

Social inequalities in infant feeding during the first year of life. The Longitudinal Study of Child Development in Québec (LSCDQ 1998–2002)

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Abstract

Objective: The aim of this paper is to describe the source and the scope of social inequalities in infant feeding practices. It examines the extent to which different recommendations are followed in different social groups and highlights the main factors influencing the total adherence to three recommendations at the population level.

Design, setting and subjects: The study follows a representative sample ($n = 2103$) of the children born in 1998 in the province of Québec (Canada). Detailed information on breast-feeding and complementary feeding was collected at 5 and 17 months by face-to-face interviews with the mother. The independent variables were mother's age, mother's education level, poverty level, family type, socio-economic status (SES) and living area. Odds ratios (adjusted for baby's rank in the family, birth weight and premature birth) are presented for breast-feeding, and for formula and cows' milk consumption, at different ages. The adherence to a combined indicator cumulating three recommendations (breast-fed at birth, complementary food at 4 months or later and cows' milk at 9 months or later) is also presented.

Results: The analysis indicates that adherence to the recommendations is low in Québec. Breast-feeding initiation, duration and its exclusivity improved with mother's age and education level and SES. Adherence to the different recommendations was interrelated, indicating an accumulation of bad nutritional circumstances for children in low-SES families. The odds of being fed in accordance with the three studied recommendations, when living in a family with the highest SES, was 2.3 times higher than when living in a family with the lowest SES. When living with a highly educated mother, the odds ratio was 2.7 times higher than when living with a low-educated mother. For mother's age, the odds ratio reached 3.7 for children from mothers aged ≥ 35 years, in comparison with children from mothers ≤ 24 years old. When SES or mother's education level was combined with mother's age, the children in the best situation were >8 more times likely than the least privileged children to be fed in accordance with these recommendations. Living area was not related with infant feeding during the first year of life.

Conclusions: Breast-feeding and nutrition could be related with different health and cognitive outcomes in childhood and later in life. Consequently, social disparities in diet during infancy could play a role in the development of social and health inequalities more broadly observed at the population level. Intervention to improve adherence to breast-feeding and nutrition recommendations in infancy should be prioritised and evaluated for its impact on the reduction on infant diet inequalities over time.

Keywords
Breast-feeding
Complementary feeding
Social inequalities
Population health
Quebec

In the first year of life, humans have to adapt to different feeding modes. Specific public health recommendations have been developed to guide mothers in feeding their newborns for optimal health and development. In Canada, the recommendation is to breast-feed exclusively for at

least 4–6 months. During this period of time, children should not be given any other type of milk or artificial formula, nor water, juice or food. Between 4 and 6 months, complementary food (purees, juice) can gradually be introduced into the daily diet of the baby, to complement

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breast-feeding which should continue up to 2 years or longer. Cows' milk should not be introduced before 9–12 months¹.

Social class disparities in infant feeding could generate short- and long-term health inequalities in a population^{2,3}. Different demographic and social factors influencing the initiation, exclusivity and duration of breast-feeding, and the age of introduction of complementary food, have been identified. Among the most influential are mother's age, educational level, ethnic origin, marital and occupational status, type of work and family income^{3–11}.

Studies on breast-feeding usually present few details about exclusive breast-feeding and complementary feeding, and are rarely based on a representative sample of children. Moreover, social factors are often studied separately, making it difficult to evaluate the most influential ones for public health interventions.

The aim of this paper is to describe the source and scope of social inequalities in infant feeding practices. It examines the extent to which recommendations are followed in different social groups and highlights the main factors influencing adherence to three infant nutrition recommendations at the population level. This will help the development of public health interventions aimed at diminishing the impact of social inequalities in infancy on health and social position later in life.

Methods

The analyses were performed on data from the Longitudinal Study of Child Development in Québec (LSCDQ 1998–2002) conducted by Santé Québec, a division of the Institut de la Statistique du Québec (ISQ). The study follows a representative sample ($n = 2103$) of the children born in 1998 in the province of Québec (total population >7 million, approximately 70 000 newborns per year), in Canada. Detailed information on breast-feeding and complementary feeding were collected at 5 months and completed at 17 months by two face-to-face interviews with the most knowledgeable person, generally the mother. More details about the study have been published elsewhere¹².

In the first data collection (at 5 months), the mother indicated if the child had been breast-fed and for how long. Questions about the age of introduction of formula, other types of milk and complementary food were also asked. In the second data collection (at 17 months), the mother indicated the age of the child when she stopped breast-feeding (whenever applicable) and started giving formula, and when she began giving cows' milk and lumpy food. Of the 2103 children in the first data collection, 1985 (94.4%) remained in the second data collection.

The data were analysed for two types of breast-feeding. *Total breast-feeding* included all breast-fed children whether or not they received formula, other types of milk, water, juice or food. *Exclusive breast-feeding*

included the children who received breast milk only (no water, formula, other milk, juice or food). Dependent variables were the duration of total and exclusive breast-feeding, the age of introduction of formula and ending thereof, and the age of introduction of cows' milk, complementary food and lumpy food.

There was some duplication in questions in the 5-months and 17-months questionnaires. Nearly 95% of the mothers gave the same answer to the number of months they breast-fed. The durations were calculated before developing the indicators. To minimise potential memory bias, 5-months questionnaire answers were first used, and answers from the 17-months questionnaire were used only to complete the duration whenever necessary. For example, duration of breast-feeding of <5 months relied on answers from the first questionnaire. If the mother was still breast-feeding at that moment, the duration was completed with the second questionnaire (17 months). All variables are presented in months.

