Decreased Prevalence of Overweight and Obesity in the Newfoundland and Labrador Preschool Population

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ABSTRACT

OBJECTIVE: This study was conducted to determine the prevalence of overweight and obesity in preschool-aged (42-66 months) children in Newfoundland and Labrador in 2009/10. Second, 2009/10 rates were compared to those reported for 2001/02 and 1988/89 to ascertain whether the previous rising trend had continued, stabilized or decreased while public health prevention and intervention efforts increased.

METHODS: Heights and weights of children measured in clinics in 2009/10, 2001/02 and 1988/89 were sampled, representing 29%, 77% and 45% of provincial births in 2005, 1997 and 1984, respectively. Body mass indices were calculated and classified as overweight, obese or neither, using World Health Organization (WHO) growth charts. ANOVA and regression procedures were used to compare cohorts.

RESULTS: Combined overweight and obesity was significantly lower in 2009/10 (35.7%) than in 2001/02 (38.9%), (OR 0.87, 95% CI 0.76-0.99). Considered separately, both overweight and obesity rates stabilized. Boys were 1.4 times more likely to be overweight or obese than girls in all samples. In 2009/10, combined overweight and obesity was higher in rural areas (OR 1.67, 95% CI 1.28-2.18). In three of four public health jurisdictions, prevalence in 2009/10 remained significantly higher than 20 years earlier. In one region, rates returned to 1988/89 levels.

CONCLUSION: Progress has been made in stabilizing, even reversing, overweight and obesity in the Newfoundland and Labrador preschool population, however, prevalence rates remain high. Surveillance and intervention efforts must continue. Given the jurisdictional and regional differences found, further research should compare ecological contexts and thus attempt to isolate and identify important contributing factors and effective interventions.

KEY WORDS: Preschool children; overweight; obesity; prevalence; rural; urban

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

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In Canada, over the past decade, many obesity prevention initiatives have been implemented at federal, provincial, regional, and community levels. It is widely agreed that it will take an intensive, multi-level effort, and decades, to control obesity, as has been observed with other public health problems like smoking and seat-belt use.¹⁻⁴ Surveillance of overweight and obesity prevalence is also necessary to evaluate the possible impact of prevention initiatives.

Recently, many countries have reported a stabilization or decline in childhood overweight and obesity following decades of rising rates.⁵⁻¹⁰ It might be expected that any decline would first be observed among young children because their eating and activity habits are just forming and parents have substantial control over their food and activity environments.^{11,12} Furthermore, with frequent check-ups, parents of young children maintain regular contact with professionals who can provide obesity prevention guidance.

This study was conducted to determine the prevalence of overweight and obesity in a sample of preschool-aged children (42-66 months) measured in 2009/10, in the province of Newfoundland and Labrador. Second, the 2009/10 prevalence was compared to that reported for children measured in 1988/89¹³ and in 2001/02¹⁴ in order to determine whether the prior trend of increasing overweight and obesity had continued, stabilized, or decreased.

Given that the World Health Organization (WHO) growth charts are now the recommended standard¹⁵ and reference¹⁶ for use in Canada¹⁷ and are regarded as representing how all children *should*

grow,¹⁸ prevalence rates at all three measurement times were calculated using these charts.

METHODS

This study was approved by the Interdisciplinary Committee for Ethics in Human Research (ICEHR) at Memorial University. Data were obtained from the records of children who participated in the province-wide, universal, and free Preschool Health Check (PSHC) and immunization program conducted by public health nurses prior to school entry. Greater than 98% of the province's children enter school fully immunized, almost all through these public health clinics.¹⁹ The previously published studies involved samples of children born in 1984¹³ and 1997¹⁴ who were measured at PSHC clinics in 1988/89 and 2001/02, respectively. The current sample comprised children born in 2005 and measured in 2009/10.

For all three cohorts, the authors or staff of the health regions collected data from children's health records, most often held in

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Conflict of Interest: None to declare.

