Risk Markers for Poor Developmental Attainment in Young Children

Results From a Longitudinal National Survey

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Objective: To evaluate social and environmental determinants of poor developmental attainment among preschool children by means of longitudinal data from a population-based sample of Canadian children.


Participants: A total of 4987 children aged 1 to 5 years at baseline, whose biological mother completed risk factor information and who were included in both cycles.

Main Outcome Measures: Poor developmental attainment (developing unusually slowly) was defined as scores more than 1 SD below the age-standardized mean for the Motor and Social Development Scale, revised Peabody Picture Vocabulary Test, or Canadian Achievement Tests in mathematics and reading/comprehension, depending on the child's age.

Results: The prevalence of sustained poor developmental attainment after 2 years of follow-up was 4.6%. Factors found to be associated with poor developmental attainment included male sex (odds ratio [OR], 1.37; 95% confidence interval [CI], 1.10-1.70), maternal depression (OR, 1.64; 95% CI, 1.25-2.15), low maternal education (OR, 1.57; 95% CI, 1.19-2.08), maternal immigrant status (OR, 1.93; 95% CI, 1.38-2.71), and household low income adequacy (OR, 1.43; 95% CI, 1.11-1.83).

Conclusions: Having a mother who has symptoms of depression, has low education, or is an immigrant, and living in a household with low income adequacy increase the risk of poor developmental attainment in children aged 1 to 5 years. The notable risks associated with these factors indicate them as possible targets for screening and interventions to prevent poor developmental attainment.


DEVELOPMENTAL DISORDERS in children range from subtle learning disabilities to severe cognitive impairment. Many risk factors have been implicated in the etiology of this range of disorders, from biological to social and environmental. The most obvious identifiable risk factors are biological, including extreme prematurity, congenital defects, and other direct causes of brain injury. Although biological risks are important determinants of all areas of development, psychosocial risks can also adversely affect cognitive and social-emotional competence. The relative weights of risk factors change during the early years of life, with biological factors becoming less important and psychosocial ones gaining influence.1,2

Currently, in Canada, infants and children with biological risk factors are supposed to receive screening and early referral to developmental intervention programs through encounters with primary care providers, although there are no data describing the effectiveness of this screening process. Some children with extreme or obvious social or environmental risk factors may be identified and referred through their involvement with social services. However, the many children with developmental disorders that lack obvious risk markers may not accrue the benefit of early identification and intervention. With limited resources available, the greatest challenge lies in ensuring a comprehensive approach, through better targeting of children at high risk and by screening them for early signs of developmental problems so they may benefit from appropriate intervention programs. The development of a “high-risk” profile based on biological and social-environmental risk factors is required to ensure that all those who may benefit from early intervention are identified.
Previous cross-sectional population-based studies have highlighted the importance of parenting activities, parental psychological stability, and socioeconomic factors in a child's developmental attainment. Previous longitudinal studies examining the risks associated with the development of children and adolescents have indicated a range of social and environmental risk factors, as well as the intertwined effects of multiple risk factors on poor developmental attainment (PDA). Very few longitudinal studies examining developmental outcomes in children have been population based or have evaluated the impact of factors present during the preschool years on outcomes in school-aged children. The Canadian National Longitudinal Survey of Children and Youth (NLSCY) provides the unique opportunity to study developmental disorders prospectively in a population-based sample. Identifying factors and the interactions among factors that impede the acquisition of early developmental skills, and gaining a better understanding of the relationship between these skills and later development, will help target high-risk children. The purpose of this project was to identify and evaluate social and environmental determinants of PDA among preschool-aged children. The NLSCY analysis, Statistics Canada defined a child with an MSD score, a PPVT-R score, or a Canadian Achievement Tests mathematical operations test. This test measures the student's ability to perform different mathematical operations depending on the student's grade or level. Like the mathematics test, the reading comprehension test was developed from the Canadian Achievement Tests and was designed to measure basic reading skills.