Social inequalities were measured by mother's age and education level, level of poverty, family type, socio-economic status (SES) and living area. Mother's age was presented in four categories: ≤ 24 years, 25–29 years, 30–34 years and ≥ 35 years. Mother's education level was classified as 'no high school diploma', 'high school diploma' and 'higher than high school diploma'. Level of poverty was based on the Canadian poverty index, which comes from family gross annual income adjusted for household size and living area. A family income <60% of the appropriate poverty level was considered as 'very poor', between 60 and 99% was considered as 'poor', and 100% or more was considered as 'not poor'. Family type distinguished between 'single-parent families' and 'two-parent families'. SES was based on the method developed by Willms and Shields¹³ and includes parents' level of education, work prestige scale and gross family income. Education level was re-scaled from 1 to 16 years and standardised with a mean of 0 and a variance of 1. Work prestige was coded according to the classification of prestige and then transformed to obtain a continuous variable with a mean of 0 and a variance of 1. Gross family income was also standardised. Indicators were averaged for all infants. Single-parent families are more likely to have lower SES mainly because their income is on average lower than that of two-parent families, especially when both parents are working. Analyses were based on tertiles (33% of the sample) of SES. The first tertile (SES1) indicated families with the lowest SES and the third tertile (SES3) indicated families with the highest SES. Living area was obtained by looking at postal codes in accordance with provincial classification of areas. Children were classified as living in an 'urban area' (64%), a 'semi-urban area' (14%) or a 'rural area' (22%). All indicators of social inequalities were collected when the children were 5 months old.

Potential confounding factors used in the analysis were baby's rank in the family, baby's birth weight and

premature birth. Baby's rank (referring to mother's parity), baby's birth weight and premature birth were obtained from medical records. First-born babies are more likely to be breast-fed than others. On the contrary, low-birth-weight and premature babies are less likely to be breast-fed. Premature birth refers to a delivery before 36 weeks of gestation.

Analyses were done by first characterising the independent effect of each social inequality indicator on each of the dependent variables by logistic regression modelling. The odds ratios were then calculated, controlling for potential confounders from logistic regression. The analyses were done using weighted data and were adjusted for the design effect as the sampling plan was of a stratified sample. Statistical significance level was fixed at 5% and SAS version 8.2 (SAS Institute, Cary, NC) was used for statistical analyses.

Results

Relationships between feeding modes

Figure 1 illustrates the relationships between the different feeding modes from birth to 18 months for the Québec children. At birth, 72% of the children were breast-fed, and 33% began their life with formula (5.8% received both breast milk and formula at the hospital). At 4 months, only 6% of the children were exclusively breast-fed. The majority were fed formula (77%) and ate complementary food (86%) daily. At 6 months, less than a third (29%) were still breast-fed, a quarter (23%) were drinking cows' milk and a tenth (11%) were eating lumpy foods. At this age, the majority (81%) were fed formula. The prevalence of breast-feeding dropped from 29% at 6 months to 10% at 12 months. The proportion of children given formula also varied from 81% to 30% between 6 and 12 months, as cows' milk gradually replaced formula. At 12 months,

the majority of the children were given cows' milk (92%) and lumpy foods (93%).

The different elements of the recommendations for infant nutrition were interrelated. Children breast-fed at birth, exclusively breast-fed at 4 months and breast-fed at 12 months were less likely to receive complementary food and cows' milk early, compared with other children. The difference is especially important for children not exclusively breast-fed at 4 months. Two-thirds (65%) of them received complementary food before 4 months. Early introduction of complementary food was also related to the early introduction of cows' milk, as 82% of the children receiving complementary food before 4 months also received cows' milk before 9 months (data not shown). Because of these associations and a low prevalence for some feeding modes at certain ages, further analyses were done only for total breast-feeding (at birth and 2, 4 and 6 months), exclusive breast-feeding (at birth and 2 months), formula (at birth and 2, 4 and 6 months) and cows' milk (at 9 and 12 months).

Influence of social inequalities on infant feeding

Table 1 presents the crude odds ratios and Table 2 the adjusted odds ratios (with 95% confidence intervals) for breast-feeding. Univariate analysis indicated that, from birth to 6 months, children from two-parent families, from families with higher SES or with older or highly educated mothers were more likely to be breast-fed than were other children. Living area was not related to breast-feeding. Mother's age and education level and SES had the strongest impact. Compared with children whose mothers were ≤ 24 years old, the odds of being breast-fed at birth and at 2, 4 and 6 months for children whose mothers were ≥ 35 years old was from 2.9 to 4.4 times higher. The odds of being breast-fed at birth was 60% higher for children whose mothers had a high school

