issue in Canada. Accordingly, Canadian Community Health Survey (CCHS) data showed that the prevalence of food insecurity was higher among households where the respondent immigrated to Canada within the past 5 years or where the respondent identified as Black or Indigenous ([5],[24]). Moreover, the two boroughs on the Island of Montreal where household food insecurity among MSP-180 patients was particularly prevalent, Montréal-Nord and Villeray – Saint-Michel – Parc-Extension, are known to have a moderate to high level of individuals living in underprivileged situations ([25]). The high prevalence of food insecurity among MSP-180 patients, the fact that more than 50% of these children were immigrant of first or second generation and that about one third lived in a lone-parent family highlight that a substantial proportion of the clinic patient pool has social vulnerability. This is of particular importance as populations with social vulnerability suffer from disparity and inequitable healthcare ([26]). Overall, our study confirms that this clinic can reach and provide care to populations with social vulnerability. It will also allow for improvement of healthcare quality through a thorough consideration of the food insecurity situation of the patients. Finally, it supports the relevance of assessing and engaging in actions targeting food insecurity in clinical settings.

With regard to the impact of the COVID-19 pandemic on food insecurity in the province of Quebec, the prevalence of food insecurity reached 12.0% in April 2020 ([27]), an increase of 4.9% from pre-pandemic levels ([3]). By the end of May 2020, the prevalence of food insecurity returned to pre-pandemic levels, at about 8% ([27],[28]). Among MSP-180 patients, we observed a

nonsignificant increase of 5.5% in the prevalence of household food insecurity among those who initiated care during the first year of the COVID-19 pandemic compared with those who

Table 2. Differences in food security status between children who initiated care at MSP-180 before the COVID-19 pandemic compared and those who initiated care during the pandemic[*]

Characteristics	Before pandemic[†] (n=222)	During pandemic[‡] (n=31)	P value
Household food security status			0.65
Food security[§]	134 (60.4)	17 (54.8)	
Moderate food insecurity	76 (34.2)	13 (41.9)	
Severe food insecurity	12 (5.4)	1 (3.2)	
Adult food security status			0.94
Food security[§]	136 (61.3)	19 (61.3)	
Moderate food insecurity	76 (34.2)	11 (35.5)	
Severe food insecurity	10 (4.5)	1 (3.2)	
Children food security status			0.48
Food security[§]	176 (79.3)	24 (77.4)	
Moderate food insecurity	44 (19.8)	6 (19.4)	
Severe food insecurity	2 (0.9)	1 (3.2)	

[*]Data are presented as n (%).
[†]July 1, 2017 to March 12, 2020.
[‡]March 13, 2020 to March 31, 2021.
[§]Food security includes food security and marginal food insecurity.

initiated care before. The lack of statistical significance may be due to insufficient statistical power since data on food insecurity were available among only 31 children who had their first MSP-180 appointment over the first year of the COVID-19 pandemic. The HFSSM may also have lacked specificity regarding the first months of the pandemic and may have underestimated the food insecurity prevalence as it queries on the food security situation in the year preceding its completion. Therefore, despite the lack of statistical significance, this 5.5% difference in food insecurity prevalence needs to be interpreted cautiously as it may reflect a true increase in food insecurity. In addition, we observed that children who had their first appointment at the clinic during the pandemic were more likely to be immigrants. This likely reflects that the COVID-19 pandemic has most severely affected populations with social vulnerability, including immigrants [29].

The lack of evidence of an association between food insecurity and children's BMIz is discordant with previous studies conducted in Canada and Quebec [7,8]. However, the limited variability in BMIz among patients in our sample may have limited our statistical ability to detect such association. Interestingly, our results suggest a differential association between children's BMIz and food insecurity depending on whether it affected only adult members of the household or both adults and children. Mean BMIz was the lowest among children living in a household where adults were severely food insecure. Conversely, BMIz appeared higher among households where children were severely food insecure. This hypothesis warrants dedicated investigations.

