

Health Reports

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Socioeconomic disparities in small-for-gestational-age birth and preterm birth

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Abstract

Background: Maternal socioeconomic disadvantage has been associated with increased risk of small-for-gestational-age birth and preterm birth. Few studies, however, have considered maternal education and income simultaneously to better understand the mechanisms underlying perinatal health disparities. This analysis examines both maternal education and income and their association with the risk of small-for-gestational-age birth and preterm birth.

Methods: The study is based on 127,694 singleton live births from the 2006 Canadian Birth-Census Cohort, a national cohort of births registered from May 2004 to May 2006 that were linked to the 2006 long-form Census. Unadjusted rates of small-for-gestational-age birth (sex-specific birth weight below the 10th percentile for gestational age) and preterm birth (before 37 completed weeks of gestation) were estimated across selected maternal characteristics. Logistic regression was used to estimate crude and covariate-adjusted risk ratios of both outcomes according to maternal education and income adequacy quintiles.

Results: Small-for-gestational-age birth was associated with both maternal education and income adequacy, while preterm birth was associated with maternal education only. These findings persisted after taking factors including maternal age, ethnicity, and marital status into account. The results suggest that the mechanism by which maternal education is associated with these outcomes is likely not through income, nor does income replace education as a potentially meaningful measure of socioeconomic position.

Interpretation: The mechanisms underlying associations between socioeconomic position and perinatal health disparities are complex. The results of this study indicate that more than one socioeconomic factor may play a role.

Keywords: Birth weight, educational status, income, perinatal, pregnancy, premature infant

Socioeconomic disparities in birth outcomes have long been recognized in developed countries.¹ Maternal socioeconomic disadvantage has been associated with increased risk of small-for-gestational-age birth and preterm birth.² Small-for-gestational-age infants are at greater risk of neonatal mortality and morbidity,³ while preterm birth is a leading cause of infant death.⁴

In studies of perinatal outcomes, maternal education is the most commonly used measure of socioeconomic position; income is less frequently available.¹ It is thought that educated women are more likely to look for, understand, and follow medical advice about optimal behaviour during pregnancy, and that women with higher incomes are more likely to have the resources to obtain such advice and the means to comply.⁵ While education and income are related—for example, a low level of education may limit access to jobs and other social resources and thereby increase the risk of low income²—assessing their separate associations with adverse birth outcomes may help disentangle the mechanisms of perinatal health disparities.⁶ Few national studies have analyzed maternal education and income together,⁷⁻⁹ and even fewer have done so in the context of a publicly funded universal health care system.⁹

In Canada, socioeconomic information is not included in most routinely collected perinatal data. A systematic review of socioeconomic disparities in birth outcomes that was published in 2010 identified 106 relevant studies from English-speaking industrialized countries.¹ Of these studies, 11 were Canadian, and 5 had individual-level measures of socioeconomic position, but only one reported national results.

Canadian evidence on socioeconomic disparities in birth outcomes has often been limited to neighbourhood income measures¹⁰⁻¹² or to provinces that collect individual-level maternal education data.¹¹ Other provincial studies have linked births to tax information to examine birth outcomes by household income measures.^{13,14} These studies reported disparities in birth outcomes, notwithstanding Canada's publicly funded, universal health care system. However, except for Pevalin et al.,⁹ none considered more than one individual-level measure of socioeconomic position simultaneously.

Based on a representative national linked dataset, this study examined associations between maternal education and income, their respective associations with the risk of small-for-gestational-age birth and preterm birth, and the influence of both socioeconomic measures simultaneously.

Methods

Data source

The analysis is based on 127,694 singleton live births in the 2006 Canadian Birth-Census Cohort, which contains all births registered in Canada between May 2004 and May 2006 that linked to a 2006 Census long-form record (about one in five dwellings received and completed a long-form questionnaire). Each person on the birth record (child, mother and father) was linked deterministically to the long-form census record according to common identification variables in the databases. An overall linkage rate of 90% was achieved, with a false-positive match rate of less than 1%. Details about the creation of the cohort have been published elsewhere.¹⁵

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Of the 135,426 births in the cohort, the following were excluded from this study: 808 stillbirths; 4,086 multiple (non-singleton) live births; 1,675 live births missing maternal education and/or income; 789 live births missing at least one covariate; and 374 live births missing birth weight or gestational age.

What is already known on this subject?