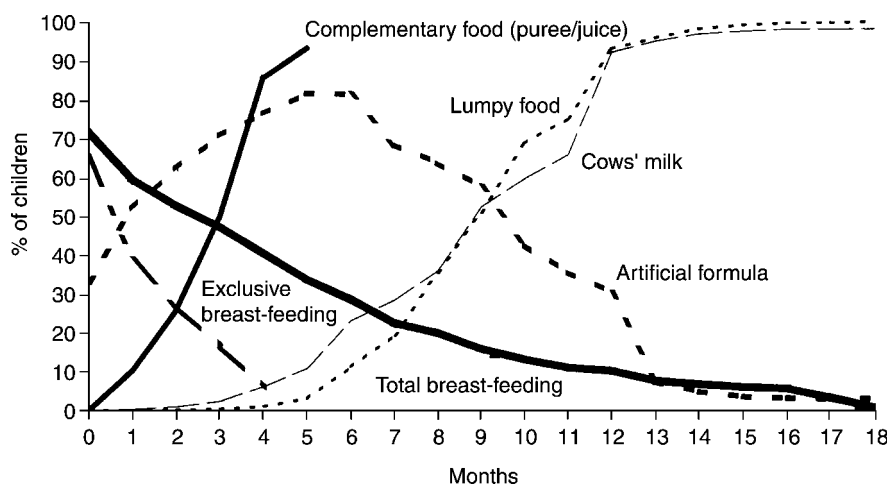


Fig. 1 Proportions of children being breast-fed (total and exclusive) and receiving artificial formula, complementary food (puree/juice), lumpy food and cows' milk during the first 18 months of life in Québec, 1998 and 1999. *Source:* Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹²

Table 1 Crude* odds ratios (95% confidence intervals) for total and exclusive breast-feeding at different ages in Québec, 1998 and 1999

	Total breast-feeding				Exclusive breast-feeding	
	At birth	At 2 months	At 4 months	At 6 months	At birth	At 2 months
Mother's age group (years)	1.000	1.000	1.000	1.000	1.000	1.000
≤24†	1.651 (1.210–2.252)	2.126 (1.583–2.856)	2.231 (1.624–3.064)	1.972 (1.371–2.836)	1.541 (1.138–2.086)	2.519 (1.713–3.703)
25–29	2.228 (1.617–3.069)	3.103 (2.297–4.191)	3.171 (2.306–4.362)	2.862 (2.000–4.094)	1.770 (1.303–2.405)	3.722 (2.543–5.448)
30–34	2.866 (1.891–4.344)	4.159 (2.860–6.049)	4.287 (2.931–6.270)	4.375 (2.903–6.595)	2.165 (1.471–3.185)	4.666 (3.024–7.201)
≥35	1.000	1.000	1.000	1.000	1.000	1.000
Mother's education level	1.000	1.000	1.000	1.000	1.000	1.000
No high school diploma†	1.602 (1.183–2.170)	1.596 (1.179–2.162)	1.926 (1.371–2.708)	2.123 (1.427–3.160)	1.578 (1.170–2.127)	2.392 (1.548–3.697)
High school diploma	3.538 (2.562–4.886)	3.661 (2.697–4.969)	4.189 (2.997–5.854)	3.813 (2.588–5.618)	3.379 (2.477–4.611)	5.106 (3.346–7.792)
Higher than a high school diploma	1.000	1.000	1.000	1.000	1.000	1.000
Poverty level	1.000	1.000	1.000	1.000	1.000	1.000
Very poor†	1.192 (0.777–1.827)	0.881 (0.594–1.307)	0.845 (0.563–1.269)	1.004 (0.649–1.553)	1.308 (0.871–1.963)	1.310 (0.808–2.126)
Poor	1.410 (1.031–1.929)	1.099 (0.822–1.471)	1.092 (0.812–1.469)	1.037 (0.752–1.430)	1.813 (1.343–2.446)	1.844 (1.283–2.651)
Not poor	1.000	1.000	1.000	1.000	1.000	1.000
Family type	1.000	1.000	1.000	1.000	1.000	1.000
Single-parent family†	2.104 (1.460–3.032)	1.588 (1.111–2.270)	1.873 (1.269–2.767)	2.003 (1.273–3.152)	2.666 (1.854–3.834)	2.079 (1.298–3.330)
Two-parent family	1.000	1.000	1.000	1.000	1.000	1.000
Socio-economic status (SES)	1.000	1.000	1.000	1.000	1.000	1.000
SES1 (least privileged)†	1.343 (1.026–1.758)	1.442 (1.120–1.856)	1.584 (1.213–2.067)	1.420 (1.059–1.903)	1.468 (1.130–1.905)	1.745 (1.275–2.390)
SES2	2.642 (1.954–3.573)	3.118 (2.394–4.061)	3.014 (2.310–3.933)	2.294 (1.724–3.052)	2.622 (1.977–3.477)	3.512 (2.596–4.751)
SES3 (most privileged)	1.000	1.000	1.000	1.000	1.000	1.000
Living area	1.000	1.000	1.000	1.000	1.000	1.000
Rural†	0.754 (0.545–1.044)	0.766 (0.568–1.033)	0.844 (0.620–1.150)	1.078 (0.778–1.495)	0.810 (0.591–1.110)	0.860 (0.611–1.209)
Semi-urban	1.022 (0.770–1.356)	0.989 (0.770–1.271)	1.171 (0.910–1.506)	0.992 (0.752–1.307)	0.967 (0.740–1.264)	0.907 (0.684–1.202)
Urban	1.000	1.000	1.000	1.000	1.000	1.000

Source: Institut de la Statistique du Québec (ÉLDEQ, 1998–2002)¹².

* Adjusted for baby's birth rank, premature birth and low birth weight.

† Reference category.

