

# What Factors Are Associated with Poor Developmental Attainment in Young Canadian Children?

Teresa To, PhD<sup>1-6</sup>

Astrid Guttmann, MDCM, MSc, FRCPC<sup>1,3,4</sup>

Paul T. Dick, MDCM, MSc, FRCPC<sup>1,3-6</sup>

Jay D. Rosenfield, MD, Med, FRCPC<sup>3,5,7,8</sup>

Patricia C. Parkin, MD, FRCPC<sup>1,3,5,6</sup>

Hongmei Cao, MSc<sup>1,2</sup>

Tatiana N. Vydykhan, MSc<sup>1</sup>

Marjan Tassoudji, MSc<sup>1</sup>

Jennifer K. Harris, MSc<sup>1</sup>

## ABSTRACT

**Background:** This study was undertaken to determine the association between poor developmental attainment (PDA) and biological, home environment and socio-demographic factors in a population-based sample of Canadian children.

**Methods:** Cross-sectional data from two cycles (1994/95 and 1996/97) of the National Longitudinal Survey of Children and Youth were used. Children aged 1-5 years were included. PDA was defined as  $\leq 15$ th percentile for motor and social developmental skills (1-3 year olds) or Peabody Picture Vocabulary Test (4-5 year olds). Multiple logistic regression was used.

**Results:** The proportion of children with PDA varies across Canada, between males and females, and by age. Among 1 year olds in Cycle I, having a low birthweight (OR=3.3; 95% CI: 2.1-5.2), being male (OR=1.6; 95% CI: 1.2-2.2) and having a mother who is an immigrant (OR=1.6; 95% CI: 1.1-2.2) increased the odds of PDA. Similar results were observed in Cycle II. Among children aged 4-5 years in Cycle II, having a mother who is an immigrant (OR=5.3; 95% CI: 4.1-6.9) and a mother with low educational attainment (OR=2.8; 95% CI: 2.1-3.9) increased the odds of PDA. Low income was a significant predictor of PDA across all age groups.

**Interpretation:** The strong and consistent associations with living in a low-income household, having a mother with low educational attainment or a mother who is an immigrant highlight the need for targeting developmental assessments and services to this population.

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

1. Population Health Sciences Program, Research Institute, The Hospital for Sick Children, Toronto, ON
2. Department of Public Health Sciences, University of Toronto
3. Department of Paediatrics, Faculty of Medicine, University of Toronto
4. The Institute for Clinical Evaluative Sciences, Toronto
5. Division of Paediatric Medicine and the Paediatric Outcomes Research Team, The Hospital for Sick Children, Toronto
6. Department of Health Policy, Management and Evaluation, University of Toronto
7. Brain and Behavioural Program, Research Institute, The Hospital for Sick Children, Toronto
8. Division of Neurology, The Hospital for Sick Children, Toronto

**Correspondence and reprint requests:** Dr. Teresa To, Population Health Sciences Program, Research Institute, The Hospital for Sick Children, 555 University Avenue, Toronto, ON M5G 1X8, E-mail: teresa.to@sickkids.ca

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Developmental disorders in children range from subtle learning disabilities to severe cognitive impairment. Although biological factors are the most obvious risk factors, psychosocial factors adversely affect cognitive and social/emotional competence and exert a greater influence after the first few years of life.<sup>1,2</sup> In Canada, children with biological risk factors receive the most consistent screening and early referral to developmental intervention programs. However, children with developmental disorders lacking obvious risk markers may not accrue the benefit of early intervention.

In 2000, an early childhood development initiative was developed.<sup>3</sup> Although this initiative represents significant investments towards programs designed to improve developmental outcomes in children, the challenge lies in ensuring a comprehensive approach to identifying children with early signs of developmental problems who would benefit from early intervention programs.<sup>3</sup> This comprehensive approach should include better targeting of screening and intervention programs for children at risk of developmental problems. Development of a "high-risk" profile from biological, social, and environmental risk factors will ensure that those children who may benefit from early intervention are identified. The Canadian National Longitudinal Survey of Children and Youth (NLSCY) provides the opportunity to study developmental disorders in a population-based sample.<sup>3</sup> This study uses data from the first two cycles of the NLSCY to assess factors associated with poor developmental attainment (PDA).