For the purpose of the NLSCY analysis, Statistics Canada defined a child with an MSD score, a PPVT-R score, or a Canadian Achievement Tests reading or mathematics score greater than or equal to 1 SD below the age standardized mean, which was roughly equivalent to a level below the 15th percentile, as having PDA (developing unusually slowly). That is, if a child was among the 15% of children with the least developed motor and social skills, the least readiness to learn, or the lowest reading or mathematics scores for his or her age group, the child was classified as having PDA.

The presence of PDA was assessed at baseline as well as at 2-year follow-up. For the univariate analysis, the longitudinal PDA status was categorized into 4 groups: (1) remained normal (results were negative for PDA in both cycles 1 and 2); (2) worsened (negative in cycle 1 but positive in cycle 2); (3) improved (positive in cycle 1 but negative in cycle 2); and (4) remained poor (positive in both cycles 1 and 2). For the longitudinal multivariate analysis, overall PDA was examined. Overall PDA incorporates PDA status in cycle 1 and in cycle 2 while considering the correlation within individuals over time.

INDEPENDENT VARIABLES

Potential covariates of interest were grouped into 3 broad categories: child characteristics, home environment characteristics, and sociodemographic factors. All covariates were measured in both cycles of data collection.

Child Characteristics

Child health status was based on the mother's rating of the child's health (excellent–very good or good-fair-poor). Temperament was assessed by means of a modified version of the Infant Characteristics Questionnaire. The Infant Characteristics Questionnaire requires parents to rate their child's behavior on a 7-point scale and focuses mainly on difficult temperament. Difficult temperament was defined as an age-standardized score above 1 SD.

Home Environment Characteristics

Maternal health status was based on her self-rating of health (excellent–very good or good-fair-poor). Family dysfunction was measured by means of the 12-item general functioning subscale of the McMaster Family Assessment Device. Maternal symptoms of depression were determined by an abbreviated version of the Center for Epidemiological Studies–Depression Scale. Both family dysfunction and maternal symptoms of depression were coded as dichotomous variables consistent with published scoring schemes: family dysfunction (score $\geq 15$) and moderate to severe maternal symptoms of depression (score $\geq 13$). A parenting scale based on...
Strayhorn and Weidman’s Parenting Practices Scale was developed for the NLSCY and was used to characterize parent-child interaction and hostile parenting practices. Age-standardized values were created and scales were subsequently divided into quartiles, and the highest quartile was used to indicate a high degree of positive parent-child interaction or hostile parenting. Single-child status was defined as living in a household with no full, half, step, adopted, or foster siblings and was coded as a dichotomous variable.

**Sociodemographic Factors**

Income adequacy was defined by Statistics Canada on the basis of household size and income. The lowest and lower-middle income adequacy categories were combined to indicate low income adequacy, a dichotomous grouping that corresponds closely to Canada’s poverty lines in 1995. Low maternal education was defined as having less than a high school diploma. Maternal employment status was categorized into 3 levels for analysis: currently working, not currently working but worked in the past year, or did not work in the past year. A child’s parent was considered an immigrant if he or she reported having immigrated to Canada.

**STATISTICAL ANALYSIS**

The generalized estimating equation model (GEE) for categorical longitudinal data was used to incorporate “time-dependent” covariates in modeling predictors of PDA in our study population. This longitudinal approach identifies factors that differentiate change in developmental attainment over time. Data collected in both cycles were used to measure the overall probability of PDA given a combination of health, social, and environmental predictors. The GEE was used to account for the longitudinal effects of the predictors on developmental attainment. A time variable was included in the model to indicate which cycle corresponds to a given measurement. The possible covariate × time interactions, known as carryover effects (ie, the effect of a risk marker in cycle 1 on the PDA outcome in cycle 2), were also taken into consideration in fitting the GEE models. Given that different factors may affect a child’s development at different ages, analyses were also stratified by age group in cycle 1: 1 to 3 years and 4 to 5 years.

To further explore the relationship between PDA and risk factors, logistic regression analyses were conducted: first using PDA status in cycle 2 as the outcome variable and the risk factors in cycle 1, cycle 2, or the change of the risk factor over time as the dependent variables; and second doing a subanalysis, using the 4 categories of longitudinal PDA status (normal, worsened, improved, or remained poor) and the risk factors in cycle 1, cycle 2, or change over time as the dependent variables.