Table 2 Adjusted* odds ratios* (95% confidence intervals) for total and exclusive breast-feeding at different ages in Québec, 1998 and 1999

	Total breast-feeding				Exclusive breast-feeding	
	At birth	At 2 months	At 4 months	At 6 months	At birth	At 2 months
Mother's age group (years)						
≤24†	1.000	1.000	1.000	1.000	1.000	1.000
25–29	1.132 (0.800–1.600)	1.516 (1.094–2.101)	1.478 (1.043–2.093)	1.387 (0.936–2.054)	0.982 (0.701–1.377)	1.606 (1.060–2.432)
30–34	1.327 (0.918–1.919)	1.949 (1.382–2.750)	1.916 (1.335–2.751)	1.905 (1.276–2.845)	0.965 (0.677–1.377)	2.060 (1.349–3.147)
≥35	1.905 (1.215–2.986)	2.736 (1.827–4.096)	2.681 (1.779–4.039)	3.017 (1.942–4.686)	1.371 (0.899–2.091)	2.844 (1.785–4.533)
Mother's education level						
No high school diploma	1.000	1.000	1.000	1.000	1.000	1.000
High school diploma	1.532 (1.081–2.170)	1.419 (1.002–2.011)	1.693 (1.152–2.489)	1.973 (1.268–3.070)	1.455 (1.035–2.045)	1.917 (1.185–3.102)
Higher than a high school diploma	2.868 (1.831–4.494)	2.246 (1.477–3.415)	2.640 (1.691–4.122)	2.895 (1.754–4.779)	2.811 (1.830–4.319)	2.888 (1.692–4.930)
Poverty level						
Very poor†	1.000	1.000	1.000	1.000	1.000	1.000
Poor	0.871 (0.546–1.389)	0.641 (0.413–0.994)	0.570 (0.360–0.901)	0.688 (0.423–1.118)	0.954 (0.613–1.484)	0.981 (0.578–1.666)
Not poor	0.698 (0.456–1.068)	0.423 (0.281–0.636)	0.372 (0.243–0.570)	0.405 (0.258–0.637)	0.971 (0.649–1.451)	0.795 (0.490–1.291)
Family type						
Single-parent family†	1.000	1.000	1.000	1.000	1.000	1.000
Two-parent family	1.705 (1.088–2.672)	1.404 (0.905–2.179)	1.667 (1.040–2.671)	2.133 (1.244–3.660)	1.992 (1.288–3.080)	1.412 (0.798–2.499)
Socio-economic status (SES)						
SES1 (least privileged)†	1.000	1.000	1.000	1.000	1.000	1.000
SES2	0.972 (0.680–1.389)	1.317 (0.936–1.853)	1.450 (1.008–2.084)	1.178 (0.795–1.746)	0.956 (0.678–1.349)	1.151 (0.764–1.733)
SES3 (most privileged)	1.254 (0.777–2.024)	2.022 (1.312–3.117)	1.970 (1.260–3.078)	1.406 (0.870–2.272)	1.137 (0.723–1.788)	1.648 (1.008–2.694)
Living area						
Rural†	1.000	1.000	1.000	1.000	1.000	1.000
Semi-urban	0.746 (0.528–1.055)	0.783 (0.567–1.081)	0.846 (0.608–1.178)	1.074 (0.760–1.517)	0.795 (0.569–1.112)	0.858 (0.597–1.231)
Urban	1.058 (0.784–1.426)	1.029 (0.787–1.345)	1.235 (0.943–1.617)	0.988 (0.738–1.321)	0.967 (0.730–1.282)	0.925 (0.687–1.246)

Source: Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹².

* Adjusted for baby's birth rank, premature birth and low birth weight, and for all variables in the table.

† Reference category.

diploma and 3.5 times higher when mothers had more than a high school diploma, in comparison with mothers who did not complete high school. Similarly, higher SES increased the odds of being breast-fed. Living in a two-parent family also doubled the odds of being breast-fed when compared with the children from single-parent families. These differences persisted from birth to 6 months except for poverty level, which had an effect only at birth. When all the variables were looked at together (Table 2), the influence of mother's age and education level remained significant. At 6 months, the odds of being breast-fed was 3 times higher for children with mothers aged ≥ 35 years than for children from the youngest mothers, and for the children of mothers with more than a high school diploma compared with the children of mothers with no high school diploma. Socio-economic status remained significant only at 2 and 4 months.

Exclusive breast-feeding also varied positively with the variables studied, especially with mother's age and education level. The crude odds of being exclusively breast-fed was 3.4 times higher at birth and 5.1 times higher at 2 months for children of mothers with more than a high school diploma, compared with mothers with no high school diploma. The odds of being exclusively breast-fed at 2 months increased with mother's age, being more than 4 times higher for children from older mothers compared with children from younger mothers. Adjusted odds ratios indicated that, when all variables were looked at together, only mother's education and family type remained significant for exclusive breast-feeding at birth. At 2 months, mother's age, education level and SES increased the odds of being exclusively breast-fed by 60% to 2.9 times. The low proportion of children exclusively breast-fed at 4 months (6%) did not allow for such analyses at this age.

Table 3 presents crude odds ratios and Table 4 adjusted odds ratios (with 95% confidence intervals) for consumption of formula and cows' milk at different ages. Univariate analysis indicated that children with older and highly educated mothers had a lower odds of being fed formula from birth to 4 months and a higher odds at 6 months (between 2.0 and 2.7 times higher) than the children from younger mothers or mothers with no high school diploma. Formula was replaced by cows' milk in the daily diet of the babies. The odds of being given cows' milk at 9 months was lower for children whose mothers were aged ≥ 25 years or had a high school diploma or more, compared with children whose mothers were aged ≤ 24 years or had no high school diploma. SES followed the same pattern as mother's education in its effect on formula and cows' milk. Children from single-parent families were also more likely to be fed formula earlier in their life than were children of two-parent families. Similarly, being very poor was related with a higher odds of being fed formula at birth and a lower odds of being fed

formula at 6 months. Living area was not related with drinking formula or cows' milk at any of the ages studied. When all the variables were looked at together (Table 4), mother's age remained significant for being fed formula from 2 to 4 months but not at birth, and for drinking cows' milk at 9 months but not at 12 months. Mother's education remained significant for being fed formula from birth to 2 months only, and for drinking cows' milk at 9 months only.