## METHODS

Cross-sectional data from the NLSCY Cycle I (C1), 1994/95 and Cycle II (C2), 1996/97 were used in this study. The NLSCY is a prospective longitudinal survey designed to measure child development, health and well-being. A full description of the NLSCY is available elsewhere ([www.statcan.ca/english/freepub/89F0078XIE/free.htm](http://www.statcan.ca/english/freepub/89F0078XIE/free.htm)).<sup>4,5</sup> Interviewers went to households and administered standardized questionnaires to the person most knowledgeable about the child. Children aged 1-5 years were included in our study.

**TABLE I**  
**Age- and Sex-specific Rates of PDA, NLSCY Cycles I and II**

Characteristics	Cycle I (N=1,736,900)*			p-value <sup>§</sup>	Cycle II (N=1,726,900) <sup>†</sup>			p-value <sup>§</sup>
	Total	PDA	(%) <sup>‡</sup>		Total	PDA	(%) <sup>‡</sup>	
Total	1,718,600	253,500	(14.8)		1,726,800	232,400	(13.5)	
Sex								
Male	883,500	155,000	(17.5)	<0.001	874,200	146,900	(16.8)	<0.001
Female	853,400	102,700	(12)		852,700	85,600	(10)	
Age Groups								
1 year	277,200	41,900	(15.1)	<0.05	272,900	34,300	(12.6)	<0.001
2-3 years	754,200	102,400	(13.6)		739,200	79,200	(10.7)	
4-5 years	705,500	113,300	(16.1)		714,800	119,000	(16.7)	
Male								
Age 1 year	142,800	25,300	(17.7)	NS	138,000	18,600	(13.5)	NS
2-3 years	386,400	70,300	(18.2)		379,900	58,800	(15.5)	
4-5 years	354,300	59,300	(16.7)		356,200	69,500	(19.5)	
Female								
Age 1 year	134,400	16,600	(12.3)	NS	134,900	15,700	(11.6)	NS
2-3 years	367,800	32,100	(8.7)		359,300	20,400	(5.7)	
4-5 years	351,100	54,000	(15.4)		358,600	49,600	(13.8)	

PDA = poor developmental attainment; NLSCY = National Longitudinal Survey of Children and Youth; NS = not significant (at  $p < 0.05$ ).

\* The number of children is weighted, and values are rounded to the nearest 100; the unweighted  $n = 8858$ .

<sup>†</sup> The number of children is weighted, and values are rounded to the nearest 100; the unweighted  $n = 7955$ .

<sup>‡</sup> Percentages are based on unrounded numbers.

<sup>§</sup> Based on overall chi-square test using normalized weights.

Developmental attainment was measured by motor and social developmental (MSD) skills in children aged 1-3 years, and readiness to learn using the revised Peabody Picture Vocabulary Test (PPVT-R) in 4-5 year olds. The MSD scale assesses motor, social and cognitive development and consists of 15 age-appropriate items that parents answer according to their observation of the child.<sup>6-8</sup> The PPVT-R assesses school readiness based on receptive (hearing) vocabulary and consists of 175 items; the child nonverbally selects one of four pictures that best describes each word's meaning.<sup>6,9</sup>

Statistics Canada defines PDA at a level equivalent to or below the 15<sup>th</sup> percentile for MSD or PPVT-R.<sup>4</sup> That is, if a child is among the 15% of children with the least developed motor and social skills or least readiness to learn for their age group, they are classified as having PDA (developing unusually slowly). This definition is consistent with that used in other studies.<sup>6-8,10</sup>

Covariates under consideration were grouped as child/biological, socio-demographic and home environment. Child/biological factors included: prematurity (<37 weeks gestation), low birthweight (<2500 grams), sex, and measures of health status. Child's health was based on their mother's rating. Child hospitalization in the previous year was a dichotomous variable. Limited activity was based on the mother's report of the child having any long-term conditions or health problems