Statistics Canada’s data publication guides were followed throughout all analyses. Longitudinal sample weights derived by Statistics Canada were applied so that the estimates could be considered representative of the total population of children in the same age group in Canada. Coefficients of variation, also derived by Statistics Canada, were used to determine the quality level of the estimates on the basis of sampling error. For multiple variable analyses, standardized sample weights were used to preserve the original sample size of each group, thereby avoiding an overestimation of significance while maintaining the same distributions as those obtained when population weights were used.

Backward elimination techniques were used in model building. The correlations between the independent variables were examined and no correlations greater than 0.20 were found. In addition, the interaction between low income adequacy and maternal symptoms of depression and between low income adequacy and maternal education were explored and found not significant. Only statistically significant variables (P<.05) or known confounders such as sex, low income adequacy, and maternal immigrant status were permitted into the final regression models. The SAS statistical package (version 8.0; SAS Institute Inc, Cary, NC) was used for all analyses.

**RESULTS**

**DEMOGRAPHICS AND OTHER CHARACTERISTICS**

Children included in this analysis and children aged 1 to 5 years who were in cycle 1 but not in cycle 2, and hence not in the longitudinal analysis, were compared. These comparisons were stratified by PDA status as defined in cycle 1, and no major differences between the 2 groups were found (results not shown).

**Table 1** shows a comparison of baseline characteristics between the 4 categories of longitudinal PDA status: remained normal, worsened, improved, and remained poor. Although the overwhelming majority (77.3%) of children maintained a normal developmental attainment status, a relatively small percentage (4.6%) of children remained poor. In addition, 10.1% of children’s PDA status worsened and 8.0% of children’s PDA status improved between cycles 1 and 2.

Overall, baseline child health status was better in children who remained normal than those who remained poor (90.3% vs 84.8%; P<.001). Of the children who remained normal, a higher percentage were from families with positive parent-child interaction at baseline (25.6% vs 21.2%; P<.001), whereas a lower percentage had mothers with symptoms of depression at baseline (8.1% vs suppressed; P<.001) when compared with those who remained poor. More children who remained poor had mothers with low education at baseline (27.5% vs 13.2%; P<.001) and had mothers who had immigrated to Canada (27.5% vs 13.2%; P<.001) than those who remained normal. Of the children whose PDA status changed over time, more of the children who worsened had excellent or very good health at baseline as compared with children who improved (87.8% vs 81.7%; P<.001), whereas more children who improved had mothers with symptoms of depression at baseline than children who worsened (19.6% vs 11.1%; P<.001).

**Table 2** shows the age- and sex-specific PDA status in cycles 1 and 2. Younger children (aged 1-3 years in cycle 1) had a higher percentage of improvement in PDA status compared with older children (aged 4-5 years in cycle 1) (9.2% and 6.2%, respectively; P<.001). In addition, a slightly higher percentage of girls remained normal and a lower percentage remained poor compared with boys, but the difference was not statistically significant.

**ESTIMATES OF PDA RISKS**

**Table 3** shows risk factors significantly associated with overall PDA in the final adjusted GEE models. The GEE models examine the association between the covariates in both periods and the overall PDA, which incorporate...
PDA status in cycle 1 and in cycle 2 while considering the correlation within individuals over time. In the final model, male sex (odds ratio [OR], 1.37; 95% confidence interval [CI], 1.10-1.70), having a mother with symptoms of depression (OR, 1.64; 95% CI, 1.25-2.15), low maternal education (OR, 1.57; 95% CI, 1.19-2.08) or maternal immigrant status (OR, 1.93; 95% CI, 1.38-2.71), and low household income adequacy (OR, 1.43; 95% CI, 1.11-1.83) were statistically significant risk factors. Having a mother who was an immigrant doubled the risk of PDA among children aged 1 to 3 years at baseline (OR, 2.40; 95% CI, 1.63-3.54). Its effect was substantially lowered, although no longer statistically significant, in older children aged 4 to 5 years at baseline (OR, 1.36; 95% CI, 0.72-2.59). Conversely, low maternal education and maternal symptoms of depression had