Adherence to three infant nutrition recommendations

Figure 2 illustrates the adjusted odds ratios (95% confidence intervals) for whether or not children were fed in total accordance with the three infant nutrition recommendations by SES, mother's education level and mother's age. Children whose mothers adhered to the recommendations were breast-fed at birth, received complementary food at 4 months or later, and cows' milk at 9 months or later (28.3% of the sample). Children whose mothers did not follow the recommendations were not breast-fed at birth, received complementary food before 4 months and cows' milk before 9 months (13.8% of the sample). The proportion of infants fed in accordance with the three studied recommendations increased gradually from 16% in SES1 to 44% in SES3, whereas the proportion of infants not fed in accordance with the same three recommendations diminished from 20% in SES1 to $< 6\%$ in SES3 (data not shown). In comparison with children from SES1, the children in SES2 and SES3 were 1.3 and 2.3 times more likely, respectively, to be fed in accordance with these recommendations. On the contrary, the odds of not being fed in accordance with these recommendations was 33% lower for children from SES3 than for children from SES1.

The impact of mother's education level was stronger than that of SES. The odds of being fed in accordance with the three recommendations was 2.7 times higher for children with the most educated mothers, compared with children whose mother had no high school diploma. On the other hand, the children of the more educated mothers had an odds of not being fed in accordance with the recommendations that was 88% lower than for the children of less educated mothers.

The impact of mother's age was even stronger. In comparison with children from mothers aged ≤ 24 years, the odds of being fed in accordance with the recommendations was 2.7 and 3.7 times higher for the children whose mothers were aged 30–34 years and ≥ 35 years, respectively. Level of poverty and family type were not associated with these recommendations.

Figure 3 illustrates the adjusted odds ratios (95% confidence intervals) for being fed in accordance with the three studied recommendations when SES and mother's age are combined, and Fig. 4 presents similar

Table 3 Crude* odds ratios (95% confidence intervals) for drinking formula and cows' milk at different ages in Québec, 1998 and 1999

	Drinking formula						Drinking cows' milk		
	At birth	At 2 months	At 4 months	At 6 months	At 9 months	At 12 months	At 9 months	At 12 months	At 12 months
Mother's age group (years)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
≤24†									
25–29	0.649 (0.479–0.878)	0.517 (0.377–0.708)	0.819 (0.574–1.168)	2.000 (1.401–2.857)	0.442 (0.324–0.602)	0.598 (0.316–1.131)	0.442 (0.324–0.602)	0.598 (0.316–1.131)	0.598 (0.316–1.131)
30–34	0.560 (0.412–0.761)	0.432 (0.315–0.593)	0.699 (0.492–0.994)	2.704 (1.867–3.916)	0.231 (0.168–0.316)	0.427 (0.231–0.790)	0.231 (0.168–0.316)	0.427 (0.231–0.790)	0.427 (0.231–0.790)
≥35	0.459 (0.312–0.677)	0.323 (0.222–0.470)	0.559 (0.370–0.844)	2.234 (1.431–3.490)	0.177 (0.121–0.260)	0.343 (0.173–0.681)	0.177 (0.121–0.260)	0.343 (0.173–0.681)	0.343 (0.173–0.681)
Mother's education level	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
No high school diploma	0.633 (0.469–0.853)	0.543 (0.386–0.762)	1.029 (0.719–1.473)	1.350 (0.960–1.898)	0.660 (0.483–0.902)	0.557 (0.272–1.141)	0.660 (0.483–0.902)	0.557 (0.272–1.141)	0.557 (0.272–1.141)
High school diploma	0.292 (0.214–0.399)	0.319 (0.228–0.445)	0.702 (0.497–0.994)	2.486 (1.727–3.579)	0.282 (0.206–0.384)	0.309 (0.155–0.614)	0.282 (0.206–0.384)	0.309 (0.155–0.614)	0.309 (0.155–0.614)
Higher than a high school diploma									
Poverty level	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Very poor†									
Poor	0.764 (0.508–1.148)	0.860 (0.568–1.300)	1.023 (0.727–1.441)	0.694 (0.445–1.082)	0.925 (0.623–1.375)	1.419 (0.713–2.823)	0.925 (0.623–1.375)	1.419 (0.713–2.823)	1.419 (0.713–2.823)
Not poor	0.550 (0.407–0.742)	0.772 (0.568–1.049)	0.865 (0.549–1.362)	1.766 (1.241–2.512)	0.900 (0.672–1.206)	1.538 (0.946–2.499)	0.900 (0.672–1.206)	1.538 (0.946–2.499)	1.538 (0.946–2.499)
Family type	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Single-parent family†									
Two-parent family	0.377 (0.262–0.542)	0.604 (0.408–0.893)	0.547 (0.337–0.886)	1.345 (0.873–2.072)	0.739 (0.516–1.058)	0.640 (0.301–1.360)	0.739 (0.516–1.058)	0.640 (0.301–1.360)	0.640 (0.301–1.360)
Socio-economic status (SES)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
SES1 (least privileged)†									
SES2	0.678 (0.522–0.881)	0.694 (0.530–0.908)	0.967 (0.716–1.036)	1.680 (1.238–2.280)	0.748 (0.578–0.969)	0.595 (0.351–1.010)	0.748 (0.578–0.969)	0.595 (0.351–1.010)	0.595 (0.351–1.010)
SES3 (most privileged)	0.383 (0.289–0.509)	0.421 (0.323–0.550)	0.786 (0.587–1.061)	3.182 (2.227–4.546)	0.293 (0.225–0.382)	0.388 (0.234–0.644)	0.293 (0.225–0.382)	0.388 (0.234–0.644)	0.388 (0.234–0.644)
Living area	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Rural†									
Semi-urban	1.244 (0.908–1.706)	1.168 (0.855–1.595)	1.110 (0.775–1.590)	1.230 (0.814–1.859)	1.191 (0.882–1.610)	0.736 (0.436–1.243)	1.191 (0.882–1.610)	0.736 (0.436–1.243)	0.736 (0.436–1.243)
Urban	1.031 (0.788–1.349)	1.114 (0.860–1.442)	1.024 (0.764–1.373)	0.829 (0.607–1.132)	1.125 (0.875–1.445)	0.842 (0.535–1.325)	1.125 (0.875–1.445)	0.842 (0.535–1.325)	0.842 (0.535–1.325)