**TABLE II**  
**Crude Provincial Rates of PDA Among Children Aged 1 to 5 Years, NLSCY Cycles I and II**

Province	Cycle I (N=1,736,900)*			Cycle II (N=1,726,900) <sup>†</sup>		
	Total	PDA	(%) <sup>‡</sup>	Total	PDA	(%) <sup>‡</sup>
Newfoundland	31,900	4,100	(12.9) <sup>§</sup>	29,500	3,900	(13.2) <sup>§</sup>
Prince Edward Island	8,600	1,000	(11.9) <sup>§</sup>	8,000	800	(9.5) <sup>§</sup>
Nova Scotia	55,200	6,400	(11.6) <sup>§</sup>	47,900	4,100	(8.7) <sup>§</sup>
New Brunswick	43,100	6,500	(15.1) <sup>§</sup>	41,000	6,300	(15.4) <sup>§</sup>
Quebec	423,600	58,400	(13.8)	415,000	55,600	(13.4)
Ontario	654,400	99,000	(15.1)	679,200	91,600	(13.5)
Manitoba	64,800	11,000	(17)	63,900	9,400	(14.6) <sup>§</sup>
Saskatchewan	58,800	7,400	(12.6)	59,100	8,100	(13.8)
Alberta	175,700	28,100	(16)	169,100	22,700	(13.4)
British Columbia	202,500	31,400	(15.5)	214,100	29,900	(14)
Total <sup>  </sup>	1,718,600	253,500	(14.8)	1,726,800	232,400	(13.5)

PDA = poor developmental attainment; NLSCY = National Longitudinal Survey of Children and Youth.

\* The number of children is weighted, and values are rounded to the nearest 100; the unweighted  $n = 8858$ .

<sup>†</sup> The number of children is weighted, and values are rounded to the nearest 100; the unweighted  $n = 7955$ .

<sup>‡</sup> Percentages are based on unrounded numbers.

<sup>§</sup> The coefficient of variation is between 16.6% and 33.3% which is considered marginal by Statistics Canada.<sup>5</sup>

<sup>||</sup> Refers only to children living in one of the 10 provinces.

which prevented their participation in any activities.

The home environment was characterized by the presence of siblings, maternal depression and maternal health. Maternal symptoms of depression were determined using an abbreviated version of the Centre for Epidemiological Studies-Depression (CES-D) Scale.<sup>11</sup> Moderate to severe symptoms of depression was defined as a score  $\geq 13$ .<sup>12</sup> Maternal health status was based on her self-rating of health.

Socio-demographic variables included: low income adequacy (LIA), low maternal education ( $\leq$  high school), maternal employment, and maternal immigrant

status. Income adequacy was determined using Statistics Canada's derived variable of income adjusting for household size. The two lowest categories were combined to indicate LIA.<sup>13</sup> Current maternal employment was a dichotomous variable. Maternal immigrant status was defined as ever having immigrated to Canada.

### Statistical analysis

The prevalence of PDA in each cycle was assessed to generate gender-, age- and province-specific rates. Analyses were restricted to children whose biological mother provided the information.