- Socioeconomic disparities in small-for-gestational-age birth and preterm birth have long been recognized in developed countries.
- Although socioeconomic position is multifaceted, most studies have focused on only one measure, often maternal education or income.
- Few studies have examined maternal education and income together, and even fewer have done so in the context of a publicly funded, universal health care system.

What does this study add?

- A representative national dataset containing information on perinatal outcomes and on maternal education and income is available in Canada.
- When factors including maternal age, ethnicity and marital status were taken into account, small-for-gestational-age birth was associated with both maternal education and income adequacy, whereas preterm birth was associated only with maternal education.
- The mechanism by which maternal education is associated with small-for-gestational-age birth and preterm birth is likely not through income, nor does income replace education as an indicator of socioeconomic position.
- Associations between socioeconomic position and perinatal health disparities are complex, and more than one socioeconomic factor plays a role.

Outcomes

Small-for-gestational-age birth and preterm birth were defined based on information on the birth record. Small-for-gestational-age birth was a sex-specific birth weight below the 10th percentile for gestational age, according to Canadian reference values.¹⁶ Preterm birth was a birth before 37 completed weeks of gestation.

Socioeconomic position and covariates

Education was based on the mother's highest level of attainment as reported to the census. It was categorized as: less than secondary graduation; secondary graduation; postsecondary diploma or certificate; or university degree.

Maternal income was based on the income reported to the census for the mother's economic family. An economic family is defined as two or more people living together who are related by blood, marriage, common-law union, or adoption.¹⁷ Economic family income adequacy quintiles were estimated from the ratio of the economic family's total pre-tax post-transfer income to the Statistics Canada low-income cut-off (pre-tax post-transfer for the 2005 reference year) for the applicable economic family and community size group. These ratios were ranked, and quintiles were constructed within each Census Metropolitan Area, Census Agglomeration, or rural and small town area (outside Census Metropolitan Areas or Census Agglomerations)¹⁸ to account for regional differences in housing costs.

Child sex, birth year (2004, 2005, or 2006), maternal age group (younger than 20, 20 to 24, 25 to 29, 30 to 34, 35 to 39, or 40 or older), birth order (first, second, or third or higher), and region of birth were based on information on the birth record. Because of small sample sizes, Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick were combined into the Atlantic region, and the Yukon, Northwest Territories, and Nunavut were combined into the Territories. Maternal ethnicity and marital status were based on census information. Ethnicity was deter-

mined from the mother's response to the visible minority status question. A more detailed breakdown was possible for crude estimates: Caucasian, Indigenous, Black, East Asian, Southeast Asian, South Asian, or other. A three-category ethnicity variable was used to produce model-adjusted estimates: Caucasian, Indigenous, or visible minority (Chinese, South Asian, Black, Filipino, Latin American, Southeast Asian, Arab, West Asian, Korean, Japanese, other visible minority, multiple visible minority). Marital status was categorized as single (neither married nor common-law on Census Day), common-law, or married.

Statistical analysis

All analyses were weighted using the cohort weight to permit inference about the population of births that the cohort represents. Bootstrap weights were used to calculate the variance of all estimates.¹⁹ The distributions of maternal education levels within income adequacy quintiles were estimated to examine associations between the two socioeconomic measures. Unadjusted rates of small-for-gestational-age birth and preterm birth were estimated across all maternal characteristics, and by maternal education within income adequacy quintiles. Logistic regression was used to estimate crude and covariate-adjusted risk ratios and their 95% confidence intervals (CIs) for small-for-gestational-age birth and preterm birth.²⁰ Models estimated associations of the birth outcomes with maternal education and income adequacy separately, and with maternal education and income adequacy together.

Several sensitivity analyses were conducted. The final adjusted models were re-run without marital status because psychosocial stress caused by living without a partner may lie on the causal pathway between low socioeconomic position and preterm birth.² Because of concerns about the quality of birth registration data in Ontario,²¹ the final adjusted national models were re-run without Ontario. Results were also examined at the regional level—in con-

sideration of provincial jurisdiction over education and health care services—and the Cochran Q test was used to test the homogeneity of the estimated risk ratios.²² Lastly, because maternal education and income were reported up to two years after the birth, the interaction between each measure and birth year in the final models was examined.