### Table 1. Baseline Characteristics of the Study Population for the Longitudinal PDA Status (NLSCY—Cycles 1 and 2)*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Remained Normal (n = 1 019 100 [77.3%])</th>
<th>Worsened (n = 132 700 [10.1%])</th>
<th>Improved (n = 106 000 [8.0%])</th>
<th>Remained Poor (n = 60 100 [4.6%])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male sex†</td>
<td>502 300 (49.3)</td>
<td>71 900 (54.2)</td>
<td>60 200 (56.7)</td>
<td>36 700 (61.0)</td>
</tr>
<tr>
<td>Excellent–very good health status†</td>
<td>919 600 (90.3)</td>
<td>116 500 (87.8)</td>
<td>86 600 (81.7)</td>
<td>51 000 (84.8)</td>
</tr>
<tr>
<td>Difficult temperament</td>
<td>88 100 (14.0)</td>
<td>12 100‡ (15.7)</td>
<td>15 100‡ (19.8)</td>
<td>SU§</td>
</tr>
<tr>
<td>Home environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent/very good maternal health status†</td>
<td>814 000 (80.2)</td>
<td>99 900 (75.6)</td>
<td>83 200 (78.6)</td>
<td>41 100‡ (68.4)</td>
</tr>
<tr>
<td>Maternal depression†</td>
<td>81 800 (8.1)</td>
<td>14 600‡ (11.1)</td>
<td>20 800‡ (19.5)</td>
<td>SU§</td>
</tr>
<tr>
<td>Hostile parenting†</td>
<td>226 200 (22.4)</td>
<td>30 200‡ (22.8)</td>
<td>36 100‡ (34.0)</td>
<td>12 100‡ (20.5)</td>
</tr>
<tr>
<td>Positive parent-child interaction†</td>
<td>260 500 (25.6)</td>
<td>29 100‡ (21.9)</td>
<td>17 700‡ (16.7)</td>
<td>12 500‡ (21.2)</td>
</tr>
<tr>
<td>Family dysfunction</td>
<td>70 100 (7.0)</td>
<td>SU§</td>
<td>14 300 (13.6)</td>
<td>SU§</td>
</tr>
<tr>
<td>Single child</td>
<td>244 100 (24.0)</td>
<td>35 400‡ (26.7)</td>
<td>23 600‡ (22.3)</td>
<td>SU§</td>
</tr>
<tr>
<td>Sociodemographic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low income adequacy†</td>
<td>170 900 (16.8)</td>
<td>44 200‡ (33.3)</td>
<td>28 000‡ (26.4)</td>
<td>19 700‡ (32.8)</td>
</tr>
<tr>
<td>Low maternal education†</td>
<td>135 100 (13.3)</td>
<td>35 400‡ (26.6)</td>
<td>12 600‡ (11.8)</td>
<td>17 000‡ (28.3)</td>
</tr>
<tr>
<td>Immigrant mother†</td>
<td>133 800 (13.2)</td>
<td>33 500‡ (25.4)</td>
<td>21 300‡ (20.2)</td>
<td>16 500‡ (27.5)</td>
</tr>
</tbody>
</table>

Abbreviations: NLSCY, National Longitudinal Survey of Children and Youth; PDA, poor developmental attainment; SU, suppressed.

*All children in longitudinal cohort aged 1 to 5 years in cycles 1 and 2 to 7 years in cycle 2 are included. The number of children is weighted and values are rounded to the nearest 100; the unweighted n = 4987. Percentages are adjusted for missing data and may not total 100 because of rounding. For the “Remained Normal” category, PDA was negative in cycles 1 and 2; for “Worsened,” PDA was negative in cycle 1 and positive in cycle 2; for “Improved,” PDA was positive in cycle 1 and negative in cycle 2; and for “Remained Poor,” PDA was positive in cycles 1 and 2.

†The coefficient of variation is between 16.6% and 33.3%, which is considered unacceptable by Statistics Canada.