TABLE III

## Age-specific Description of Correlates of PDA Among Children Aged 1 to 5 Years\*, NLSCY Cycle 1

Covariates	1 Year Olds <sup>†</sup>		2-3 Year Olds <sup>†</sup>		4-5 Year Olds <sup>†</sup>		All Ages Combined <sup>†</sup>	
	No PDA (N=206,300) %	With PDA (N=36,800) %	No PDA (N=580,400) %	With PDA (N=86,900) %	No PDA (N=534,000) %	With PDA (N=100,600) %	No PDA (N=1,320,700) %	With PDA (N=224,400) %
Child/biological characteristics								
Male sex	49.9	60.1 <sup>§</sup>	48.9	67.3 <sup>  </sup>	50.1	52.1	49.5	59.3 <sup>  </sup>
Good/fair/bad health	11.9	21.5 <sup>§</sup>	9.5	12.1 <sup>¶</sup>	11.0	21.8 <sup>  </sup>	10.5	17.9 <sup>  </sup>
Limited activity		SU <sup>**</sup>	2.0	5.8 <sup>¶  </sup>	2.8	4.9 <sup>¶‡</sup>	2.4	5.5 <sup>¶  </sup>
Hospitalization in previous year	10.5	15.0 <sup>¶‡</sup>	6.1	7.5 <sup>¶</sup>	4.9	5.0 <sup>¶</sup>	6.3	7.6
Prematurity	8.7	18.6 <sup>¶  </sup>	9.7	15.0 <sup>¶  </sup>		NA	9.4	16.1 <sup>  </sup>
Low birthweight	5.2	13.4 <sup>¶  </sup>	4.6	11.7 <sup>¶  </sup>		NA	4.8	12.2 <sup>  </sup>
Home environment characteristics								
Excellent/very good maternal health	79.8	76.0	78.7	74.1 <sup>§</sup>	78.9	63.8 <sup>  </sup>	78.9	69.8 <sup>  </sup>
Maternal symptoms of depression		SU <sup>**</sup>	9.5	17.7 <sup>  </sup>	6.8	19.1 <sup>  </sup>	8.4	17.4 <sup>  </sup>
Single child	42.5	34.2 <sup>¶‡</sup>	27.1	22.9	14.6	9.5 <sup>¶§</sup>	24.5	18.8 <sup>  </sup>
Socio-demographic characteristics								
Low income adequacy	20.6	23.0 <sup>¶</sup>	19.7	28.7 <sup>  </sup>	16.3	33.5 <sup>  </sup>	18.5	29.9 <sup>  </sup>
Low maternal education	17.6	19.7 <sup>¶</sup>	15.0	21.0 <sup>§</sup>	12.5	28.6 <sup>  </sup>	14.4	24.2 <sup>  </sup>
Mother currently working	54.3	48.1	57.0	45.9 <sup>  </sup>	58.0	41.7 <sup>  </sup>	57.0	44.4 <sup>  </sup>
Mother or father is an immigrant	21.1	27.6 <sup>¶‡</sup>	19.9	25.6 <sup>§</sup>	18.6	40.6 <sup>  </sup>	19.5	32.7 <sup>  </sup>
Mother is an immigrant	17.3	24.3 <sup>¶‡</sup>	14.0	21.6 <sup>  </sup>	13.6	34.1 <sup>  </sup>	14.4	27.7 <sup>  </sup>

PDA = poor developmental attainment; NLSCY = National Longitudinal Survey of Children and Youth; NA = not applicable, variable was not measured in that age group; SU = Suppressed.

\* Restricted to children whose biological mother provided risk factor information; unweighted n = 8029.

<sup>†</sup> The number of children is weighted, and values are rounded to the nearest 100; percentages are adjusted for missing data.

<sup>‡</sup> p<0.05, based on Pearson chi-square test using normalized weights.

<sup>§</sup> p<0.01, based on Pearson chi-square test using normalized weights.

<sup>||</sup> p<0.001, based on Pearson chi-square test using normalized weights.

<sup>¶</sup> The coefficient of variation is between 16.6% and 33.3% which is considered marginal by Statistics Canada.<sup>5</sup>

<sup>\*\*</sup> The coefficient of variation is more than 33.3% which is considered unacceptable by Statistics Canada.<sup>5</sup>

Characteristics of children were compared using the Pearson chi-square statistic. Multivariable logistic regression using backward elimination techniques was conducted to evaluate the association between covariates and PDA. Only statistically significant variables (p<0.05) or known confounders such as sex and LIA were permitted into the final models. The correlations between independent variables were also examined and none greater than 0.2 were found. Additionally, the interaction between LIA and maternal symptoms of depression was explored and found not to be significant. The Hosmer and Lemeshow test was used to ascertain the goodness-of-fit of models. All statistical analyses were stratified by age group.

Statistics Canada's data publication guidelines were followed throughout the analyses.<sup>4</sup> Sample weights<sup>4</sup> were applied so that the estimates could be representative of the Canadian population of children aged 1-5 years. Coefficients of variation were used to determine the quality of the estimates on the basis of sampling error.<sup>4</sup> Estimates with coefficients of variation greater than 33.3% were considered unacceptable<sup>4</sup> and were suppressed. For tests of significance, standardized sample weights were used to preserve the original sample size, thereby avoiding an overestimation of significance. The SAS statistical package

(SAS version 8.0, Cary, North Carolina, USA) was used.