Table 1. Mean (Standard Deviation) Age, Height, Weight and BMI for All, Boys and Girls in Each Cohort

		All	Boys	Girls
Age (mos)	2009/10	51.3 (3.5) [‡]	51.2 (3.4) [‡]	51.4 (3.6) [‡]
	2001/02	51.2 (3.9) [‡]	51.2 (3.9) [‡]	51.2 (3.9) [‡]
	1988/89	54.1 (5.2) ^{*†}	54.3 (5.1) ^{*†}	54.0 (5.2) ^{*†}
Height (cm)	2009/10	106.4 (4.8) [†]	106.8 (4.8) [†]	106.0 (4.7) [†]
	2001/02	105.8 (5.0) ^{*‡}	106.3 (4.9) ^{*‡}	105.2 (5.0) ^{*‡}
	1988/89	106.6 (5.5) [†]	107.1 (5.4) [†]	106.1 (5.5) [†]
Weight (kg)	2009/10	18.7 (3.1) [‡]	19.0 (3.2) [‡]	18.4 (3.0) [‡]
	2001/02	18.7 (3.2) [‡]	19.0 (3.2) [‡]	18.4 (3.3) [‡]
	1988/89	18.3 (3.0) ^{*†}	18.6 (2.8) ^{*†}	18.1 (3.2) [†]
BMI (kg/m ²)	2009/10	16.5 (2.0) ^{†‡}	16.6 (2.0) ^{†‡}	16.4 (2.1) [‡]
	2001/02	16.6 (2.1) ^{*‡}	16.7 (2.0) ^{*‡}	16.5 (2.1) [‡]
	1988/89	16.1 (1.9) ^{*†}	16.1 (1.7) ^{*†}	16.0 (2.0) ^{*†}

* Significantly different from 2009/10.

† Significantly different from 2001/02.

‡ Significantly different from 1988/89.

Table 2. Prevalence Rate (95% Confidence Interval) by Province, Health Region and Year of Measurement

	n	Overweight	Obese	Combined
Province				
2009/10	1305	23.4 (21.1-25.7)	12.3 (10.5-14.1)	35.7 (33.1-38.3) ^{†‡}
2001/02	4161	25.6 (26.9-24.3)	13.2 (12.2-14.2)	38.9 (37.4-40.4) ^{*‡}
1988/89	3857	19.7 (18.4-21.0)	8.3 (7.4-9.2)	27.9 (26.5-29.3) ^{*†}
Region 1				
2009/10	779	24.0 (21.0-27.0)	11.3 (9.1-13.5)	35.3 (31.9-38.7) [‡]
2001/02	2474	25.2 (23.5-26.9)	12.1 (10.8-13.4)	37.3 (35.4-39.2) [‡]
1988/89	2401	18.5 (16.9-20.1)	7.8 (6.7-8.9)	26.4 (24.6-28.2) ^{*†}
Region 2				
2009/10	214	14.0 (9.4-18.6)	11.7 (7.4-16.0)	25.7 (19.8-31.6) [†]
2001/02	713	24.8 (21.6-28.0)	14.3 (11.7-16.9)	39.1 (35.5-42.7) ^{*‡}
1988/89	493	21.5 (17.9-25.1)	8.1 (5.7-10.5)	29.6 (25.6-33.6) [†]
Region 3				
2009/10	212	27.8 (21.8-33.8)	12.7 (8.2-17.2)	40.6 (34.0-47.2) [‡]
2001/02	666	27.9 (24.5-31.3)	13.7 (11.1-16.3)	41.6 (37.9-45.3) [‡]
1988/89	671	18.8 (15.8-21.8)	9.2 (7.0-11.4)	28.0 (24.6-31.4) ^{*†}
Region 4				
2009/10	100	29.0 (20.1-37.9)	21.0 (13.0-29.0)	50.0 (40.2-59.8) [‡]
2001/02	308	26.0 (21.1-30.9)	18.8 (14.4-23.2)	44.8 (39.2-50.4)
1988/89	292	27.7 (22.6-32.8)	10.3 (6.8-13.8)	38.0 (32.4-43.6) [*]

Note: Combined rates are calculated from frequencies and not by adding overweight and obesity rates together. There are differences due to rounding. Statistical differences are noted only for combined overweight and obesity.