‡The coefficient of variation is more than 33.3%, which is considered unacceptable by Statistics Canada.

### Table 2. Age- and Sex-Specific Proportions of PDA Categories (NLSCY—Cycles 1 and 2)*

<table>
<thead>
<tr>
<th>Age group</th>
<th>Remained Normal</th>
<th>Worsened</th>
<th>Improved</th>
<th>Remained Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aged 1-3 y in cycle 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys†</td>
<td>296 000 (71.7)</td>
<td>46 500 (11.3)</td>
<td>48 000 (11.6)</td>
<td>22 500‡ (5.4)</td>
</tr>
<tr>
<td>Girls†</td>
<td>334 800 (82.5)</td>
<td>32 600‡ (8.0)</td>
<td>27 100‡ (6.7)</td>
<td>11 400‡ (2.8)</td>
</tr>
<tr>
<td>Total†</td>
<td>630 800 (77.0)</td>
<td>79 100 (15.7)</td>
<td>75 100 (9.2)</td>
<td>33 900‡ (4.1)</td>
</tr>
<tr>
<td>Aged 4-5 y in cycle 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>206 300 (79.9)</td>
<td>25 400‡ (9.8)</td>
<td>12 200‡ (4.7)</td>
<td>14 200‡ (5.5)</td>
</tr>
<tr>
<td>Girls</td>
<td>182 000 (75.5)</td>
<td>28 200‡ (11.7)</td>
<td>18 800‡ (7.8)</td>
<td>12 000‡ (5.0)</td>
</tr>
<tr>
<td>Total</td>
<td>388 300 (77.8)</td>
<td>53 600 (10.7)</td>
<td>31 000‡ (6.2)</td>
<td>26 200‡ (5.3)</td>
</tr>
<tr>
<td>Overall (aged 1-5 y in cycle 1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boys</td>
<td>502 300 (74.9)</td>
<td>71 900 (10.7)</td>
<td>60 200 (9.0)</td>
<td>36 700 (5.5)</td>
</tr>
<tr>
<td>Girls</td>
<td>516 800 (79.9)</td>
<td>60 800 (9.4)</td>
<td>45 900 (7.1)</td>
<td>23 400‡ (3.6)</td>
</tr>
<tr>
<td>Total</td>
<td>1 019 100 (77.3)</td>
<td>132 700 (10.1)</td>
<td>106 100 (8.0)</td>
<td>60 100 (4.6)</td>
</tr>
</tbody>
</table>

Abbreviations: See Table 1.

*All children in longitudinal cohort aged 1 to 5 years in cycles 1 and 2 to 7 years in cycle 2 are included. The number of children is weighted and values are rounded to the nearest 100; the unweighted n = 4987. Percentages may not total 100 because of rounding. For the “Remained Normal” category, PDA was negative in cycles 1 and 2; for “Worsened,” PDA was negative in cycle 1 and positive in cycle 2; for “Improved,” PDA was positive in cycle 1 and negative in cycle 2; and for “Remained Poor,” PDA was positive in cycles 1 and 2.

†P < .001, based on overall χ² test comparing PDA categories by means of normalized weights.

‡Quality of estimate is marginal according to Statistics Canada because coefficient of variation is between 16.6% and 33.3%.
stronger impacts on the risk of PDA in older children (OR, 1.98; 95% CI, 1.25-3.15; and OR, 1.77; 95% CI, 1.09-2.86, respectively). The carryover effects of the covariates considered for the model were examined but not found to be statistically significant. This indicates that none of the covariates in cycle 1 had a lasting effect on the PDA status in cycle 2.

The results found by using the additional logistic regression analyses produced results similar to those with the GEE (results not shown). For instance, risk factors in cycle 1 had a stronger effect on PDA in cycle 1 than in cycle 2, further verifying the lack of carryover effects. The consistency between analytical methods adds strength to our findings.

Results from this longitudinal population-based study allude to the complex relationships between risk factors and developmental outcomes. The results of this study reinforce the importance of changing risk factor profiles and PDA status over time and support the notion that social and environmental factors play an increasing role in the development of young or preschool children as they get older. Studies of child development should therefore stratify by age, enabling researchers to clarify the changing strength of associations in risk factor profiles of preschool children. A complete understanding of how social and environmental risk markers change over time and how these changes relate to future school performance and social behaviors is required.