## RESULTS

A weighted sample of 1,736,900 children in C1 and 1,726,900 children in C2 were included in this study. A greater proportion of boys than girls had PDA (17.5% vs. 12.0% p<0.001 in C1, 16.8% vs. 10.0% p<0.001 in C2, Table I). In both cycles, children aged 4-5 years had the highest rates of PDA.

Table II shows the rates of PDA by province. There was some variation in the ranking of the provinces between the two cycles. In both cycles, Manitoba, New Brunswick, and British Columbia maintained higher than average rates of PDA. Manitoba had the highest rate in C1 (17.0%) and the second highest rate in C2 (14.6%). Newfoundland, PEI, and Nova Scotia maintained lower than average rates of PDA, with Nova Scotia having the lowest rates (11.6% in C1 and 8.7% in C2). Alberta had the largest shift in rank, from having the second highest rate of PDA in C1 (16.0%) to the fourth lowest in C2 (13.4%), though the actual percent change was small. None of the differences between cycles reached statistical significance.

Tables III and IV show the age-specific descriptions of correlates of PDA in C1 and

C2, respectively. Children with PDA were more likely to have poor health (17.9% vs. 10.5% p<0.001 in C1, 15.0% vs. 11.2% p<0.01 in C2), have a mother with symptoms of depression (17.4% vs. 8.4% p<0.001 in C1, 13.7% vs. 9.2% p<0.001 in C2) and less likely to have a mother in excellent/very good health (69.8% vs. 78.9% p<0.001 in C1, 72.1% vs. 76.4% p<0.01 in C2), than children without PDA. In both cycles, the association of these maternal characteristics was stronger in older children. The socio-demographic characteristics of the families of children with PDA also differed. These children were more likely to come from a household with LIA (29.9% vs. 18.5% p<0.001 in C1, 29.8% vs. 17.9% p<0.001 in C2), have a mother with low education (24.2% vs. 14.4% p<0.001 in C1, 20.4% vs. 10.8% p<0.001 in C2) and have an immigrant mother (32.7% vs. 19.5% p<0.001 in C1, 33.4% vs. 18.3% p<0.01 in C2) than children without PDA. For most socio-demographic factors, the differences were more pronounced in older children.

Table V presents the adjusted odds ratios (OR) for PDA stratified by age group and cycle. For children aged 1-5 years, the following factors were associated with PDA in both cycles: being a boy, having activity limitations, belonging to a household with LIA, or having a mother who is an immi-

TABLE IV

## Age-specific Description of Correlates of PDA Among Children Aged 1 to 5 Years\*, NLSCY Cycle II

Covariates	1 Year Olds <sup>†</sup>		2-3 Year Olds <sup>†</sup>		4-5 Year Olds <sup>†</sup>		All Ages Combined <sup>†</sup>	
	No PDA (N=207,700) %	With PDA (N=30,400) %	No PDA (N=598,900) %	With PDA (N=68,100) %	No PDA (N=542,300) %	With PDA (N=109,900) %	No PDA (N=1,348,900) %	With PDA (N=208,300) %
Child/biological characteristics								
Male sex	50.1	54.3 <sup>¶</sup>	48.1	76.0 <sup>¶¶</sup>	47.6	58.0 <sup>¶¶</sup>	48.2	63.3 <sup>¶¶</sup>
Good/fair/bad health	11.3	13.8 <sup>¶</sup>	11.3	19.6 <sup>¶¶</sup>	10.9	12.4 <sup>¶</sup>	11.2	15.0 <sup>¶</sup>
Limited activity		SU <sup>**</sup>	1.8	6.5 <sup>¶</sup>		SU <sup>**</sup>	2.3	3.9 <sup>¶</sup>
Hospitalization in previous year	9.0	15.1 <sup>¶¶</sup>	6.0	8.1	4.8	5.8 <sup>¶</sup>	6.0	7.9 <sup>¶</sup>
Prematurity	11.2	16.6 <sup>¶¶</sup>		NA		NA	11.2	16.6 <sup>¶¶</sup>
Low birthweight		SU <sup>**</sup>		NA		NA		SU <sup>**</sup>
Home environment characteristics								
Excellent/very good maternal health	76.6	72.1	75.4	73.2	77.4	71.4 <sup>¶¶</sup>	76.4	72.1 <sup>¶</sup>
Maternal symptoms of depression		SU <sup>**</sup>	10.5	13.8 <sup>¶</sup>	8.4	14.6 <sup>¶¶</sup>	9.2	13.7 <sup>¶¶</sup>
Single child	42.3	26.7 <sup>¶¶</sup>	24.0	16.4 <sup>¶¶</sup>	17.3	21.2	24.1	20.4 <sup>¶</sup>
Socio-demographic characteristics								
Low income adequacy	18.7	30.5 <sup>¶¶</sup>	18.3	26.8 <sup>¶¶</sup>	17.1	31.6 <sup>¶¶</sup>	17.9	29.8 <sup>¶¶</sup>
Low maternal education	11.2	20.5 <sup>¶¶</sup>	11.6	18.4 <sup>¶¶</sup>	9.6	21.7 <sup>¶¶</sup>	10.8	20.4 <sup>¶¶</sup>
Mother currently working	58.1	47.0 <sup>¶¶</sup>	56.0	48.9 <sup>¶¶</sup>	63.0	47.7 <sup>¶¶</sup>	59.1	48.0 <sup>¶¶</sup>
Mother or father is an immigrant	19.3	27.6 <sup>¶¶</sup>	20.1	24.7 <sup>¶</sup>	16.0	40.5 <sup>¶¶</sup>	18.3	33.4 <sup>¶¶</sup>
Mother is an immigrant	15.1	24.4 <sup>¶¶</sup>	16.2	21.2 <sup>¶</sup>	11.2	37.7 <sup>¶¶</sup>	14.0	30.4 <sup>¶¶</sup>

