Taking a Social Determinants Perspective on Children’s Health and Development
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Disclaimer

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The Canadian Public Health Association (CPHA) is a national, independent, not-for-profit, voluntary association representing public health in Canada, with links to the international public health community. CPHA's members believe in universal and equitable access to the basic conditions which are necessary to achieve health for all Canadians.

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Foreword

The Canadian Institute for Health Information (CIHI) is an independent, not-for-profit corporation that provides information on Canada’s health system and the health of Canadians. As part of CIHI, the Canadian Population Health Initiative (CPHI) explores patterns of health within and between population groups to develop a better understanding of factors that affect the health of individuals and communities. We also seek out and summarize evidence about “what works” at a policy and program level to contribute to the development of policies that reduce inequities and improve the health and well-being of Canadians. “Reducing Gaps in Health” is a priority theme for CPHI. By “gaps” we mean those potentially modifiable differences in health between populations and subpopulations that are linked to multiple, interrelated social factors. The overall objective of CPHI’s involvement in this area is to build an increased understanding and awareness of gaps in health and to highlight evidence on “what works” to address these health gaps.

Over the last decade, CPHI has examined the respective relationships to health of variations in income, gender and urban-rural differences. In November 2008, we released Reducing Gaps in Health: A Focus on Socio-economic Status in Urban Canada. This report explores the links between health and a census-based measure of socio-economic status developed by the Institut national de santé publique du Québec. In May 2010, we released Exploring Urban Environments and Inequalities in Health in Canada’s Census Metropolitan Areas. These analyses expanded and refined those presented in the Reducing Gaps report. We have also funded and produced work in the area of child and adolescent health, including a chapter on early child development in our first Improving the Health of Canadians report and more recently in Improving the Health of Young Canadians (2005) and Youth Health Outcomes and Behaviours in Relation to Developmental Assets (2009).

CPHI continues to work with researchers and policy stakeholders to encourage research designed to identify gaps in the population health evidence base and to address questions of what works and what does not work from a policy and program perspective. Our sponsorship of this special issue of the Canadian Journal of Public Health – with its focus on social determinants approaches to children’s health and development – is an extension of this work. The papers presented herein serve to advance our understanding of some of the complex issues surrounding child health and development. CPHI looks forward to continuing the dialogue among research and policy- and decision-makers on these important issues.

Keith Denny, PhD
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Taking a Social Determinants Perspective on Children’s Health and Development

Keith Denny, PhD, Marni Brownell, PhD

In early 2007, then Minister of Health Tony Clement appointed Dr. Kellie Leitch, Chief of the Division of Paediatric Surgery at the Children’s Hospital of London, Ontario, as his Children’s Health Advisor. Her mandate was to review the role of the federal government in the health of Canada’s children. Dr. Leitch submitted her report, Reaching for the Top,1 to the Minister in July 2007. The report was subsequently made public in March 2008. In her report, Dr. Leitch made it clear that in terms of child health and well-being, Canada did not compare well with other nations. Specifically, she highlighted the fact that when compared to other OECD (Organisation for Economic Co-operation and Development) nations, Canada ranked 21st of 29 for child well-being (a category that included mental health), 22nd in terms of preventable childhood injuries and deaths, and 27th for childhood obesity.

Reaching for the Top was widely endorsed by health professionals and organizations working in the area of child and youth health. The report provides a solid foundation to support such work and, in amassing and presenting a large body of evidence, Dr. Leitch throws into sharp profile the urgency of the need to act to improve the health and well-being of Canada’s children and youth. What is more, the report identifies specific options and a number of priority areas for action, which we shall discuss shortly.

An area that is not adequately addressed in the report is that of social determinants of health. Dr. Leitch acknowledges that “a look through the lens of social determinants of health tells us a lot about our children,” but she goes on to assert that her mandate did not extend to addressing those determinants. Rather, the report includes a brief appendix “to reference the three social determinants that affect child and youth health that were raised repeatedly during [our] roundtables: poverty, housing and education” (ref. 1, p.174). The need for a substantive treatment of social determinants of health to complement the contribution of the Leitch Report was one of the motivating factors in the genesis of this supplement.

