Effects of low income on infant health

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Abstract

Background: Few population-based studies have analyzed the link between poverty and infant morbidity. In this study, we wanted to determine whether inadequate income itself has an impact on infant health.

Methods: We interviewed 2223 mothers of 5-month-old children participating in the 1998 phase of the Quebec Longitudinal Study of Child Development to determine their infant's health and the sociodemographic characteristics of the household (including household income, breast-feeding and the smoking habits of the mother). Data on the health of the infants at birth were taken from medical records. We examined the effects of household income using Statistics Canada definitions of sufficient (above the low-income threshold), moderately inadequate (between 60% and 99% of the low-income threshold) and inadequate (below 60% of the low-income threshold) income on the mother's assessment of her child's overall health, her report of her infant's chronic health problems and her report of the number of times, if any, her child had been admitted to hospital since birth. In the analysis, we controlled for factors known to affect infant health: infant characteristics and neonatal health problems, the mother's level of education, the presence or absence of a partner, the duration of breast-feeding and the mother's smoking status.

Results: Compared with infants in households with sufficient incomes, those in households with lower incomes were more likely to be judged by their mothers to be in less than excellent health (moderately inadequate incomes: adjusted odds ratio [OR] 1.5, 95% confidence interval [CI] 1.1–2.1; very inadequate incomes: adjusted OR 1.8, 95% CI 1.3–2.6). Infants in households with moderately inadequate incomes were more likely to have been admitted to hospital (adjusted OR 1.8, 95% CI 1.2–2.6) than those in households with sufficient incomes, but the same was not true of infants in households with very inadequate incomes (adjusted OR 0.7, 95% CI 0.4–1.2). Household income did not significantly affect the likelihood of an infant having chronic health problems.

Interpretation: Less than sufficient household incomes are associated with poorer overall health and higher hospital admission rates among infants in the first 5 months of life, even after adjustment for factors known to affect infant health, including the mother's level of education.

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The relation between poverty and children's health is widely recognized,[1–4] but the mechanisms through which poverty is linked to health are still poorly understood.[5–7] Growing up in conditions of poverty has negative effects on health, physical growth and development, and it increases the risk of death among children.[8–11] Poorer health in poor children is generally explained by the parents' low level of education and negative health behaviours[12–16] and by the higher frequency of neonatal health problems.[1,2,17,18] However, there are few data to establish whether low income alone affects infant morbidity.

Few population-based studies have examined the relation between infant health and family poverty. One study of a representative sample reported infant morbidity without analyzing the family's socioeconomic status.[19] Others focused only on the links between the mother's characteristics and the health of the child.[20,21] Studies that have considered the impact of poverty or socioeconomic status on health during the first year of life dealt more often with infant mortality than with morbidity.[1,9,22–29] Several studies concerning infant morbidity[13,30–33] have recognized the link between poverty and health, but they examined poverty or socioeconomic status as a confounding, not an explanatory, factor. Moreover, they tended not to examine overall health but, rather, looked at the most frequent health problems found among infants from poor families, such as respiratory problems,[13] iron deficiency anemia,[30] otitis media[31] and the consequences of premature birth or low birth weight.[32,33]

Population-based studies of the relation between poverty and children's health have most often been based on data from surveys of children under 18 as a group and have not presented data specifically related to infants.[2,3,10,16,34–38] Cohort studies that have analyzed socioeconomic status and children's health have generally presented data for older children.[39–45] In Canada, data from the National Longitudinal Study of Children are collected from children who were less than 12 years old at enrolment.[16]

The impact of poverty on infant health has yet to be determined, in particular the influence of low income compared with the influence of other indicators of socioeconomic status (e.g., parents' level of education or absence of a partner).[46–52] Because few studies have involved Canadian children specifically, almost all of the available information comes from American research. However, because of differences in access to health care services between the 2 countries and the close association between poverty and race in the United States,[53] it is difficult to generalize the results of the US studies to the situation in Canada.

In this study, we examined the link between poverty and infant health in Quebec households to determine whether inadequate family income is associated with poorer infant

health. We controlled for the infants' characteristics and neonatal health problems and for the sociodemographic characteristics and lifestyles of the mothers.

Methods

The study protocol was approved by the Research Ethics Committee of the Faculty of Medicine, Université de Montréal.