Source: Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹².

* Adjusted for baby's birth rank, premature birth and low birth weight.

† Reference category.

Table 4 Adjusted* odds ratios (95% confidence intervals) for drinking formula and cows' milk at different ages in Québec, 1998 and 1999

	Drinking formula						Drinking cows' milk		
	At birth	At 2 months	At 4 months	At 6 months	At 9 months	At 12 months	At 9 months	At 12 months	At 12 months
Mother's age group (years)	≤24†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	25–29	1.018 (0.725–1.428)	0.702 (0.498–0.990)	0.926 (0.630–1.360)	1.573 (1.068–2.318)	0.594 (0.421–0.838)	0.982 (0.491–1.964)	0.982 (0.491–1.964)	0.982 (0.491–1.964)
	30–34	1.025 (0.718–1.464)	0.656 (0.458–0.938)	0.792 (0.532–1.179)	1.793 (1.183–2.718)	0.342 (0.239–0.491)	0.707 (0.355–1.410)	0.707 (0.355–1.410)	0.707 (0.355–1.410)
	≥35	0.724 (0.474–1.106)	0.467 (0.312–0.700)	0.620 (0.397–0.967)	1.641 (1.017–2.649)	0.255 (0.168–0.386)	0.582 (0.277–1.223)	0.582 (0.277–1.223)	0.582 (0.277–1.223)
Mother's education level	No high school diploma†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	High school diploma	0.684 (0.487–0.963)	0.623 (0.427–0.910)	1.074 (0.718–1.608)	1.097 (0.746–1.611)	0.747 (0.518–1.077)	0.619 (0.275–1.397)	0.619 (0.275–1.397)	0.619 (0.275–1.397)
	Higher than a high school diploma	0.345 (0.224–0.530)	0.465 (0.299–0.724)	0.718 (0.446–1.158)	1.217 (0.735–2.015)	0.556 (0.361–0.857)	0.529 (0.218–1.288)	0.529 (0.218–1.288)	0.529 (0.218–1.288)
Poverty level	Very poor†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Poor	1.045 (0.671–1.627)	1.133 (0.723–1.777)	0.994 (0.613–1.612)	0.632 (0.393–1.016)	1.133 (0.727–1.765)	2.363 (1.093–5.108)	2.363 (1.093–5.108)	2.363 (1.093–5.108)
	Not poor	1.018 (0.680–1.523)	1.592 (1.052–2.409)	1.465 (0.940–2.283)	1.152 (0.733–1.810)	2.405 (1.582–3.655)	6.081 (3.014–12.27)	6.081 (3.014–12.27)	6.081 (3.014–12.27)
Family type	Single-parent family†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
	Two-parent family	0.507 (0.328–0.785)	0.696 (0.436–1.113)	0.453 (0.260–0.791)	0.772 (0.465–1.283)	0.865 (0.553–1.352)	0.503 (0.200–1.262)	0.503 (0.200–1.262)	0.503 (0.200–1.262)
	SES1 (least privileged)†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Socio-economic status (SES)	SES2	1.053 (0.746–1.487)	0.859 (0.603–1.226)	1.049 (0.707–1.556)	1.292 (0.870–1.919)	0.717 (0.502–1.024)	0.350 (0.171–0.718)	0.350 (0.171–0.718)	0.350 (0.171–0.718)
	SES3 (most privileged)	0.913 (0.579–1.438)	0.646 (0.417–1.003)	1.090 (0.666–1.784)	1.990 (1.143–3.465)	0.375 (0.240–0.584)	0.219 (0.092–0.521)	0.219 (0.092–0.521)	0.219 (0.092–0.521)
	Rural†	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Living area	Semi-urban	1.271 (0.908–1.778)	1.159 (0.836–1.607)	1.156 (0.797–1.677)	1.301 (0.841–2.012)	1.201 (0.865–1.667)	0.667 (0.384–1.159)	0.667 (0.384–1.159)	0.667 (0.384–1.159)
	Urban	1.031 (0.777–1.368)	1.095 (0.836–1.435)	1.039 (0.769–1.403)	0.872 (0.630–1.208)	1.073 (0.817–1.409)	0.755 (0.473–1.207)	0.755 (0.473–1.207)	0.755 (0.473–1.207)

Source: Institut de la Statistique du Québec (ÉLDEQ, 1998–2002)¹².