The observation that health outcomes tend to be poorer among individuals and within areas of lower socio-economic status (SES) compared to individuals and areas of higher SES is now a commonplace one. In a nutshell, we know that experiences of health and illness are “stratified along various lines of social and economic inequality”.2 What is more, we do not only see differences between the wealthiest and the most poorly off. Differences in health are seen across the entire socio-economic spectrum: individuals with the highest income tend to have better health than those who fall into the middle-income group, who in turn experience better health than those individuals who fall into the lowest income group. This relationship, found consistently over many years, has been labeled the social gradient in health.

Such observations are not new of course. They have become almost tiresomely familiar. That there are direct and indirect links between material deprivation and health was the central message of the UK’s landmark Black Report, which is thirty years old.3 At the same time, the influential Whitehall Study of British civil servants was demonstrating the effect of social position such that “each group had a higher mortality rate than the group one step higher in the hierarchy”.4 The enigma, perhaps, is that despite all that we know about the links between social factors and health inequities, those inequities have remained remarkably robust.

This general pattern of health inequities linked to social environments is found among children too. We know that in contexts of lower socio-economic status, children are more likely to be born at low birth weight;3 to experience higher rates of injuries,5 higher rates of disability and disease;6 mental health disorders7 and behavioural problems;8 and to start school in a less-developed state of readiness to learn than their better-off counterparts.9 When health inequities are considered, there are, of course, children in Canada who fare particularly poorly. The plight of Aboriginal children is the one area of health inequities that is addressed at some length in Reaching for the Top. Dr. Leitch acknowledged that First Nation and Inuit children “lag behind on almost all health indicators compared to the Canadian average” (ref. 1, p.40).

We also know that many of Canada’s children and youth continue to live in circumstances that are likely to perpetuate health inequities. In 2004, for example, 13% of Canadian children still lived in low-income households. This was essentially the same as the proportion in 1989,10 the year in which Canada’s parliament voted unanimously to eradicate child poverty by 2000. Subsequently, Statistics Canada reports that the proportion fell to below 10% by 2007,11 though others, such as the OECD, put the figure higher using a different method of calculation.12 The situation is considerably worse for Aboriginal children. In 2006, about half of Aboriginal children under the age of six in urban areas, and a quarter of those in rural areas, were growing up in low-income families.13 Statistics Canada’s LICO measure is not

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applicable in the territories or on reserves, but we know that poverty and related phenomena are common there too.

What do we know about the nature of the relationship between social inequalities and health inequities? In other words, what are the modifiable factors that are open to change? In the conclusion to her report, Dr. Leitch calls for bold changes if Canada is to be “a world leader in the area of child and youth health.” When it comes to taking action to reduce child health inequities, it seems clear that developmental factors, early experiences and exposure to various risk factors in early life offer opportunities for the implementation and evaluation of interventions.

Material deprivation may affect health directly in a number of ways: household income, for example, will be linked to adequacy of accommodation, food security, and vulnerability to effects of heat and cold. Material deprivation can also compromise a person’s ability to participate in society in ways that most of us take for granted – for example, in terms of social interaction with family, friends and community, participation in economically or socially valuable activities, engagement in political processes, and capacity to purchase goods and services. Furthermore, less well-off geographic areas tend to be characterized by: relatively limited access to healthy recreation; fewer retail outlets for healthy food; lower-quality fruit and vegetables and higher prices for healthy foods; lower provision of primary health care; less access to libraries, museums and other cultural resources; poorer air quality; and less aesthetically pleasing surroundings.