PDA = poor developmental attainment; NLSCY = National Longitudinal Survey of Children and Youth; NA = not applicable, variable was not measured in that age group; SU = Suppressed.

\* Restricted to children whose biological mother provided risk factor information; unweighted n = 7243.

† The number of children is weighted, and values are rounded to the nearest 100; percentages are adjusted for missing data.

‡ p<0.05, based on Pearson chi-square test using normalized weights.

§ p<0.01, based on Pearson chi-square test using normalized weights.

¶ p<0.001, based on Pearson chi-square test using normalized weights.

¶¶ The coefficient of variation is between 16.6% and 33.3% which is considered marginal by Statistics Canada.<sup>5</sup>

\*\* The coefficient of variation is more than 33.3% which is considered unacceptable by Statistics Canada.<sup>5</sup>

TABLE V

## Adjusted Odds Ratio Estimates\* for PDA Stratified by Age and Survey Cycle

Cycle I Covariate	1 Year Olds		2-3 Year Olds		4-5 Year Olds		All Ages Combined	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Mother is an immigrant	1.55 <sup>§</sup>	1.12-2.16	1.70 <sup>¶¶</sup>	1.31-2.21	3.37 <sup>¶¶</sup>	2.68-4.25	2.26 <sup>¶¶</sup>	1.95-2.63
Maternal symptoms of depression	—	—	1.78 <sup>¶¶</sup>	1.33-2.37	2.74 <sup>¶¶</sup>	2.04-3.69	2.00 <sup>¶¶</sup>	1.67-2.40
Low maternal education	—	—	—	—	2.24 <sup>¶¶</sup>	1.73-2.89	1.54 <sup>¶¶</sup>	1.31-1.81
Low income adequacy	1.14	0.82-1.59	1.57 <sup>¶¶</sup>	1.24-1.99	2.02 <sup>¶¶</sup>	1.59-2.57	1.57 <sup>¶¶</sup>	1.35-1.83
Limited activity	—	—	2.51 <sup>¶¶</sup>	1.53-4.10	2.21 <sup>§</sup>	1.33-3.67	2.18 <sup>¶¶</sup>	1.61-2.96
Male sex	1.61 <sup>¶¶</sup>	1.21-2.15	2.17 <sup>¶¶</sup>	1.75-2.69	1.02	0.83-1.26	1.48 <sup>¶¶</sup>	1.30-1.69
Not a single child	—	—	—	—	1.74 <sup>¶¶</sup>	1.23-2.44	1.45 <sup>¶¶</sup>	1.23-1.71
Low birth weight	3.28 <sup>¶¶</sup>	2.08-5.16	—	—	—	—	—	—
Goodness-of-fit <sup>†</sup>	$\chi^2 = 6.13, p<0.19$		$\chi^2 = 12.15, p<0.02$		$\chi^2 = 16.53, p<0.01$		$\chi^2 = 20.19, p<0.003$	
Cycle II Covariate	1 Year Olds		2-3 Year Olds		4-5 Year Olds		All Ages Combined	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Mother is an immigrant	1.92 <sup>¶¶</sup>	1.30-2.84	—	—	5.34 <sup>¶¶</sup>	4.11-6.93	2.73 <sup>¶¶</sup>	2.32-3.22
Maternal symptoms of depression	—	—	1.43 <sup>¶</sup>	1.01-2.01	1.65 <sup>§</sup>	1.16-2.35	1.37 <sup>¶¶</sup>	1.10-1.70
Low maternal education	—	—	—	—	2.82 <sup>¶¶</sup>	2.05-3.86	1.84 <sup>§</sup>	1.52-2.23
Low income adequacy	1.70 <sup>§</sup>	1.18-2.46	1.57 <sup>¶¶</sup>	1.20-2.07	1.47 <sup>§</sup>	1.11-1.94	1.50 <sup>¶¶</sup>	1.26-1.77
Limited activity	3.56 <sup>§</sup>	1.48-8.63	3.40 <sup>¶¶</sup>	2.02-5.74	—	—	1.88 <sup>¶¶</sup>	1.28-2.76