* Significantly different from 2009/10.

† Significantly different from 2001/02.

‡ Significantly different from 1988/89.

paper files and in numerous community public health offices throughout the province. The data collection process was resource intensive and thus, at each time point, the sample size was maximized within the limitations of the available human and financial resources. Since the study of the children measured in 2001/02 was the first examination of the provincial prevalence of overweight and obesity in preschoolers, all records available at the time of data collection were provided. The final sample of 4,161 represented 77% of the 5,428 children born in 1997.²⁰ The second study utilized archived records to examine any change in overweight and obesity rates between 1988/89 (the earliest available) and 2001/02. Every second record was selected to yield a sample of 3,857, representing 45% of the 8,560 children born in 1984.²¹ For the current study of preschoolers measured in 2009/10, every third record was sampled. The final sample of 1,305 represented 29% of the 4,527 children born in 2005.²²

The child's date of birth, sex, date of the PSHC, and nurse-measured height and weight were recorded from the child's file. Nurses throughout the province follow the same standard measurement protocol and use regularly maintained and calibrated equipment. Additionally, postal codes, available for 2009/10 only, were collected to designate whether a child lived in a rural or urban community.

Body mass index (BMI) (weight in kilograms/height in metres²) was calculated for each child and classified as "overweight",

"obese", or neither, based on the age- and sex-specific WHO growth charts. For children under five years of age, WHO uses the terms "at risk for overweight" for a BMI greater than one standard deviation (>+1SD) of the WHO Growth Standards¹⁵ median, and "overweight" for a BMI greater than two standard deviations (>+2SD) of the median. However, we use the terms "overweight" and "obese", respectively. This terminology is consistent with that recommended for children five years and older, for whom the same cut-off values are used relative to the WHO Growth Reference.¹⁶ Thus, a BMI >+1SD but ≤+2SD of the WHO median was classified as "overweight", and a BMI >+2SD was classified as "obese". Measurements from the 1988/89 and 2001/02 studies^{13,14} were also reassessed using the WHO growth charts.

The province has four public health regional authorities with considerable autonomy, thus specific programs and practices can vary. Therefore, regional comparisons were also conducted.

Analyses were conducted using SPSS 19. ANOVAs were used to compare continuous variables (e.g., heights, weights, etc.). Prevalence estimates were compared using multinomial or binary logistical regression analyses with body weight status at PSHC as the dependent variable and year of measurement as a predictor variable. Models were adjusted for age, sex, and health region to account for any differences among cohort samples.

Figure 1. Prevalence of overweight (triangles), obesity (circles) and both combined (squares) among preschool children in Newfoundland and Labrador, by sex, across three cohorts

Error bars represent the 95% confidence intervals. Solid lines indicate a significant difference between years and dashed lines indicate non-significance.

RESULTS

Sample characteristics

Mean age, weight, height and BMI for each sample are presented in Table 1. One-way ANOVAs showed significant differences among the three cohorts on age ($F_{(2, 9320)}=492.87, p<0.000$), height ($F_{(2, 9320)}=29.84, p<0.000$), weight ($F_{(2, 9320)}=13.60, p<0.000$) and BMI ($F_{(2, 9320)}=80.66, p<0.000$). Post-hoc Tukey's tests showed, specifically, that children were older in the 1988/89 sample, and lighter. Children were significantly shorter in the 2001/02 sample. BMI was significantly lower in 2009/10 than in 2001/02. BMI in 1988/89 was significantly lower than in 2001/02 or 2009/10. Boys showed this pattern of results. Girls also had the same pattern with two exceptions. The difference between 1988/89 and 2009/10 on weight ($p=0.052$) and between 2001/02 and 2009/10 on BMI ($p=0.081$) did not attain statistical significance.