In addition to such material factors, contexts characterized by low income and other aspects of deprivation are associated with psychosocial stressors that induce their own psychobiological stress responses. These stress responses can in turn lead to elevated vulnerability to disease states. “Allostatic load” is a measure of cumulative stress. It is a concept that refers to the “wear and tear” of allostatics (the body’s protective stress response) on the body. Over the long term, this allostatic load can lead to physiologic changes in the body – particularly in the immune system and brain. This in turn can lead to disease through a variety of biological mechanisms.

Stress is seen as a factor that may contribute to socio-economic disparities in health because, though most of us experience stress from various sources, people with limited economic resources or who are experiencing social disadvantage appear to face a greater amount of stress over the life course. This differential exposure to stressors means that the adverse biological effects of chronic stress may cumulate more among those of lower socio-economic status. A review of the literature concluded that socio-economic position is associated with both the frequency of stressful life events and stress responses. Lower SES is likely to be correlated, for example, with residence in environments with higher population density, noise, crime, pollution, poor access to resources, and with a life of routine stresses such as food insecurity and unstable housing tenure.

More recent research has documented the emergence of SES differentials in allostatic load in children as young as five. Children, particularly young children, can be victims of stress because they are unable to communicate their feelings effectively. They may also be more likely to be exposed to events or environments over which they have no control. In general, low-income children experience a wider array of stressors – such as hunger, residential crowding, community violence, family turmoil, parental stress, and lack of household structure and routine – than do children in higher-income groups.

Chronic stress exposures in early childhood may adversely affect brain development, and this may be further accentuated if children live in environments that are not cognitively stimulating. In recent decades, researchers have found SES differentials among children in brain and cognitive development and achievement outcomes: the gradient that we see in health is matched by a parallel gradient in cognitive and behavioural development in early life. Canadian studies have found that SES differentials in development and behavioural problems are apparent by kindergarten age.

So, what can be done? Reaching for the Top presents many recommendations for improving child health in Canada. These recommendations have been widely endorsed by various groups. Of the many recommendations in the report, Dr. Leitch highlighted five areas as priorities for action:

2. Reducing childhood obesity by establishing a Centre of Excellence on Childhood Obesity;
3. Improving mental services for Canadian children and youth;
4. Undertaking a longitudinal cohort study to provide data on the health of Canadian children and youth to help understand environmental factors impacting children’s health; and,
5. Establishing a National Office of Child and Youth Health with a permanent Advisor.” (p. 3)

In its March 2010 speech from the throne, the Canadian government committed itself to working with non-government organizations to launch a national strategy on childhood injury prevention. In 2007, the Federal Government created the Mental Health Commission of Canada (MHCC). The Commission is currently developing a mental health strategy, one of the advisory committees for which focuses on children and youth. Specific responses are still awaited in the other three areas. Increased rates of obesity and sedentary lifestyles, in particular, have been highlighted as issues that need to be addressed.

With the exception of the expansion of the Aboriginal Head Start Program, tuberculosis surveillance in the North, and better cross-jurisdictional coordination in relation to the health of Aboriginal children, none of the recommendations are aimed specifically at the reduction of inequities in children’s health. Two potential areas for action to achieve this goal are the reduction of rates of children experiencing low income, and comprehensive programs for early childhood education and care.

In Canada, we have experience of successful reductions in low-income rates. In the late 1970s, for example, almost 20% of Canada’s seniors lived with low income – the highest percentage of any group. Pension policies introduced at that time led to a steady decline in this rate to just over 2% by 2006. This is now the country’s lowest incidence of low income. Similarly, although to a lesser extent, in 2004 the redistribution of income through income taxes and transfers helped reduce the incidence of low income among children from 22% – the rate based on market income alone – to 13%. A study of effective strategies to reduce child poverty conducted by the OECD concluded that for developed countries, the most successful route lies in the right balance between redistributive and employment-based approaches; employment in and
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of itself is not always sufficient if the rewards do not elevate those with employment above low-income status.29 Given that low-income rates are significantly higher among Aboriginal children and youth than among non-Aboriginal, it is likely that particular attention will need to be given to this group.