For our analyses we used cross-sectional data from the 1998 phase of the Quebec Longitudinal Study of Child Development (QLSCD)[54] for a sample of 2223 infants whose mean age was 5 months (range 15–36 weeks), corrected for gestational age, at the time of the interview. The QLSCD is a longitudinal study of the development of children in which children are followed annually up to the age of 7 years. The sample we used was selected from the master registry of live births, compiled by the Ministry of Health and Social Services of Quebec. The sample was representative of singleton births in Quebec in 1997/98, excluding births to mothers living in the Northern Quebec administrative region, in Cree or Inuit territory, or on Indian reserves. Infants whose gestational age was unknown and premature babies born before 24 weeks' gestation were excluded from the initial sample. The data were weighted to correct for the levelling effect and for variations in response rates.[54]

We collected data from 2 sources: medical records, to establish the infants' neonatal health, and interviews with the mothers. The interviews were conducted at home when the infants were 5 months old (corrected for gestational age), after the mothers signed an informed consent form. The mothers were asked to describe the baby's health ("Generally speaking, would you say that your baby's health is excellent, very good, good, fair or poor?"), any chronic health problems that had been diagnosed by a health professional, and whether their child had ever been admitted to hospital for 1 night or more since birth. They were also asked how long they breast-fed, the type of day care they used, their age, their level of education, whether or not they had a partner, their immigration status, the number of children they had, their employment status, their household income during the 12 months before the interview and whether they smoked.

Low-income thresholds established by Statistics Canada are the most widely used measures of poverty in Canada. They take into account the size of the household and the size of the area inhabited, and they are based on data from the Survey of Household Spending.[55] A family living below the low-income threshold devotes 20% more of its before-tax income to food, shelter and clothing than does the average family. According to the low-income thresholds established by Statistics Canada for 1998,[55] a moderately inadequate income for a family of 3 people in a city of 500 000 or more inhabitants is between $16 238 and $27 063, and a very inadequate income is below $16 238.

For our analyses, we defined household income for the 12 months before the interview, as reported by the mother, as "sufficient" if it was above the low-income threshold, "moderately inadequate" if it fell between 60% and 99% of the low-income threshold or "very inadequate" if it was below 60% of the low-income threshold.

Following descriptive and univariate analyses, we estimated multivariate models using logistic regression analyses for each of the dependent variables: the mother's perception of her baby's health (excellent or less than excellent), the presence of at least 1 chronic health problem diagnosed by a health professional, and the baby having been admitted to hospital for 1 night or more. Many studies have shown that infant health data reported by the mother are valid.[56–58] Perception of an infant's health by the mother appears to be a good indicator of the infant's overall health,[57,59] although the mother's health may influence her perception.[60] Our analyses showed a strong correlation between the mother's perception of the baby's health and other indicators of infant health. Perceived health of the infant was categorized as either excellent or less than excellent because of the small number of babies perceived to be in good, fair or poor health.

Household income was the main independent variable. We controlled for the baby's sex, the baby's age at the time of the interview, neonatal health (as indicated by a cumulative score for neonatal risk [this score is the weighted sum of health problems at birth, including preterm birth, small for gestational age, congenital abnormalities and neonatal complications[46]]), the mother's age, level of education, immigrant status and smoking status, the duration of breast-feeding, and the presence or absence of a partner.

Given that the purpose of the analysis was explanatory, the infants' characteristics and the mother's characteristics and lifestyle were considered individually and were introduced stepwise into the logistic models in the following sequence: baby's age at the time of the interview, baby's sex, baby's health at birth, mother's age, mother's level of education, presence or absence of a partner, mother's immigrant status, duration of breast-feeding and mother's smoking status. This process identified the contribution of each variable to the association between poverty and the mother's perception of her infant's health, reported chronic health problems at 5 months and reported hospital admissions since birth. Analyses were conducted using the sample weights. To account for the complex sample design, SUDAAN was used to estimate confidence intervals for the parameters.

Results

The participation rate among the families originally sampled was 83.1%. After accounting for nonresponses for some of the data collection instruments, the response rate for the study was 75.8%. The lowest response rates for some of the instruments were found among mothers with the lowest level of education (43.3% for primary school only) and those who spoke neither French nor English (45.9%).[54] The questions were addressed to the mother in 99.6% of the cases; in the remaining 0.4% of cases, the person most familiar with the child, usually the father, answered the questions.

Of the infants in our study, 12.0% were living in households with moderately inadequate incomes and 15.5% were in households with very inadequate incomes (Table 1). Table 1 also presents the distribution of the other sociodemographic characteristics by level of household income.

The data presented in Table 2 show that, compared with infants in households with sufficient incomes, those in households with moderately inadequate and very inadequate households were more likely to be perceived by their mothers to be in less than excellent health and to have chronic health problems. However, whereas infants in households with moderately inadequate incomes were more likely to be admitted to hospital than those in house-

holds with sufficient incomes, infants in households with very inadequate incomes were not admitted to hospital significantly more often those in either of the other 2 groups.