It is well documented in the literature that children of mothers who experience depression are not only at risk for the development of psychopathology, but also for behavioral problems. Parental characteristics of depression might affect children by altering patterns of parent-child interaction or by increasing marital discord. This has been shown to have, in itself, potentially negative effects on child development. However, the results of this study indicate that, although parenting factors were independently related to PDA, when all variables were considered simultaneously in the model they were not significantly related to PDA. A recent study using the National Maternal and Infant Health Survey examined the links between material hardship (poverty) and maternal depression on child outcomes. The results showed that chronic maternal depression had severe implications for both boys and girls, while persistent poverty had a strong effect on the development of girls.

The results of our study highlight the importance of identifying and treating mothers with high levels of depressive symptoms. Although a number of studies have shown that the prevalence of depression is relatively high among mothers of young children, maternal depression remains underdiagnosed. A recent study by Heneghan et al found that pediatric health care providers did not recognize most mothers with high levels of self-reported symptoms of depression. Given their regular contact with mothers of young children, primary health care providers should be trained to identify mothers with symptoms of depression.

The finding that a mother with only high school education is another important risk factor for PDA is supported by other studies. This risk factor can be used to target child developmental screening and interventions. Studies suggest that mothers with low education lack the intellectual resources to stimulate the child and hence the child’s developmental attainment is poor. It has also been shown that targeted interventions of this population can increase the child’s intellectual development.

Although no lasting carryover effects were found between the covariates and PDA status, the ability to examine the temporal relationships between the covariates and developmental attainment was a major strength of this study. Other strengths include the ability to assess the same cohort at 2 points in time. These children were assessed at baseline and after a 2-year follow-up period, hence the changes in covariates and PDA could be examined.

The main limitations of this study were that different measures of development were used at various ages, so that some of the change in developmental status may be a function of the tests capturing different aptitudes. Observed improvement in developmental outcomes through longitudinal analysis may be artifactual and as-

Table 3. Adjusted Odds Ratios for Overall PDA Based on Longitudinal Logistic Regression and Stratified by Age Groups

<table>
<thead>
<tr>
<th>Covariate</th>
<th>OR (95% CI)</th>
<th>P Value§</th>
<th>OR (95% CI)</th>
<th>P Value§</th>
<th>OR (95% CI)</th>
<th>P Value§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal depression</td>
<td>1.63 (1.17-2.28)</td>
<td>.004</td>
<td>1.77 (1.09-2.86)</td>
<td>.02</td>
<td>1.64 (1.25-2.15)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Male sex</td>
<td>1.87 (1.42-2.45)</td>
<td>&lt;.001</td>
<td>0.88 (0.62-1.25)</td>
<td>.48</td>
<td>1.37 (1.10-1.70)</td>
<td>.005</td>
</tr>
<tr>
<td>Immigrant mother</td>
<td>2.40 (1.63-3.54)</td>
<td>&lt;.001</td>
<td>1.36 (0.72-2.59)</td>
<td>.34</td>
<td>1.93 (1.38-2.71)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Low income adequacy</td>
<td>1.36 (0.97-1.89)</td>
<td>.07</td>
<td>1.58 (1.09-2.31)</td>
<td>.02</td>
<td>1.43 (1.11-1.83)</td>
<td>.006</td>
</tr>
<tr>
<td>Low maternal education</td>
<td>1.35 (0.98-1.85)</td>
<td>.06</td>
<td>1.98 (1.25-3.15)</td>
<td>.004</td>
<td>1.57 (1.19-2.08)</td>
<td>.001</td>
</tr>
<tr>
<td>Cycle</td>
<td></td>
<td></td>
<td></td>
<td>1.03 (0.81-1.30)</td>
<td>.84</td>
<td>1.41 (1.06-1.89)</td>
</tr>
<tr>
<td>Overall:</td>
<td>1.98 (1.25-2.15)</td>
<td>&lt;.001</td>
<td>1.36 (0.72-2.59)</td>
<td>.34</td>
<td>1.63 (1.17-2.28)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Aged 1-5 y in Cycle 1†</td>
<td>1.63 (1.25-2.15)</td>
<td>&lt;.001</td>
<td>1.36 (0.97-1.89)</td>
<td>.07</td>
<td>1.98 (1.25-3.15)</td>
<td>.004</td>
</tr>
<tr>
<td>Aged 4-5 y in Cycle 1‡</td>
<td>1.63 (1.25-2.15)</td>
<td>&lt;.001</td>
<td>1.36 (0.97-1.89)</td>
<td>.07</td>
<td>1.98 (1.25-3.15)</td>
<td>.004</td>
</tr>
<tr>
<td>Aged 6-7 y in Cycle 2</td>
<td>1.63 (1.25-2.15)</td>
<td>&lt;.001</td>
<td>1.36 (0.97-1.89)</td>
<td>.07</td>
<td>1.98 (1.25-3.15)</td>
<td>.004</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; OR, odds ratio; PDA, poor developmental attainment.
*Based on logistic regression using normalized weights.
†Based on unweighted n = 3217.
‡Based on unweighted n = 1770.
§Based on logistic regression using normalized weights.
| Controlled for time in the 2 cycles.
It is well documented in the literature that the relative weights of risk factors for child development change during the first few years of life, with biological factors becoming less important and the psychosocial ones gaining influence. The development of a “high-risk” profile for different age groups is necessary to ensure that all those who may benefit from early intervention are identified. A population-based study to generate relative risks associated with risk factors and poor developmental attainment has never been completed in Canada. In addition, this study’s longitudinal approach allows for the examination of change in developmental attainment over time.