There is evidence that some progress is being made. A number of provincial poverty reduction strategies have been implemented in recent years, along with federal initiatives, such as the introduction of a Universal Child Care Benefit and the child tax credit. As noted above, in 2007 the proportion of children living with low income, according to Statistics Canada, dropped below 10%. Since that time, of course, economic circumstances have altered dramatically with the recession experienced since 2008.

Writing in the Encyclopedia on Early Childhood Development, Harvard researcher Jack Shonkoff argues that, “the basic principles of neuroscience indicate that providing supportive conditions for early childhood development is more effective and less costly than attempting to address the consequences of early adversity later”.30 This assertion is supported by a report commissioned by Human Resources and Skills Development Canada (HRSDC) on early childhood education and care (ECEC). The authors found that there is widespread international agreement in the academic literature “that ECEC programs tend to significantly improve cognitive abilities, future economic well-being and social outcomes for disadvantaged children [and]... that ECEC improves cognitive abilities and the future economic well-being of more advantaged children”.31 What is more, the study concludes that there is persuasive evidence that dollars invested in ECEC programs are more than recouped through the benefits that accrue to the economy as a whole. The importance of early childhood education and care has been highlighted in reports from the World Health Organization32,33 and Canada’s Senate Subcommittee on Population Health, which released its final report in June 2009.34 Closing the Gap in a Generation, the final report of the World Health Organization’s Commission on Social Determinants of Health, for example, includes the recommendation that, “Governments build universal coverage of a comprehensive package of quality early child development programmes and services for children, mothers, and other caregivers, regardless of ability to pay” (ref. 32, p.202).

This editorial began with a reflection on the significant contribution of Dr. Kellie Leitch’s report to the field of child and adolescent health in Canada – a contribution that has much to offer to policy development in the area. The intention of this special issue of the Canadian Journal of Public Health is to expand that contribution through a more specific focus on social determinants of health and health inequities. The papers that are brought together in this issue reflect the range and quality of Canadian scholarship in the area of children’s health. Collectively, they constitute a considerable contribution to discussions of child and youth health inequities and their determinants.

Kershaw et al. address issues related to the economic costs of avoidable vulnerability in early childhood. Looking at data from the Early Development Instrument (EDI), they find that more than 25% of Canadian children arrive at kindergarten in a state of developmental “vulnerability.” Such vulnerability is not evenly distributed. In British Columbia, rates vary considerably between school districts. What is more, early vulnerability can shape later educational experiences and economic opportunities with consequences for both individuals and societies. Puchala, Vu and Muhajarine also make use of the EDI to measure readiness among kindergarten children. Their focus, however, is on the individual and contextual factors related to readiness among children in Saskatoon for whom English is a second language.

Looking at older age groups, Tramonte and Willms estimate the prevalence of anxiety for males and females and the extent to which it varies among middle and secondary schools. Using data from the Tell Them from Me survey, which tracks indicators of student engagement, wellness, and learning environment, and the theoretical concept of “flow” (a state achieved when there is congruence between challenges and skills), they provide insights into the relationships between students’ confidence in their skills and levels of anxiety. Exploring adolescent health through the wider lens of the social environment, Elgar, Trites and Boyce find that social capital – derived from this case from a five-item scale developed for the Health Behaviour of School-aged Children survey – has a considerable mitigating effect on SES differences in physical and psychological health outcomes. Findings such as these highlight the relevance of community belonging and social support in relation to social inequities and health.

Brownell et al. explore, from a temporal perspective, the relatively understudied issue of socio-economic differences in childhood injury hospitalizations. Their analysis of Manitoba data revealed that behind a substantial overall drop in injury hospitalizations between 1986 and 2006 lies an increased socio-economic gradient. This phenomenon, whereby an overall reduction is matched by increased differences in socio-economic status, speaks to the value of a broader understanding of the social determinants of injury and other important child health indicators. In Canada, the percentage of children and youth who are overweight or obese has risen dramatically over the last 25 years or so. The social consequences of this shift and the related costs to the health care system have yet to be determined. In their research, presented in this journal, Simen-Kapeu and Veugelers found a social gradient for overweight among children, as well as for parental encouragement for healthy eating and physical activity.