* Adjusted for baby's birth rank, premature birth and low birth weight, and for all variables in the table.

† Reference category.

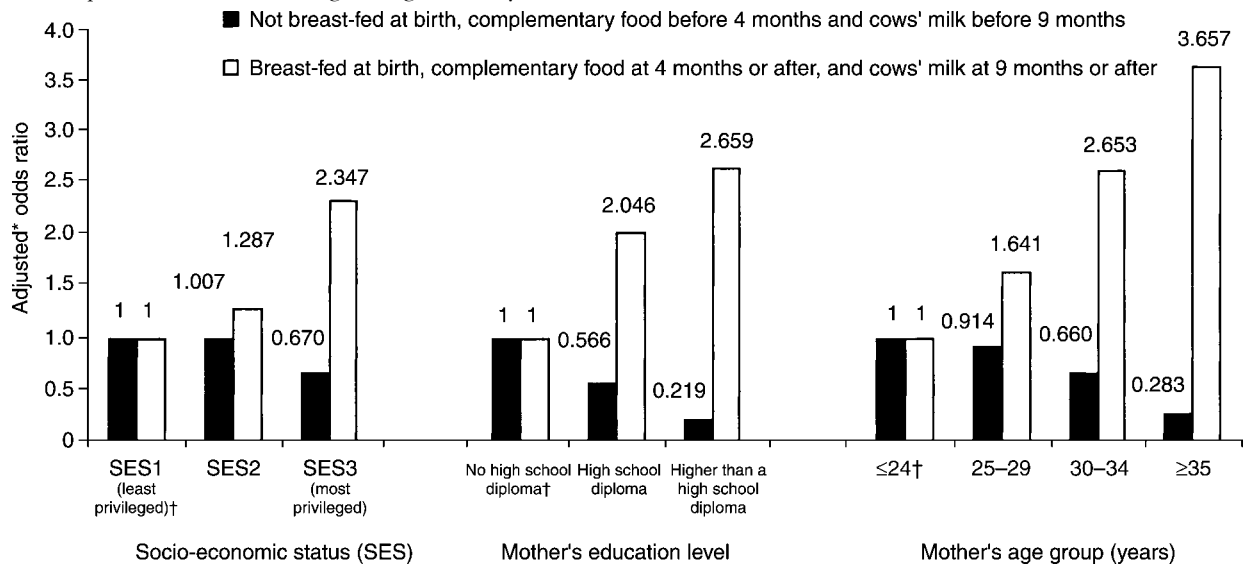


Fig. 2 Adjusted* odds ratio (95% confidence interval) for being fed in accordance with three infant nutrition recommendations by socio-economic status (SES), mother's education level and mother's age group in Québec, 1998 and 1999. *Adjusted for baby's birth rank, premature birth, low birth weight, living area, SES, mother's education level, mother's age, poverty level, family type and living area; †reference category. *Source:* Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹²

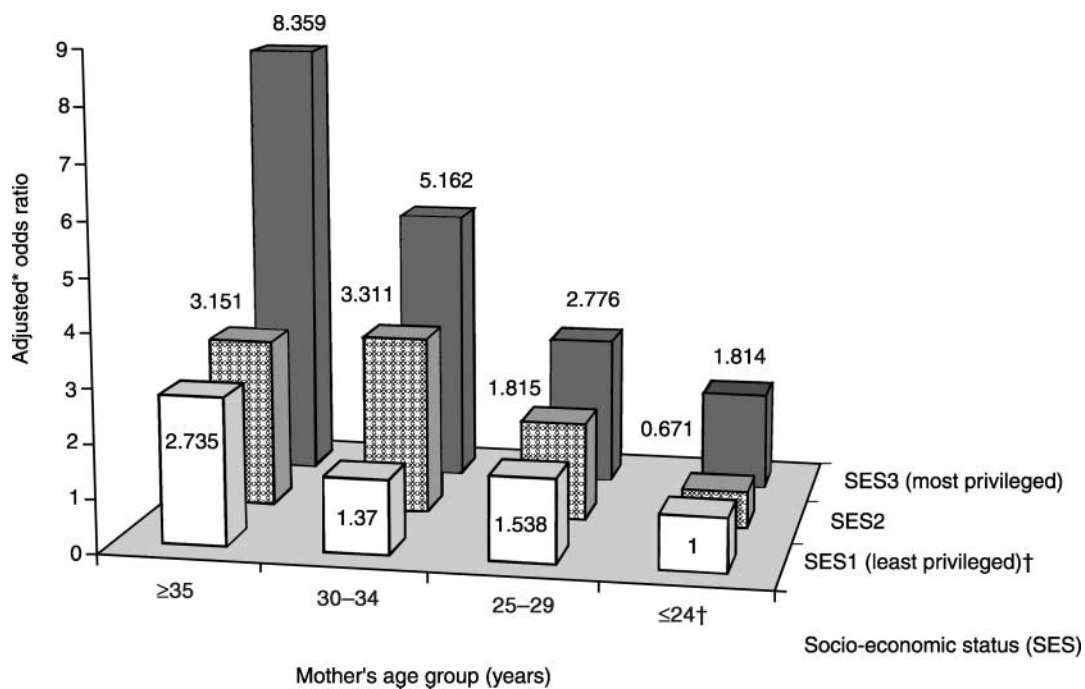


Fig. 3 Adjusted* odds ratio (95% confidence interval) for being fed in total accordance with three infant nutrition recommendations (breast-fed at birth, solid food at 4 months or later and cows' milk at 9 months or later) for the combination of socio-economic status (SES) and mother's age group in Québec, 1998 and 1999. *Adjusted for baby's birth rank, premature birth, low birth weight, living area, SES, mother's education level, mother's age, poverty level, family type and living area; †reference category. *Source:* Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹²

data when mother's education level and mother's age are combined. Being in the highest SES category had a positive influence at any age of the mother. The odds of being fed in accordance with the three studied recommendations was especially high for children whose mothers were aged ≥ 30 years (5 to 8 times higher). For mother's education, having a high school

diploma or higher had a positive influence that increased gradually with mother's age.