The final stepwise multivariate model (Table 3) revealed that, with sufficient household income as the comparison group, the odds of an infant being perceived to be in less than excellent health was greater when household income was moderately inadequate (adjusted odds ratio [OR] 1.5, 95% confidence interval [CI] 1.1–2.1) or very inadequate (adjusted OR 1.8, 95% CI 1.3–2.6), after adjustment for the infant characteristics and neonatal health problems and the mother's characteristics and lifestyle.

The likelihood of a mother reporting that her infant had chronic health problems did not differ significantly by household income level (Table 3). However, the likelihood tended to be greater in households with very inadequate incomes (adjusted OR 1.4, 95% CI 0.8–2.2).

The multivariate model for hospital admissions followed the same pattern as that of the univariate analysis. Compared with infants in households with sufficient incomes, those in households with moderately inadequate incomes were more likely to have been admitted to hospital (adjusted OR 1.8, 95% CI 1.2–2.6). The same was not true for infants in households with very inadequate incomes (adjusted OR 0.7, 95% CI 0.4–1.2).

Interpretation

These data from the QLSCD study reveal that, in 1998, a high proportion of 5-month-old infants in Quebec were from families with an inadequate income. Up to 28% of these infants lived in conditions of poverty. Babies from poor families were perceived to be in less than excellent health more often and were admitted to hospital more of-

Table 1: Sociodemographic characteristics of mothers with 5-month-old infants in Quebec's birth cohort, 1998, by level of sufficiency of household income

Characteristic	Household income; % (and no.) of mothers*			Total % (and no.)*
	Sufficient	Moderately inadequate	Very inadequate	
Mother's age, yr				
< 20	1.0 (15)	6.9 (18)	10.4 (35)	3.1 (68)
20–34	85.3 (1344)	78.9 (205)	74.8 (253)	82.9 (1802)
≥ 35	13.7 (217)	14.2 (37)	14.8 (50)	14.0 (304)
Mother's level of education				
No high school diploma	10.3 (163)	24.4 (63)	47.5 (161)	17.8 (387)
High school diploma	10.1 (159)	15.1 (39)	12.7 (43)	11.1 (241)
Vocational or trade school diploma	11.0 (174)	14.4 (37)	6.8 (23)	10.8 (234)
College or university studies	68.6 (1079)	46.1 (119)	33.0 (112)	60.3 (1310)
Presence of a partner				
Lives with a partner	98.4 (1551)	85.7 (221)	66.0 (223)	91.9 (1995)
Does not live with a partner	1.6 (25)	14.3 (37)	34.0 (115)	8.1 (177)
Immigrant status				
Nonimmigrant or European immigrant	95.0 (1496)	78.2 (204)	63.1 (214)	88.0 (1914)
Non-European immigrant	5.0 (79)	21.8 (57)	36.9 (125)	12.0 (261)
Breast-feeding status				
Still breast-feeding at				
≥ 20 wk	35.7 (562)	33.8 (88)	33.4 (113)	35.1 (763)
10–19 wk	14.0 (221)	12.6 (33)	9.2 (31)	13.1 (285)
< 10 wk	23.8 (375)	24.5 (64)	22.2 (75)	23.6 (514)
Never breast-fed	26.5 (417)	29.1 (76)	35.2 (119)	28.2 (612)
Mother's smoking status				
Nonsmoker or occasional smoker	78.7 (1241)	70.5 (184)	65.2 (221)	75.6 (1646)
Smoker	21.3 (335)	29.5 (77)	34.8 (118)	24.4 (530)
Type of day care used				
Infant at home with mother or other person	88.4 (1393)	89.3 (233)	93.2 (316)	89.2 (1942)
Infant at day care in another home	9.1 (144)	8.4 (22)	2.4 (8)	8.0 (174)
Infant at day-care centre	1.5 (23)	1.9 (5)	3.8 (13)	1.9 (41)
Other	1.0 (16)	0.4 (1)	0.6 (2)	0.9 (19)

*Based on weighted data. The percentages are precise values; the numbers are only indicative, given the weighted nature of the data.

ten than those from families whose income was above the low-income threshold.

The multivariate analyses showed that this risk was present even after adjustment for neonatal complications, the mother's level of education, the presence or absence of a partner, the duration of breast-feeding and the mother's smoking status, all factors known to affect infant health. Family poverty, defined by a household income below the low-income threshold, appears to have a significant effect on infant health problems beyond the mother's level of education, the presence or absence of a partner and the mother's lifestyle. These results contribute to the debate over the impact of income and the impact of mother's level of education and lifestyle on infant health. The lack of material resources, although not the only factor at play, appears to be an important element in this detrimental situation for infants from poor families.[61–63]