The papers in this supplement collectively highlight the important role of social factors as determinants of child health and development. In doing so, the perspectives they provide offer a useful expansion to the insights presented in Reaching for the Top and a valuable resource to those working to improve the health of all Canadians.

REFERENCES

The key to a society's long-term economic success lies in its ability to optimize human development: its ability to promote "a state of minds," to borrow a phrase from economist Tom Courchene, who recommends a human capital future for Canadians. Since globalization requires countries with developed economies to compete with the less expensive labour available in other regions, our governments must compensate by generating labour that will thrive in technological-based information and knowledge industries. Thus, countries with developed economies need more than "all hands on deck" to exploit resource advantages; they also need all "heads": healthy, well-educated, innovative and productively employed adults with strong social and intercultural competencies.

The link between human development and human capital provides Canadians with much reason to pause, because population-level data in our country reveal that citizens now entering our formal school system endure a level of developmental vulnerability that too few acknowledge. Teacher evaluations of students in almost all kindergarten classes in British Columbia, Saskatchewan, Manitoba, Ontario and New Brunswick reveal that when children start school more than 27% are vulnerable, as measured by one or more of the five scales of the Early Development Instrument (EDI): physical health, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge in the majority language and culture. These province-wide findings are consistent with vulnerability levels reported for select regions in Alberta, Nova Scotia, Newfoundland and Quebec. Such levels of vulnerability at school entry are at least five times higher than the rates of biological vulnerability that are detectable in the postnatal period.

Optimal development, as measured by the EDI, does not imply that children must be rocket scientists or the next Mozart by the time they reach kindergarten. Rather, it implies that children come to school appropriately dressed, nourished and rested; able to hold a pen, climb stairs and use the washroom independently; able to follow instructions and get along with peers (demonstrating that they can moderate their physical and relational aggression); know at least 10 letters of the alphabet, can write simple words and can tell a story about their day in the language of instruction in the classroom (English or French). More than 25% of Canadian children arrive at kindergarten struggling with these and other age-appropriate competencies. When these struggles affect one or more scales of the EDI sufficiently, the child is deemed to be "vulnerable" in his or her development. The early vulnerability rate is a canary in the coal mine predicting the future quality of our country’s labour supply. It signals that we are now tolerating an unnecessary brain drain that will dramatically deplete our future stock of human capital.

Economic analyses reveal that this depletion will cause Canada to forgo 20% in GDP (gross domestic product) growth over the next 60 years. The economic value of this loss is equivalent to investing $2.2 trillion to $3.4 trillion today at a rate of 3.5% interest, even after paying for the social investment required to reduce vulnerability.

Key words: Child development; population health; public policy

Objective: The study estimates the economic costs of early vulnerability in the light of population-level data showing that between 25% and 30% of Canadian children do not arrive at kindergarten meeting all of the developmental benchmarks they need to thrive both now and into the future.

Methods: The study examines Early Development Instrument (EDI) data across Canada as of 2008/09, and across time within British Columbia since 2001. We then link the BC EDI data with school achievement results on standardized tests in grades four and seven, along with graduation records and criminal justice information.

Results: The result is a synthetic cohort with which we can simulate the impact on economic growth of reducing early vulnerability in BC from its current rate of 29% to 10%, a threshold above which child vulnerability is biologically unnecessary.

Discussion: Nearly three times what it should be, a rate of early vulnerability that approaches 30% signals that the country now tolerates an unnecessary brain drain that will dramatically deplete our future stock of human capital. Economic analyses reveal that this depletion will cause Canada to forgo 20% in GDP (gross domestic product) growth over the next 60 years. The economic value of this loss is equivalent to investing $2.2 trillion to $3.4 trillion today at a rate of 3.5% interest, even after paying for the social investment required to reduce vulnerability.
“brain drain”, which will dramatically deplete our future stock of human capital because early physical, social/emotional and cognitive vulnerability in a population will influence the quality of its labour market participation later in life.