Results

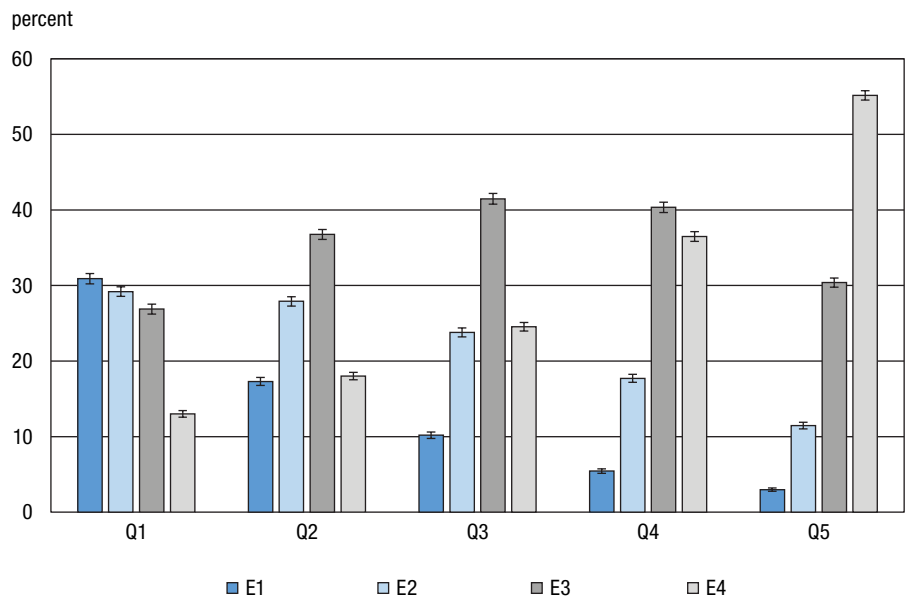
Maternal education was moderately correlated with income adequacy (Pearson $r = .40$). Mothers in the lowest income adequacy quintile tended to have less education (30% had less than secondary graduation; 13% had a university degree) than did those in the highest quintile (3% versus 55%) (Figure 1).

The overall crude rate of small-for-gestational-age birth was 8.2% (95% CI: 8.1 to 8.4%) (Table 1). Education and income gradients were apparent, with higher crude rates among children born to mothers with less education and lower income ($p < 0.001$ for trend for both). Furthermore, crude rates of small-for-gestational-age birth showed a distinct gradient by level of maternal education *within* income quintiles (Figure 2).

The overall crude rate of preterm birth was 6.4% (95% CI: 6.3% to 6.5%) (Table 1). Crude rates were higher at lower levels of maternal education ($p < 0.001$ for trend) and at the lowest income quintile. As was the case for small-for-gestational-age birth, crude rates of preterm birth showed a gradient by level of maternal education within income quintiles, but there was little evidence of a gradient across income quintiles (Figure 3).

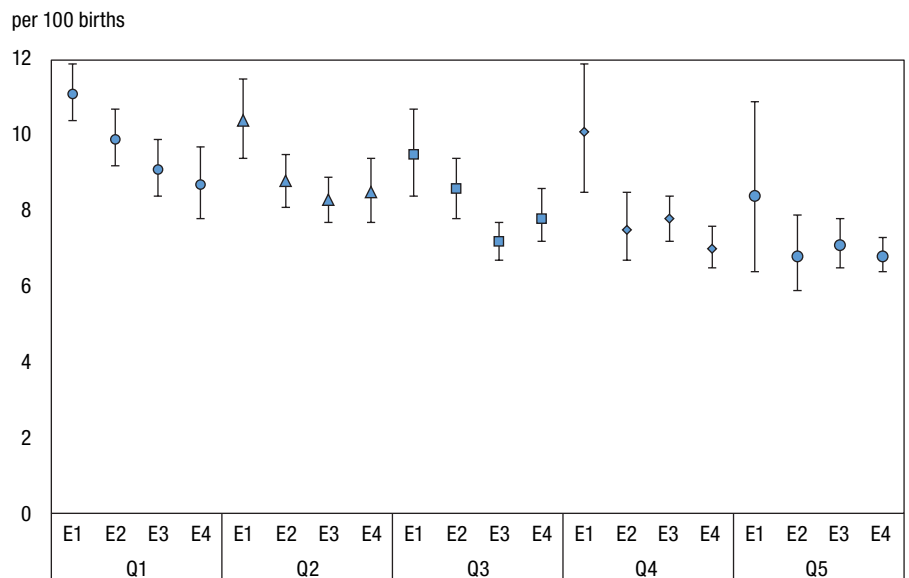
The relatively high risk of small-for-gestational-age birth among mothers with less than a university degree persisted when adjusting for covariates (Table 2). Compared with mothers who had a university degree, adjusted risk ratios for small-for-gestational-age birth were 1.55 (95% CI: 1.45 to 1.67) for those with less than secondary graduation; 1.22 (95% CI: 1.14 to 1.29) for those with secondary graduation; and 1.13 (95% CI:

Figure 1
Association between maternal education level and economic family income adequacy quintile, Canada, 2004 through 2006



I = 95% confidence interval
Notes: E1 = less than secondary graduation; E2 = secondary graduation; E3 = postsecondary diploma or certificate; E4 = university degree; Q1 = 1st (lowest) income adequacy quintile; Q2 = 2nd income adequacy quintile; Q3 = 3rd income adequacy quintile; Q4 = 4th income adequacy quintile; Q5 = 5th (highest) income adequacy quintile.
Source: 2006 Canadian Birth-Census Cohort database.

Figure 2
Crude rate per 100 births of small-for-gestational-age, by maternal education level within income adequacy quintiles, singleton live births, Canada, 2004 through 2006



I = 95% confidence interval
Notes: E1 = less than secondary graduation; E2 = secondary graduation; E3 = postsecondary diploma or certificate; E4 = university degree; Q1 = 1st (lowest) income adequacy quintile; Q2 = 2nd income adequacy quintile; Q3 = 3rd income adequacy quintile; Q4 = 4th income adequacy quintile; Q5 = 5th (highest) income adequacy quintile.
Source: 2006 Canadian Birth-Census Cohort database.

Table 1
Singleton live births and rate of small-for-gestational-age (SGA) birth and preterm birth (PTB), by selected characteristics, Canada, 2004 through 2006

Characteristics	Total singleton births				Small-for-gestational-age (less than 10th percentile)			Preterm (less than 37 weeks)		
	Number	%	95% confidence interval		Rate per 100 births	95% confidence interval		Rate per 100 births	95% confidence interval	
			from	to		from	to		from	to
Total	127,694	100.0	8.2	8.1	8.4	6.4	6.3	6.5
Child sex										
Male	65,324	51.4	51.2	51.5	8.4	8.2	8.6	6.9	6.7	7.1
Female	62,370	48.6	48.5	48.8	8.1	7.9	8.3	5.9	5.7	6.1
Child birth year										
2004	39,791	31.2	31.0	31.3	8.0	7.8	8.3	6.5	6.3	6.8
2005	63,815	50.2	50.1	50.4	8.3	8.0	8.5	6.4	6.2	6.6
2006	24,088	18.6	18.5	18.7	8.5	8.1	8.9	6.3	6.0	6.7
Maternal age group										
Younger than 20	6,162	4.0	4.0	4.1	10.8	9.8	11.9	8.4	7.6	9.3
20 to 24	21,162	16.2	16.1	16.3	9.6	9.1	10.1	6.5	6.1	6.9
25 to 29	39,353	31.1	30.9	31.2	8.1	7.8	8.4	6.0	5.7	6.3
30 to 34	39,386	31.5	31.3	31.6	7.4	7.2	7.7	6.1	5.8	6.3
35 to 39	18,033	14.3	14.2	14.4	8.1	7.7	8.5	6.7	6.3	7.1
40 or older	3,598	2.9	2.9	3.0	8.4	7.4	9.5	9.8	8.8	10.9
Live birth order										
First	56,055	46.5	46.2	46.8	10.5	10.2	10.7	7.3	7.1	7.6
Second	44,301	35.3	35.0	35.5	6.2	6.0	6.5	5.2	5.0	5.5
Third or higher	27,338	18.3	18.0	18.5	6.4	6.1	6.8	6.3	6.0	6.7
Region of birth										
Atlantic	7,928	6.3	6.3	6.4	8.0	7.4	8.7	6.4	5.9	7.1
Quebec	27,724	22.1	22.0	22.2	8.2	7.9	8.5	6.2	5.9	6.5
Ontario	45,823	39.2	39.0	39.3	8.5	8.3	8.8	6.2	6.0	6.5
Manitoba	7,989	4.2	4.2	4.3	8.7	7.9	9.5	7.3	6.6	8.0
Saskatchewan	6,059	3.5	3.5	3.6	8.0	7.2	8.9	6.2	5.5	7.0
Alberta	16,379	12.3	12.2	12.4	8.6	8.1	9.1	7.4	7.0	7.9
British Columbia	14,204	12.0	11.9	12.1	7.2	6.8	7.7	5.9	5.4	6.3
Territories	1,588	0.4	0.4	0.4	5.6	4.2	7.5	7.0	5.9	8.3
Maternal ethnicity										
Caucasian	87,308	73.8	73.5	74.1	7.2	7.1	7.4	6.1	5.9	6.2
Indigenous	17,285	5.9	5.6	6.2	6.4	5.8	6.9	8.2	7.6	8.8
Black	3,824	3.4	3.3	3.5	11.5	10.5	12.6	9.2	8.2	10.3
East Asian	4,945	4.3	4.2	4.4	9.8	9.0	10.7	5.5	4.9	6.1
Southeast Asian	3,211	2.9	2.7	3.0	14.4	13.1	15.8	9.3	8.3	10.4
South Asian	6,896	6.1	6.0	6.3	15.9	15.1	16.9	7.0	6.4	7.7
Other	4,225	3.7	3.5	3.8	9.2	8.4	10.1	5.7	4.9	6.5
Maternal marital status										
Single	16,933	11.6	11.4	11.8	10.8	10.3	11.4	8.0	7.5	8.5
Common-law	31,077	23.3	23.0	23.5	8.4	8.0	8.7	6.7	6.4	7.0
Married	79,684	65.1	64.9	65.4	7.7	7.6	7.9	6.0	5.8	6.2
Maternal education†										
Less than secondary graduation	22,514	13.4	13.1	13.6	10.5	10.0	11.0	7.7	7.3	8.1
Secondary graduation	27,197	22.0	21.8	22.3	8.6	8.3	9.0	6.6	6.3	7.0
Postsecondary diploma or certificate	42,778	35.2	34.8	35.5	7.8	7.6	8.1	6.5	6.2	6.7
University degree	35,205	29.5	29.2	29.7	7.4	7.1	7.7	5.6	5.3	5.9
Maternal economic family income adequacy quintile‡										
1 (lowest)	28,111	20.1	19.8	20.3	9.9	9.5	10.3	7.1	6.7	7.4
2	25,482	19.9	19.7	20.2	8.8	8.5	9.2	6.3	6.0	6.7
3	24,807	19.9	19.7	20.2	7.9	7.6	8.3	6.2	5.9	6.6
4	24,617	20.1	19.8	20.3	7.6	7.2	7.9	6.1	5.7	6.4
5 (highest)	24,677	20.0	19.8	20.2	7.0	6.6	7.3	6.3	6.0	6.6