The fact that babies in households with very inadequate incomes were less likely to be admitted to hospital than those in households with moderately inadequate incomes leads us to question the factors that influence the use of hospital services in Canada. Infants of mothers with a low level of education and no partner were at increased risk of being admitted to hospital in the first 5 months of life (data not shown). However, the likelihood of hospital admission was lower among infants in the poorest income category than among those in the moderately inadequate income category regardless of the mother's level of education or the presence of a partner. In contrast, infants in the poorest households were perceived to be in less than excellent health by their mothers as often as those in households with moderately inadequate incomes. An infant's admission to hospital thus seems to be linked to determinants of health services utilization and may not be a reflection of the infant's health, especially if he or she is very poor.[64–66] Further research is required to clarify whether the lower hospital admission rate among infants from very poor families reflects a lack of material resources or the mother's social isolation, which could limit her getting to a hospital emergency department.

This finding could also be the result of selection bias. Because of the lower response rate among the poorest mothers (those with very low level of education or those who spoke neither French nor English),[54] our results may be an underestimation of reality. Selection bias may per-

Table 2: Infant health in the first 5 months of life, in Quebec's birth cohort, 1998, by level of sufficiency of household income

	% (95% CI) and no.*		
	Health perceived to be less than excellent	Chronic health problems present	Admitted to hospital since birth
Household income			
Sufficient	20.8 (18.6–23.0) 329	7.9 (6.5–9.3) 124	11.5 (9.9–13.1) 181
Moderately inadequate	31.2 (25.0–37.5) 81	11.3 (6.8–15.8) 30	21.2 (15.6–26.8) 55
Very inadequate	33.2 (27.3–39.1) 112	13.4 (9.2–17.5) 45	13.3 (9.1–17.5) 45
Total	24.1 (22.2–26.0) 522	9.2 (7.9–10.5) 199	12.9 (11.3–14.5) 281

Note: CI = confidence interval. Confidence intervals were calculated using SUDAAN. Information on the infants' health was reported by the mothers during an interview.
*Based on weighted data. The percentages and CIs are precise values; the numbers are only indicative, given the weighted nature of the data.

Table 3: Crude and adjusted odds ratios (ORs) for infant health in the first 5 months, in Quebec's birth cohort, 1998, by level of sufficiency of household income

	Health perceived to be less than excellent		Chronic health problems present		Admitted to hospital since birth	
Household income	Crude OR (95% CI)	Adjusted OR (95% CI)*	Crude OR (95% CI)	Adjusted OR (95% CI)*	Crude OR (95% CI)	Adjusted OR (95% CI)*
Sufficient	1 (–)	1 (–)	1 (–)	1 (–)	1 (–)	1 (–)
Moderately inadequate	1.6 (1.2–2.2)†	1.5 (1.1–2.1)‡	1.5 (0.9–2.4)	1.3 (0.8–2.1)	2.2 (1.5–3.2)†	1.8 (1.2–2.6)§
Very inadequate	2.0 (1.5–2.7)†	1.8 (1.3–1.6)†	1.7 (1.1–2.6)‡	1.4 (0.8–2.2)	1.3 (0.9–2.0)	0.7 (0.4–1.2)

*Adjusted for infant's age at interview and sex, cumulative score for neonatal risk, mother's level of education, presence or absence of a partner, duration of breast-feeding and mother's smoking status.
†$p < 0.001$.
‡$p < 0.05$.
§$p < 0.01$.

sist even if certain household characteristics are weighted, because the weighting assumes equivalence among participating and nonparticipating families. Another limitation of the study was that one of the indicators of infant health was based on perception. However, the mother's perception of her infant's health was closely correlated to the other indicators of infant health. Moreover, McCormick and colleagues[59] showed that a mother's perception of her baby's health is a valid indicator of the infant's overall health, even in an underprivileged environment. One of the main strengths of our study was that it is a representative study of singleton births in Quebec. In addition, household income, which was used to define the poverty levels, was reported by the mother herself and was not an estimate.

Despite recent prosperity in Canada, poverty is still a problem, especially among families with young children.[67,68] The results of our study show that some of the health problems experienced by children from poor families are related to household income. Social policies that favour families with young children, including those with specific financial remedies, are needed to alleviate this situation. In Ontario, Curtis and colleagues[69] have suggested that cash programs may be more effective than non-cash programs. Governments could also learn from the family programs and policies introduced in the United Kingdom, France and Sweden, where the rates of infant poverty are much lower than here, especially among single mothers.[2,11,68]

Our findings suggest that it is not enough to prevent babies from being born prematurely or from having low birth weights, nor is it enough to closely follow these infants to ensure the health of those raised in underprivileged families. It is important to monitor children from poor families as well as those being raised by mothers who are single or are poorly educated. In addition, future research is required to study the utilization of hospital services for babies of very poor families, to better understand the factors associated with the low admission rates in this group.

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