Such high rates of early vulnerability caution against relying on Canadian results in the Programme for International Student Assessment (PISA) to evaluate child development trajectories in Canada. Although PISA reports that Canadian high school students are historically strong achievers by international standards, we know that children who are vulnerable on the EDI are significantly less likely to even write standardized examinations later in school. This trajectory information warns that standardized tests like PISA may reflect a sample bias, because children who were vulnerable in their early years are disproportionately excluded. Population-level linkages between medical service birth records and standardized test achievement in Manitoba schools reinforce this sample bias concern. For instance, our calculations based on data published by Brownell, Roos et al. show that 84% of Manitoba grade twelve students pass the standard language arts test in that province. But this impressive pass rate obfuscates the story illuminated by population-wide data: that just 54% of the children who should have written the standardized test in that year actually passed the examination.

As we reconsider school test scores in the light of data that are virtually population-wide, provided by sources like the EDI, it is imperative to recognize that high rates of early vulnerability in Canada are not just a one-time finding. The Human Early Learning Partnership has collected BC-wide EDI data on three different occasions over the last decade: the vulnerability rate was 26.1% in 2004, 29.6% in 2007 and has since leveled off at 28.6% in 2008/09. The rise in vulnerability between 2004 and 2007 is particularly noteworthy, because this was a period of impressive economic growth in the province, which pushed BC unemployment down to levels unseen in decades and generated substantial surpluses for provincial and federal governments. Yet the public policy strategies, including the priority given to income tax cuts in 2001, which aimed to generate this strong economic growth did not simultaneously grow strong families with children. In this article, we show that economic stimulus strategies are short-sighted if they tolerate unnecessary child vulnerability. The population-level human development data on which we report reveal that the more children are not ready for kindergarten, the more high schools will graduate students who are not job ready for the knowledge economy.

Figure 1 disaggregates the 28.6% vulnerability rate for British Columbia in 2008/09 by the province’s 59 geographically contiguous school districts. The map uses a grey-scale colour scheme to
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convey the alarming range in vulnerability across the province, as measured by one or more scales of the EDI. The darkest, almost black, school districts are places where all Canadians need to stop and take notice, because they endure vulnerability rates that are very high by national standards – some above 50%. Grey districts have mid-range vulnerability levels, and light, almost white, districts enjoy low vulnerability rates by national standards. However, among the latter, only Revelstoke and Arrow Lakes report vulnerability rates at or below 10%, as do a select few other, not necessarily privileged, communities across Canada.4 If 10% or less is possible in some communities, it is possible anywhere, provided there is the political will to make it so. We therefore propose this target as an objective for all regions in the country.

While the summary map illuminates the range in overall vulnerability by school district, it overlooks diverging trends that are apparent when we attend to EDI scales individually. Between 2003/04 and 2008/09, there were particular increases in physical, social and emotional vulnerability, along with a rise in vulnerability on the communication and general knowledge scale. In contrast, the language and cognitive vulnerability rate reported for kindergarten children over this period declined somewhat.

Although the latter trend provides reason for hope, we must be cautious about the “tyranny of cognitive seduction”, since these results suggest that efforts to address the early years have focused selectively on language and cognitive development at the expense of other developmental domains. Yet BC data confirm that population vulnerability on one or more of any of the five EDI scales predicts less school success and more criminal activity at the population level. We know this because building on EDI data for the population of kindergarten children we can follow individuals as they progress through the school system to reach grade four, when children write standardized Foundations Skills Assessment (FSA) tests. These anonymized, person-specific trajectories from kindergarten to grade four can then be linked with population-level data for children in grade four for whom we have FSA data and who have since gone on to write standardized FSA exams in grade seven. The latter trajectories can, in turn, be connected to population-level information about children who have worked their way from grade seven through to high school graduation and/or the criminal justice system.