Discussion

This research indicates that adherence to infant feeding recommendations is low in Québec. Even if 72% of the

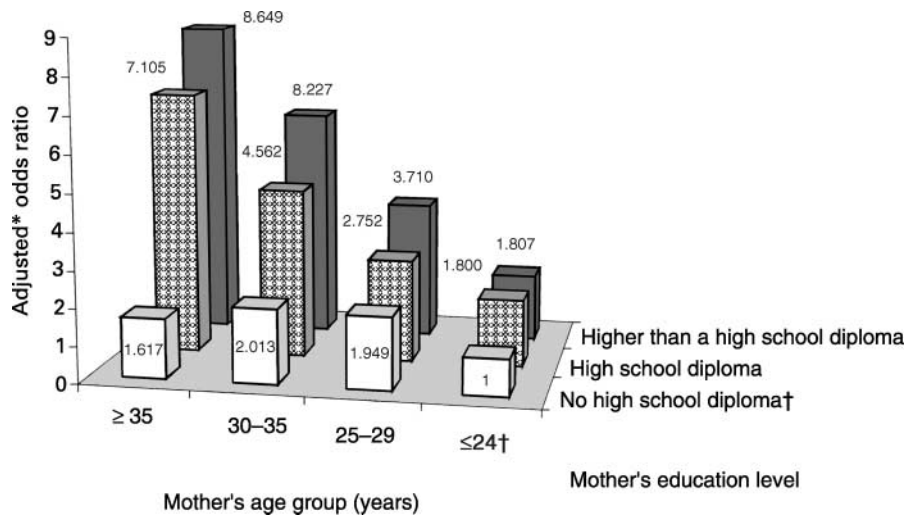


Fig. 4 Adjusted* odds ratio (95% confidence interval) for being fed in total accordance with three infant nutrition recommendations (breast-fed at birth, solid food at 4 months or later and cows' milk at 9 months or later) for the combination of mother's education level and mother's age in Québec, 1998 and 1999. *Adjusted for baby's birth rank, premature birth, low birth weight, living area, socio-economic status, mother's education level, mother's age, poverty level, family type and living area; †reference category. *Source:* Institut de la Statistique du Québec (ÉLDEQ 1998–2002)¹²

children are breast-fed at birth, only 6% are exclusively breast-fed at 4 months, 61% receive complementary food before this age and 35% are given cows' milk before 9 months. At 12 months, only 10% of the children are still breast-fed. Similar results have been reported in other countries^{4,7,10,14–19}.

This gap generates high social and medical costs that could be reduced at the population level with better adherence to the recommendations^{20,21}. But adherence to the recommendations is highly sensitive to social inequalities. The higher the social class into which a child is born, the better the odds that the child is fed in accordance with public health recommendations. Breast-feeding initiation and duration, and its exclusivity, improve with educational level of the mother and with higher SES, whereas early formula and cows' milk consumption follows a reverse pattern. The scope of social inequalities observed from the lowest to the highest SES in this research is a source of preoccupation because of its long-term consequences on children's health. As mother's age is also an important source of inequalities, it is important to promote education for young girls and to intervene in early pregnancy for less educated women and for women with the lowest SES.

The adherence to the different recommendations is interrelated, indicating an accumulation of bad nutritional circumstances for children further down in the social hierarchy. In the lowest SES, almost a quarter of children are not fed in accordance with three important recommendations, i.e. they are not breast-fed at birth, and receive complementary food before 4 months and cows' milk before 9 months. When SES or mother's education level is combined with mother's age, the children in the best situation have >8 times higher odds

than the least privileged children to be fed in accordance with these recommendations. Nevertheless, even in the best social situation, less than half of the children are fed in accordance with the three recommendations. This indicates that interventions should be aimed at the whole population, while targeting the lower socio-economic groups more specifically. Good support early after birth is also essential, as the adherence to the different recommendations is interrelated.

More research is needed to identify the specific factors contributing to the generally low rate of breast-feeding in the population. It is also essential to document the cultural and social factors influencing the shorter duration of breast-feeding in lower socio-economic groups. For example, the length of maternity leave, mother's type of work and the number of working hours could interfere separately or in combination with breast-feeding. The importance of husband's and family members' support also needs to be documented. Interventions targeting both parents and workplaces have to be evaluated, to find the most efficient way of increasing the initiation and duration of breast-feeding at the population level.

Breast-feeding and nutrition could be related with different health and cognitive outcomes in childhood and later in life. Consequently, social disparities of diet in infancy could play a role in the development of social and health inequalities more broadly observed at the population level. Intervention to improve adherence to breast-feeding and nutrition recommendations in infancy should be prioritised. In parallel, it is important to develop appropriate measurements adapted to different social groups to evaluate if social inequalities in infant diet increase or decrease in the population over time.

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