This study needs to be interpreted in the context of limitations and strengths. First, we leveraged clinical data that were not a priori intended for research. However, this approach allowed us to assess food insecurity in a sample of individuals with social vulnerability, which are highly underrepresented in healthcare quality improvement research [26]. Second, the limited sample of patients who initiated care over the first year of the COVID-19 pandemic and among whose household food insecurity was

Table 3. Children's BMI z-score according to the food security status of their household[*]

Model[†]	Covariates	Household food security status		P value
		Food security[‡]	Food insecurity[§]	
1	None	3.32 (3.15, 3.48)	3.06 (2.85, 3.26)	0.06
2	Household type	3.51 (3.19, 3.83)	3.25 (2.92, 3.58)	0.06
3	Household type, generation status	3.35 (3.04, 3.67)	3.14 (2.82, 3.46)	0.13
4	Household type, generation status, date of the first MSP-180 appointment (before versus during COVID-19 pandemic)[ǁ]	3.30 (2.95, 3.64)	3.08 (2.73, 3.43)	0.12

[*]Data are presented as mean (95% confidence interval).
[†]Models 1 and 2: n=248 (food security: n=149, food insecurity: n=99); Models 3 and 4: n=224 (food security: n=131, food insecurity: n=93);
[‡]Food security includes food security and marginal food insecurity.
[§]Food insecurity includes moderate and severe food insecurity.
[ǁ]Before the COVID-19 pandemic: July 1, 2017 to March 12, 2020; During the pandemic: March 13, 2020 to March 31, 2021.

assessed (n=31) limited the statistical power of the analyses. The HFSSM queries on food insecurity over the year preceding its completion and may, thus, have lacked sensitivity among patients who initiated care in the first months of the pandemic. We also cannot exclude that household food insecurity was underestimated because of a desirability bias as the module was completed in clinical settings. Still, the use of the HFSSM, a validated and standardized tool, to assess the food security status of patients is a strength of the study as it facilitated comparisons with CCHS and CIS data.

In conclusion, we observed that 40.3% of children treated at MSP-180 lived in a food insecure household. We also observed a nonstatistically significant increment of 5.5% in the food insecurity prevalence among patients who initiated care during the COVID-19 pandemic compared with those who were treated before the pandemic. Finally, we found no evidence of a relationship between food insecurity and BMIz. This study supports the relevance and crucial importance of assessing and engaging in actions targeting food insecurity in clinical paediatric settings.

SUPPLEMENTARY DATA

Supplementary data are available at *Paediatrics & Child Health* Online by searching for pxac072.

AUTHOR CONTRIBUTIONS

The authors' responsibilities were as follows – JPDC: designed the research; MS, JSP: coordinated clinical data collection; MCD, JPDC: conducted the statistical analysis; MCD: drafted the manuscript; MS, JSP, JPDC: made critical revisions to the manuscript for key intellectual content and read and approved the final manuscript; JPDC is the guarantor of this work, and, as guarantor, takes responsibility for the integrity of the data and the accuracy of the data analysis.

POTENTIAL CONFLICTS OF INTEREST

JSP is the lead paediatrician at the *Maison de Santé Prévention – Approche 180 de Montréal* and Chair Member (Founder) of the *Réseau d'action en santé cardiovasculaire*. JSP is supported by the Ministère de la santé et des services sociaux du Québec and Novo-Nordisk. MS is a registered nurse working at the *Maison de Santé prevention – Approche 180 de Montréal*. She also reports a payment made to her from Laval University, and payments made to her institution by *Fondation des étoiles*. JPDC and MCD report grants received from *Centre d'excellence sur l'obésité infantile, Réseau d'action en santé cardiovasculaire* and Mitacs. There are no other disclosures. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

ETHICAL APPROVAL

All procedures performed in the study were in accordance with the ethical standards of the *Comité d'éthique de la recherche en sciences de la santé de l'Université Laval (2021-045/18-03-2021)*, the *Commission d'accès à l'information du Québec* (1025726-S), and with the 1964 Helsinki declaration and its later amendments.

DATA AVAILABILITY

Data described in the manuscript, code book, and analytic code will not be made publicly available.

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