Provincial prevalence

Prevalence rates are presented in Table 2 and illustrated in Figure 1. Binary logistic regression, adjusted for age, sex and health region, confirmed a significant increase in combined overweight and obesity between 1988/89 and 2001/02. Children measured in 2001/02 had significantly greater odds of being classified as overweight or obese than not, as compared to children measured in 1988/89 (OR 1.61, 95% CI 1.46-1.78). However, that rise did not continue. In fact, from 2001/02 to 2009/10, there was a modest but significant decline. Children born in 2009/10 had a significantly lower odds of being overweight or obese than those measured in 2001/02 (0.87, 0.76-0.99). Importantly, however, children were still more likely to be overweight or obese in 2009/10 than in 1988/89 (1.40, 1.22-1.60).

Considered separately in a multiple logistical regression adjusted for age, sex and health region, rates of overweight (OR 1.51, 95% CI 1.35-1.69) and obesity (1.84, 1.57-2.15) also increased significantly between the first two time points, with no further increase evident between 2001/02 and 2009/10 in overweight (0.86, 0.74-1.00) or obesity (0.88, 0.73-1.07). However, both overweight (1.30, 1.11-1.53) and obesity (1.62, 1.31-2.00) remained significantly higher in 2009/10 than two decades earlier.

Sex differences

Among boys (see Figure 1), the prevalence of overweight (OR 1.49, 95% CI 1.28-1.74) and obesity (1.95, 1.57-2.41) increased significantly from 1988/89 to 2001/02, as did the rate of overweight and obesity combined (1.62, 1.41-1.86). There was, however, no further increase in overweight (0.83, 0.68-1.02), obesity (0.90, 0.69-1.16) or the two combined from 2001/02 to 2009/10 (0.85, 0.71-1.02). The combined prevalence remained significantly higher in 2009/10 than in 1988/89 (1.38, 1.15-1.67), as did obesity (1.74, 1.31-2.31), however, the prevalence of overweight did not (1.24, 1.00-1.54). A boy was no more likely to be overweight in 2009/10 than in 1988/89.

The odds of a girl being classified as overweight or obese also increased significantly from 1988/89 to 2001/02 (OR 1.60, 95% CI 1.38-1.85), as did the odds for overweight (1.55, 1.31-1.83) and obesity (1.72, 1.37-2.16) examined separately. Among girls, from 2001/02 to 2009/10, there was no further increase in the previously rising rates of overweight (0.90, 0.73-1.12), obesity (0.86, 0.64-1.15), or the two combined (0.88, 0.73-1.07). However, the 2009/10 rates of overweight (1.39, 1.10-1.75), obesity (1.47, 1.07-2.01), and

the two combined (1.41, 1.16-1.73) remained significantly higher than two decades earlier.

When compared, boys were more likely to be overweight or obese than girls at each time point. Boys had a 1.4 times greater odds of being overweight or obese than girls in 1988/89 (OR 1.39, 95% CI 1.21-1.60), 2001/02 (1.42, 1.25-1.61), and 2009/10 (1.37, 1.09-1.73).

Health regions

In all Regions (see Table 2), combined overweight and obesity increased substantially from 1988/89 to 2001/02. This change was statistically significant in Region 1 (OR 1.58, 95% CI 1.38-1.80), Region 2 (1.52, 1.19-1.95), and Region 3 (1.95, 1.50-2.54) but not Region 4 (1.31, 0.94-1.83). From 2001/02 to 2009/10, there was no further increase in Region 1 (0.91, 0.77-1.08) or Region 3 (0.95, 0.69-1.31) and a non-significant increase (1.24, 0.79-1.95) in Region 4. In Region 2, there was a significant decrease (0.53, 0.38-0.75), such that prevalence in 2009/10 was no longer higher than in 1988/89 (0.81, 0.56-1.17). Conversely, rates in Region 1 (1.44, 1.20-1.72), Region 3 (1.86, 1.32-2.61) and Region 4 (1.62, 1.02-2.57) remained significantly higher than 20 years earlier.