Male sex	1.15	0.83-1.60	3.34 <sup>¶¶</sup>	2.56-4.35	1.63 <sup>¶¶</sup>	1.29-2.05	1.80 <sup>¶¶</sup>	1.56-2.09
Not a single child	2.02 <sup>¶¶</sup>	1.40-2.91	—	—	—	—	—	—
Low birthweight	2.37 <sup>¶¶</sup>	1.43-3.92	—	—	—	—	—	—
Goodness-of-fit <sup>†</sup>	$\chi^2 = 5.76, p<0.45$		$\chi^2 = 2.47, p<0.48$		$\chi^2 = 10.64, p<0.03$		$\chi^2 = 15.42, p<0.004$	

PDA = poor developmental attainment; OR = odds ratio; CI = confidence interval.

\* Based on logistic regression using normalized weights.

† Hosmer & Lemeshow test.

‡ p<0.05, based on multiple logistic regression using normalized weights.

§ p<0.01, based on multiple logistic regression using normalized weights.

¶ p<0.001, based on multiple logistic regression using normalized weights.

grant, has low education or is depressed. Among 1 year olds in Cycle I, having a low birthweight (OR=3.3; 95% CI: 2.1-5.2), an immigrant mother (OR=1.6; 95% CI: 1.1-2.2), and being a male (OR=1.6; 95% CI: 1.2-2.2) increased the odds of PDA after controlling for measures of socio-

economic status. Similar results were observed in Cycle II. Biological factors such as low birthweight and activity limitations showed no statistical association with PDA among older children. Conversely, maternal or socio-economic factors had highly significant associations with PDA, especially among the

4-5 year olds. For example, maternal immigrant status showed a greater than 5-fold risk for PDA among 4-5 year olds in Cycle II after adjusting for socio-economic factors, maternal symptoms of depression and male sex. LIA was a significant risk factor for PDA across all age groups and in both cycles.

## DISCUSSION

Our results show that an estimated quarter of a million or 14% of young Canadian children are affected by PDA, with substantial age, gender and provincial variation. Important social risk factors include LIA, low maternal education, and maternal immigrant status. Consistent with previous studies,<sup>1,2,14-18</sup> these associations were more pronounced in older children, while having low birthweight was a risk factor among younger children. The difference in the proportion of male and female children with PDA may be due to the social, biological and environmental interactions. Developmental research has consistently found differences between the sexes in terms of motor skills, cognitive development, and behaviour.<sup>19-21</sup> Girls tend to be more advanced in motor skills as toddlers, and boys tend to be slower to start talking.<sup>21</sup> Furthermore, it has been found that while males and females have equivalent scores in mental tests, males have greater variability.<sup>20</sup> This results in a greater proportion of males in the lowest percentiles, as seen in this study.