... not applicable

† test for trend significant for rate of SGA birth and PTB at $p = 0.00$

‡ test for trend significant for rate of SGA birth at $p = 0.00$

Notes: Single mothers were those who were not married or living common-law on Census Day. All percentage and rate estimates are weighted. The confidence interval are based on variance estimates produced using the cohort bootstrap weights.

Source: 2006 Canadian Birth-Census Cohort database.

1.06 to 1.19) for those with a postsecondary diploma or certificate (Figure 4). These estimates were slightly attenuated when income adequacy was taken into account (Table 2, adjusted model 2).

The income gradient in the risk of small-for-gestational age birth persisted after covariate adjustment. Compared with mothers in the highest income adequacy quintile, adjusted risk ratios were 1.31 (95% CI: 1.22 to 1.41) for those in the lowest quintile; 1.25 (95% CI: 1.17 to 1.34) for those in the 2nd quintile; 1.16 (95% CI: 1.08 to 1.23) for those in the 3rd; and 1.12 (95% CI: 1.04 to 1.20) in the 4th (Table 2, adjusted model 1). Accounting for maternal education only slightly attenuated these associations (Figure 4).

An increased risk of preterm birth for mothers with less than a university degree persisted when adjusting for covariates (Table 2, adjusted model 1). Relative to university degree-holders, adjusted risk ratios were 1.40 (95% CI: 1.28 to 1.52) for mothers with less than secondary graduation; 1.24 (95% CI: 1.15 to 1.33) for those with secondary graduation; and 1.20 (95% CI: 1.13 to 1.28) for those with a postsecondary diploma or certificate (Figure 4). Accounting for income adequacy had little impact on these associations (Table 2, adjusted model 2). Unlike small-for-gestational-age birth, the slightly increased crude risk of preterm birth among mothers in the lowest income quintile did not persist after covariate adjustment (Figure 4).