Rural and urban

Postal codes were obtained for the 2009/10 cohort only. For 97%, the postal code was available to designate the child's place of birth as rural ($n=631$) or urban ($n=636$). Binary logistic regression, controlling for age, sex and health region, showed that children born in rural versus urban communities had a 1.67 (95% CI 1.28-2.18) times greater odds of being overweight or obese.

A comparison between rural and urban communities within each health region was also conducted, excluding Region 4 in which urban communities were insufficiently represented. The odds of a child being overweight or obese was greater in rural communities within Region 1 (OR 1.47, 95% CI 1.06-2.05) and Region 3 (2.44, 1.32-4.51) while in Region 2 there was no difference (1.42, 0.69-2.91).

DISCUSSION

This study of a Newfoundland and Labrador preschool population found that previously rising rates of overweight and obesity have stabilized over the past decade. In fact, a small but significant decline in the combined rate of overweight and obesity between 2001/02 to 2009/10 was observed. This decrease is similar to that reported for children in several other countries including Australia, Denmark, France, Germany, Sweden, the United Kingdom and the United States⁵⁻¹⁰ and in Canada for older children.²³

Stabilization of the prevalence of overweight and obesity was found among boys and girls. Among boys, the prevalence of overweight, though not obesity, returned to the 1988/89 level. In all cohorts, boys were 1.4 times more likely to be overweight or obese than girls. Provincially, in 2009/10, overweight and obesity was higher in rural versus urban areas. Others have reported similar gender and regional differences.²³⁻²⁶ In 2009/10, in three of four health regions, overweight and obesity rates remained significantly higher than 20 years earlier. However, in one region, prevalence was back to 1988/89 levels and there was no rural-urban difference. Rural-urban differences over time could not be examined.

Lobstein²⁷ suggested that with increased obesity awareness, parents of overweight children may refuse participation in prevalence studies, creating sampling bias. This is not likely a factor here. First,

because children must be fully immunized prior to school entry, and almost 98% are,¹⁹ the PSHC is very well attended. Also, parents accept that their child is measured during the check-up. Second, data were collected from files retrospectively, and not in the context of an obesity prevalence study. In the few cases where measurements were missing, other data were also missing, suggesting a missed visit rather than a refusal of measurement. In no case did nursing notes indicate parental refusal to have a child measured.

It is also unlikely that the observed provincial and regional prevalence changes reflect demographic differences. The regions do not differ substantially in ethnic make-up. Region 1 does encompass the largest metropolitan area while Region 4 is the most rural. Over the span of the three studies, there has been movement from more rural to urban areas, from Regions 2, 3 and 4 to Region 1, and substantial provincial out-migration. Regions 2 and 3 are most similar in demographic and economic character, and in the rate of migration,²⁸ yet overweight and obesity prevalence differs significantly between them and only in Region 2 did rates return to 1980s levels.

In Newfoundland and Labrador, as elsewhere, there has been concerted public health effort to develop and implement obesity prevention awareness campaigns, policies and programs. New nutrition policies governing schools and child care centres have been introduced as have parent education and support programs such as Healthy Baby Clubs, breastfeeding clinics and the province-wide Poverty Reduction Strategy, Mother Baby Nutrition Supplement and Healthy Beginnings programs.²⁹ Government has also funded research and numerous community programs through initiatives like the Provincial Wellness Grants program. The reversal of previously rising rates of preschool overweight and obesity reported here, particularly in one health region, in the absence of other systematic population changes, suggests some public health initiatives may have been effective.