Clearly, the burden of PDA is the result of complex interactions among social, biological and environmental factors. Thus, early intervention strategies need to focus on effective milieus for screening and intervention. On one hand, children living in lower-income neighbourhoods are less likely to have continuity of health provider care and receive fewer preventive services,<sup>22,23</sup> thus not receiving consistent developmental screening. In addition, healthcare visits become less frequent after the second year of life when social risk factors begin to predominate. On the other hand, the health system is probably the most universally utilized resource for preschool children, and as such may represent the best option for screening. Intervention programs need to be located in areas of greatest need.

Each Canadian province or territory is unique, composed of different populations with access to different educational, health and social systems. These differences may explain some of the provincial variation seen in PDA, and may help target province-specific initiatives. For example, provinces with a higher prevalence of poverty need to allocate a greater propor-

tion of their resources to this group of children. Similarly, provinces with high rates of immigration need to target these populations and their specific needs, including language barriers, to have effective early childhood development strategies. The current federal/provincial early childhood development initiative recognizes this, allowing each province/territory to develop its own approach.<sup>24</sup> Future research should focus on evaluating the success of the different approaches adopted by the provinces/territories.

## Limitations

To obtain consistent risk factor information, our analysis was limited to children whose biological mother provided the information. However, a majority (89%) of Canadian children aged 1-5 years live with their biological mother. Additionally, our definition of PDA was limited by data collected in the NLSCY. No studies have assessed the correlation between PDA defined by MSD versus PPVT-R, thus it is possible that they measure somewhat different constructs. This may partly explain some of the differences between the sex- and age-groups. Moreover, caution is required in interpreting the association between maternal immigrant status and PDA. The tests used to assess PDA are largely based on verbal skills and children of mothers who are immigrants may be disadvantaged in terms of their exposure to French or English. Nevertheless, this still implies that these children would benefit from additional services to maximize their academic potential.

## SUMMARY

In conclusion, our findings suggest that living in a low-income household, with a mother who has low education, and/or a mother who is an immigrant, increase the risk of PDA in children. This highlights the need for targeting screening and interventions to children with these risk factors.

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## RÉSUMÉ

**Contexte :** Cette étude a été effectuée pour évaluer les liens entre le niveau de développement (ND) et les facteurs biologiques, domestiques et socio-démographiques dans un échantillon représentatif d'enfants canadiens.

**Méthode :** Les données transversales de deux cycles (1994-1995 et 1996-1997) de l'Enquête longitudinale nationale sur les enfants et les jeunes ont été utilisées. Les enfants âgés de 1-5 ans ont été inclus. Un faible ND a été défini comme inférieur au 15<sup>e</sup> percentile pour les aptitudes de développement moteur et social (1-3 ans) ou selon le Test d'échelle vocabulaire en image Peabody (4-5 ans). La régression logistique multiple a été utilisée.

**Résultats :** La proportion d'enfants souffrant d'un faible ND varie d'une région à l'autre du Canada selon le sexe et l'âge. Chez les enfants de 1 an du Cycle I, le fait d'avoir un faible poids à la naissance (RC=3,3; IC de 95 % = 2,1-5,2), d'être un garçon (RC=1,6; IC de 95 % = 1,2-2,2) et d'avoir une mère immigrée (RC=1,6; IC de 95 % = 1,1-2,2) augmentaient le risque de présenter un faible ND. Les mêmes résultats ont été obtenus dans le Cycle II. Chez les enfants de 4-5 ans du Cycle II, le fait d'avoir une mère immigrée (RC=5,3; IC de 95 % = 4,1-6,9) et une mère avec un faible niveau d'études (RC=2,8; IC de 95 % = 2,1-3,9) augmentaient le risque de présenter un faible ND. Un foyer à faible revenu était un facteur de risque significatif de faible ND dans toutes les catégories d'âge.

**Interprétation :** Les liens forts et cohérents entre le fait de vivre dans un foyer à faible revenu, d'avoir une mère faiblement scolarisée et d'avoir une mère immigrée soulignent le besoin de cibler des contrôles et des services de développement pour ces enfants.

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