This longitudinal population-based study reinforces the importance of changing risk factor profiles over time and supports the notion that social and environmental factors play an increasing role in the motor, social, and cognitive development of children as they get older. This adds to the literature by indicating risk factors of a child having poor developmental attainment and also suggesting that there is no significant carryover effect of modifiable risk factors, such that a child’s present developmental status is mainly a function of his or her current risk profile. This adds weight to the call for intervention around the modifiable risk factors identified in this longitudinal, population-based study.

associated with the change in measure from MSD to PPVT-R, for example. Furthermore, caution is required in interpreting the association between maternal immigrant status and PDA because of potential measurement issues. Specifically, the tests used were largely based on verbal skills, and children of mothers who are immigrants may be disadvantaged in terms of their exposure to French or English, particularly during the preschool years. Finally, response bias is a concern in all population-based surveys; however, there were no significant differences between those included and excluded in the analysis.

The overall results of this study are consistent with previous studies suggesting that social and environmental risk factors tend to become more notable determinants of children’s development as they get older. It adds to the literature by supporting the notion that factors present at one point in time may not necessarily carry their effect on a child’s development at a later stage. The longitudinal nature of this study makes the results more powerful, as the analysis incorporated the risk factors and PDA status over time while incorporating the correlation within individuals at baseline and follow-up. The increased risk of having a mother with symptoms of depression or low education or who is an immigrant and coming from a household with low income adequacy on PDA indicates possible targets for screening and intervention programs aimed at increasing the developmental attainment of at-risk children. Policies seeking to identify children at risk for poor developmental outcomes will need to take into account which factors are important at a given age. Programs seeking to improve the outcomes of these children will need to focus on these social and environmental determinants of poor developmental outcomes in these children.

What This Study Adds

This is, to our knowledge, the first longitudinal population-based study to have generated relative risk estimates for PDA in Canada. Results suggest that having a mother who has symptoms of depression, who has low education, or who is an immigrant, and having a family with low income adequacy increase the risk of overall PDA in children. The results of this study are in line with those of other studies that suggest that social and environmental risk factors tend to become increasingly important determinants of children’s development as they get older. The relative risk estimates provide valuable information for targeting interventions, and the evidence that a child’s developmental status improves in tandem with modifiable risk factors allows for better advocacy for such interventions.

CONCLUSIONS

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