Results of the sensitivity analyses were very similar to the main findings. The patterns of risk ratios across categories were largely unaffected when marital status was removed from the models (data not shown). Results were also similar when stratifying by Ontario versus all other provinces and territories (data not shown). Adjusting for covariates, some regional variation in the magnitude of the increased risk of small-for-gestational-age birth ($p = .00$ for heterogeneity) and preterm birth ($p = .06$ for heterogeneity) was observed for mothers with less than secondary graduation. However, regions differed little in their risk of small-for-gestational-age birth across income adequacy quintiles ($p = .68$ for heterogeneity, lowest versus

highest quintile), and the lack of association between income adequacy and preterm birth at the national level when adjusting for covariates was observed across the regions. Interactions between birth year and education and between

birth year and income quintile were not statistically significant for small-for-gestational-age birth ($p = .29$ and $p = .22$, respectively) or for preterm birth ($p = .86$ and $p = .14$, respectively).

Discussion

In Canada, small-for-gestational-age birth was independently and inversely associated with both maternal education and income adequacy, while preterm birth was inversely associated only with maternal education. These relationships remained when factors including maternal age, ethnicity, and marital status were taken into account.

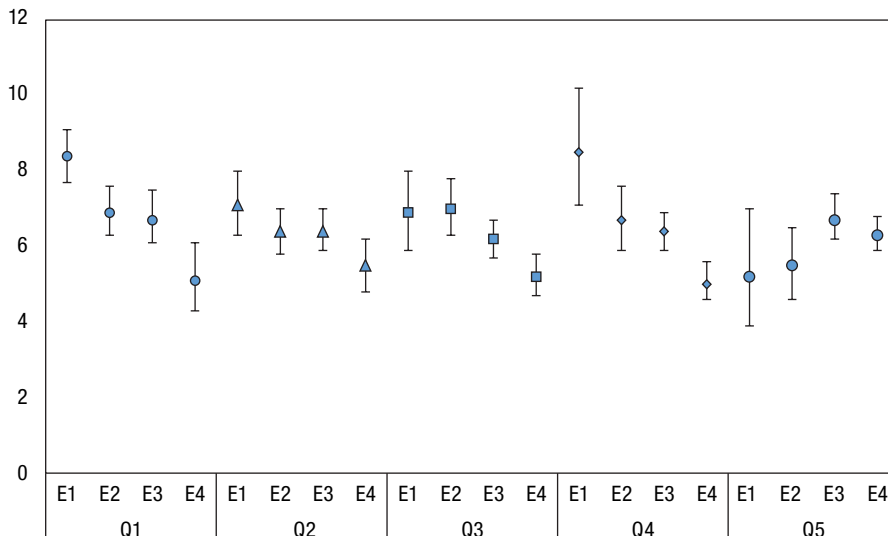
The association between maternal socioeconomic position and the risk of small-for-gestational-age and preterm birth is consistent with other studies—Canadian and non-Canadian.¹ Furthermore, the association of both birth outcomes with maternal education, regardless of income adequacy, confirms the importance of education as a determinant of perinatal health.²³

Some authors have cautioned against examining more than one socioeconomic factor simultaneously because of the risk of misinterpreting the importance of one measure versus another.²⁴ Other researchers argued that income and education are not interchangeable, and that they should not be used as proxies for each other.²⁵

The results of this study provide empirical support for the latter. Maternal education was only moderately correl-

Figure 3
Crude rate per 100 births of preterm birth, by maternal education level within income adequacy quintiles, singleton live births, Canada, 2004 through 2006

per 100 births



I = 95% confidence interval

Notes: E1 = less than secondary graduation; E2 = secondary graduation; E3 = postsecondary diploma or certificate; E4 = university degree; Q1 = 1st (lowest) income adequacy quintile; Q2 = 2nd income adequacy quintile; Q3 = 3rd income adequacy quintile; Q4 = 4th income adequacy quintile; Q5 = 5th (highest) income adequacy quintile.

Source: 2006 Canadian Birth-Census Cohort database.

Table 2

Crude and adjusted risk ratios of association between maternal education level and economic family income adequacy quintile and small-for-gestational-age (SGA) birth and preterm birth (PTB), singleton live births, Canada, 2004 through 2006