The relatively large decline in one health region presents a follow-up research opportunity. Regional comparisons of the content and implementation of prevention policies and programs that are associated with varying efficacy can help to isolate effective elements. Likewise, comparisons with other provinces and countries can identify the policy and program mix most likely to be beneficial. Initial investigation suggests that the level of engagement with, and continuity and integration of, pre- and postnatal services; the degree of collaboration between public health nursing and community-based programs; and the dedication of champions such as paediatricians, community nurses and other community leaders, may be important elements of the kind of sustained, comprehensive and multisectoral approach widely considered necessary for obesity prevention.

This study reports a halt and modest reversal in previously rising rates of overweight and obesity in the Newfoundland and Labrador preschool population. Several countries have recently reported similar stabilization or decline following decades of an upward trend, though, as in this province, overweight and obesity rates remain high. In Newfoundland and Labrador, almost 36% of preschoolers are still overweight or obese. This is higher than the 33% reported by WHO for preschoolers in 2010 in developed countries worldwide.³⁰ Given the potential associated health consequences, this is a cause for great concern. It should also be noted, as it has been by others, that a period of stabilization can be followed by further increase.⁵ Thus, continued intervention and surveillance are nec-

essary in order to guide and evaluate the public health measures intended to reduce the impact of overweight and obesity on the current and future health of children.

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RÉSUMÉ

OBJECTIF : Déterminer la prévalence du surpoids et de l'obésité chez les enfants d'âge préscolaire (42-66 mois) de Terre-Neuve-et-Labrador en 2009-2010. Nous avons ensuite comparé les taux de 2009-2010 aux taux déclarés en 2001-2002 et en 1988-1989 pour vérifier si la tendance haussière antérieure s'est maintenue, s'est stabilisée ou a diminué, alors que la santé publique a accru ses efforts de prévention et d'intervention.

MÉTHODE : Nous avons échantillonné la taille et le poids d'enfants mesurés en clinique en 2009-2010, 2001-2002 et 1988-1989; ces enfants représentaient respectivement 29 %, 77 % et 45 % des naissances dans la province en 2005, 1997 et 1984. Les indices de masse corporelle ont été calculés et classés dans trois catégories (en surpoids, obèse ou ni l'un ni l'autre) selon les fiches de croissance de l'Organisation mondiale de la santé (OMS). Nous avons comparé les cohortes au moyen d'analyses de la variance et d'analyses de régression.

RÉSULTATS : Le surpoids et l'obésité combinés étaient significativement plus faibles en 2009-2010 (35,7 %) qu'en 2001-2002 (38,9 %) (RC 0,87, IC de 95 % 0,76-0,99). Pris séparément, les taux de surpoids et d'obésité se sont stabilisés. Les garçons étaient 1,4 fois plus susceptibles d'être en surpoids ou obèses que les filles dans tous les échantillons. En 2009-2010, le surpoids et l'obésité combinés étaient plus élevés en milieu rural (RC 1,67, IC de 95 % 1,28-2,18). Dans trois régions sanitaires sur quatre, leur prévalence en 2009-2010 était encore sensiblement plus élevée que 20 ans plus tôt. Dans une des régions, les taux étaient revenus à ceux de 1988-1989.

CONCLUSIONS : On a fait des progrès pour stabiliser, et même inverser, le surpoids et l'obésité dans la population préscolaire de Terre-Neuve-et-Labrador, mais les taux de prévalence demeurent élevés. Les efforts de surveillance et d'intervention doivent se poursuivre. À la lumière des écarts provinciaux et régionaux constatés, il faudrait pousser la recherche pour comparer les contextes écologiques afin de tenter d'isoler et d'identifier les facteurs qui contribuent à la situation et les interventions efficaces.

MOTS CLÉS : enfant d'âge préscolaire; surpoids; obésité; prévalence; population rurale; population urbaine