	Highest level of maternal education [†]									Maternal economic family income adequacy quintile [‡]											
	Less than secondary graduation			Secondary graduation			Postsecondary diploma or certificate			1st (lowest)			2nd			3rd			4th		
	95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval		
	Risk ratio	from	to	Risk ratio	from	to	Risk ratio	from	to	Risk ratio	from	to	Risk ratio	from	to	Risk ratio	from	to	Risk ratio	from	to
SGA birth																					
Crude	1.41	1.33	1.51	1.17	1.10	1.24	1.06	1.00	1.12	1.42	1.34	1.52	1.27	1.19	1.35	1.14	1.06	1.22	1.09	1.02	1.17
Adjusted model 1 [§]	1.55	1.45	1.67	1.22	1.14	1.29	1.13	1.06	1.19	1.31	1.22	1.41	1.25	1.17	1.34	1.16	1.08	1.23	1.12	1.04	1.20
Adjusted model 2 ^{††}	1.48	1.37	1.59	1.17	1.10	1.25	1.10	1.04	1.16	1.22	1.13	1.31	1.18	1.11	1.27	1.11	1.04	1.19	1.09	1.02	1.17
PTB																					
Crude	1.37	1.27	1.48	1.18	1.10	1.27	1.15	1.08	1.23	1.12	1.05	1.21	1.01	0.93	1.08	0.99	0.91	1.06	0.96	0.89	1.03
Adjusted model 1 [§]	1.40	1.28	1.52	1.24	1.15	1.33	1.20	1.13	1.28	1.08	0.99	1.17	1.03	0.96	1.11	1.03	0.95	1.11	0.99	0.92	1.07
Adjusted model 2 ^{††}	1.40	1.28	1.53	1.24	1.15	1.34	1.21	1.13	1.29	1.00	0.92	1.09	0.97	0.90	1.04	0.97	0.90	1.05	0.96	0.89	1.03

[†] university degree is reference group

[‡] 5th (highest) income adequacy quintile is reference group

[§] adjusted for child sex, child birth year, region of birth, age group of mother, maternal ethnicity (3-category), birth order, marital status, and either highest level of maternal education or income adequacy quintile

^{††} adjusted for child sex, child birth year, region of birth, age group of mother, maternal ethnicity (3-category), birth order, marital status, and both highest level of maternal education and income adequacy quintile

Source: 2006 Canadian Birth-Census Cohort database.

ated with income adequacy. As well, the adjusted risk of small-for-gestational-age birth or preterm birth by level of education did not substantially change when income adequacy was included as a covariate. This suggests that the mechanism by which maternal education is associated with these outcomes is likely not through income, nor does income replace education as a meaningful measure of socioeconomic position. Furthermore, an increased risk of small-for-gestational-age birth was observed at lower levels of maternal education *and* also at lower quintiles of income adequacy, suggesting that both education and income are important. Although this study could not provide the reason for this finding, it is consistent with social science theory suggesting that education and income can be regarded as overlapping, but distinct, elements of the multidimensional concept of socioeconomic position.²⁶

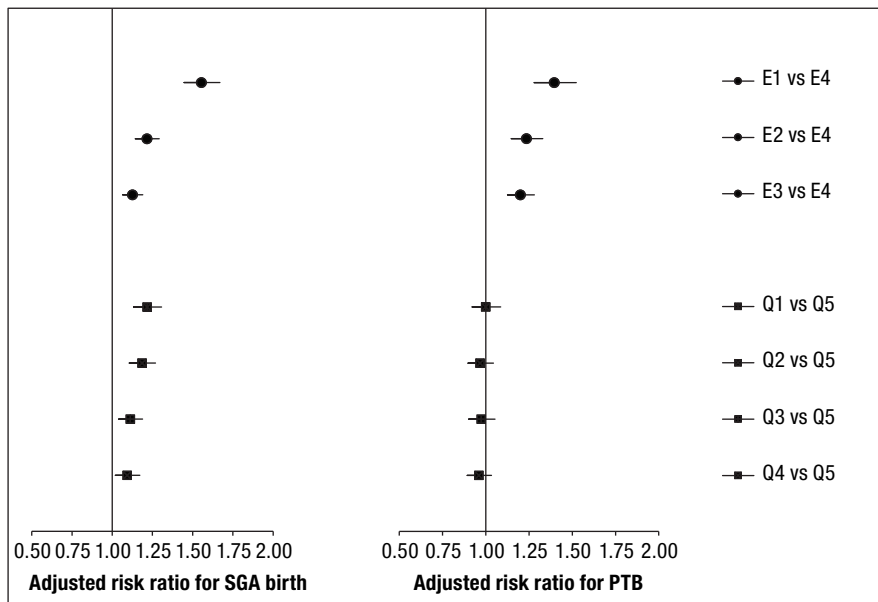
The few studies that examined maternal education and income simultaneously differed in design, target population, and choice of perinatal outcome. In an analysis of a cohort of singleton births in England, Scotland, Northern Ireland, and Wales,⁷ Snelgove and Murphy found that the crude risk of preterm birth was inversely associated with both education and income, but that adjusting for psychosocial indicators, including household employment and social support, attenuated the associations. In the United States, Reagan and Salsberry included maternal education and family income in a 2005 study of very and moderately preterm births; the results suggested a positive association between maternal education and moderately preterm birth (33 to 36 weeks' gestation).⁸ Nonetheless, they cautioned that their study sample underrepresented births to mothers younger than 21 and

older than 34. Pevalin et al. examined preterm and small-for-gestational-age birth in 1994 in Canada.⁹ They found a significant association between maternal education and these outcomes even after adjusting for income adequacy, but no association between income adequacy and either outcome. However, the analysis was based on self-reported, retrospective data pertaining to infants younger than 24 months and excluded preterm and small-for-gestational-age infants and children who had died.

The present study found a significant gradient in the risk of small-for-gestational-age birth by income adequacy, independent of maternal education, a pattern reported in other countries with state-funded health care systems.²⁷ In a study of prenatal health care use in high-income countries, including Canada, Feijen-de Jong et al. observed that lower education and lower income were each associated with late or inadequate use of prenatal care.²⁸ Even so, the pathway from socioeconomic disadvantage to increased risk of small-for-gestational-age birth may not be mediated by inadequate prenatal care. Factors such as smoking and nutrition, which could not be examined in the present study, may be more important.²

The analysis of the 2006 Canadian Birth-Census Cohort offers little evidence of either a threshold effect or an inverse gradient between income adequacy and preterm birth. A plausible explanation relates to an increase over time in the percentage of iatrogenic (medically indicated) versus spontaneous preterm births.²⁹ Joseph et al. suggest that this trend reduced the income gradient because iatrogenic preterm birth is more strongly associated with older age,¹⁴ and the prevalence of births among older women, especially those of higher socioeconomic position, has risen.³⁰

Figure 4
Adjusted risk ratios and 95% confidence intervals for small-for-gestational-age (SGA) birth and preterm birth (PTB), by highest level of maternal education and economic family income adequacy quintile, singleton live births, Canada, 2004 through 2006



I = 95% confidence interval

Notes: E1 = less than secondary graduation; E2 = secondary graduation; E3 = postsecondary diploma or certificate; E4 = university degree; Q1 = 1st (lowest) income adequacy quintile; Q2 = 2nd income adequacy quintile; Q3 = 3rd income adequacy quintile; Q4 = 4th income adequacy quintile; Q5 = 5th (highest) income adequacy quintile. Estimates for maternal education based on model that adjusted for child sex, child birth year, region of birth, age group of mother, maternal ethnicity (3-category), birth order, and marital status. Estimates for income adequacy quintiles adjusted for child sex, child birth year, region of birth, age group of mother, maternal ethnicity (3-category), birth order, marital status, and maternal education.

Source: 2006 Canadian Birth-Census Cohort database.

Strengths and limitations

A major strength of this study is the large dataset that permitted analysis of maternal education and income at the national level. The study controlled for several

other risk factors for small-for-gestational-age birth and preterm birth, which made it possible to examine independent associations of maternal education and income with these outcomes. Regional patterns in the unadjusted risk ratios (data not shown) are consistent with results from Quebec and Nova Scotia.^{11,13} The findings confirmed that education and income are not interchangeable measures of socioeconomic position, particularly with respect to the risk of small-for-gestational-age birth.

The results should be considered in the context of several limitations. Information was not available about potential mediating factors such as maternal behaviours (smoking and alcohol use) and other risk factors (height, pre-pregnancy body mass index, gestational weight gain, gestational diabetes, and hypertension). Although maternal education and income

are well-established socioeconomic markers, the possibility of residual confounding cannot be discounted, given that other aspects or measures of socioeconomic position were not included in the study.³¹

Paternal education was not included as a marker of socioeconomic position. An earlier analysis based on the same dataset found that while paternal education was independently associated with small-for-gestational-age birth and preterm birth, it did not attenuate the independent association between maternal education and these outcomes, nor were the risk ratios associated with paternal versus maternal education substantially different.³²

Maternal occupation was not examined in the present study because the employment data pertained to the week leading up to the 2006 Census Day.

Mothers in the study had given birth between 2004 and 2006; consequently, a substantial percentage of them were not in the labour force during that reference week.

Conclusion

The risk of small-for-gestational-age birth was associated with both maternal education and income adequacy, and the risk of preterm birth was associated with maternal education. The mechanisms through which socioeconomic position is associated with perinatal health disparities are complex. Future research might examine whether maternal education and income operate via different causal pathways, for example, through health behaviour in general, behaviours specific to pregnancy, or stress. ■

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