METHOD

We make these linkages using three sets of regression analyses. The first identifies the characteristics of grade seven students that predict high school graduation and/or criminal activity, drawing on data from the grade seven to twelve cohort. Data about student characteristics in grade seven include their numeracy FSA score; reading FSA score; writing FSA five-point score; whether the students wrote each of these FSA tests; the reason for not writing a test, when relevant; special needs classification; age; language spoken at home; Aboriginal status; English as a second language (ESL) status; participation in French immersion; and sex. We combine these student variables into two composite measures based on their importance in predicting i) educational attainment in grade twelve (measured as grade point average, which is treated as censored if the individual did not graduate) and ii) the likelihood of being incarcerated. We run regression analyses separately for boys and girls to determine what weight to assign each of the student characteristics in the composite indices. We then repeat this line of analysis a second and third time. The second set of regressions is used to produce indices of grade four educational achievement and likely incarceration, and with these indices we can link the grade four to grade seven cohort with the population that has transitioned from grades seven to twelve. For this analysis, we rely on the student characteristics available in the sample of children moving from grade four to grade seven, and treat the grade seven indices of educational attainment and potential incarceration as the dependent variables. We conduct a third set of regressions to produce indices of kindergarten educational achievement and likely criminal activity. In these latter analyses, we use the kindergarten to grade four sample to identify children’s characteristics and use the grade four indices of educational attainment and potential incarceration as the dependent variables. (The output from these various regressions are available in Forer et al.). We then link the three population-level samples of children on the basis of the grade four and grade seven composite indices of achievement/incarceration to produce a synthetic population-level cohort, which moves from kindergarten through to grade twelve.

RESULTS

The synthetic cohort provides important insights. Not all children who start out behind their classmates end up behind, and not all children who start out ahead continue to thrive (see also D’Angiulli et al.). Life events, parents, teachers, friends, schools and communities can all affect children’s progress after kindergarten. But the synthetic cohort also shows that a strong start in kindergarten goes a long way towards diverting the population from criminal activity and ensuring that high school is completed successfully without delaying a year or more and with grades conferring eligibility for university and other post-secondary institutions.

To demonstrate this finding, we use the cohort to simulate the population-level outcomes if vulnerability at kindergarten in BC were reduced from 29% to 10%. We do so by identifying the normalized EDI score at the 29th percentile and shifting the distribution to the right until the normalized score is at the 10th percentile. The curve is shifted by increasing the weight for students with high values on the educational index at kindergarten and decreasing the weights for those with low values, until the new distribution is one in which just 10% of children are vulnerable. These weights are calculated as the ratio of children in the new distribution at each value of the educational/incarceration indices relative to the number of children in the old distribution at the same value of the indices. The revised weightings in the kindergarten indices are then applied to the grade four outcomes. The simulated grade four outcomes were analyzed to construct revised weightings to apply to the grade four to grade seven cohort, and we repeated this two-part process a third time to adjust the distribution of children at school completion and incarceration (for the revised weightings, see Forer et al.). As a result of this simulation, reducing the proportion of children who are vulnerable on entering kindergarten to 10% is projected to reduce crime in BC by one third and to increase on-time graduation rates. Of those graduating, the cohort achieving university-eligible grades would rise by more than one third, from 41.5% to 55.6%. Research on population trajectories in Ontario support these findings.
A substantial economic literature makes clear that improving the population’s school achievement by reducing early vulnerability of children to 10% will yield substantial long-term economic gains for private individuals, businesses and the economy in general, as well as for governments specifically. Research by Hanushek is particularly insightful about the economic gains generated for jurisdictions by population-level school achievement. He and colleagues use international test score data for children aged 9 to 15 to analyze the relation between population-level cognitive skills and per capita GDP growth across countries. Their analyses show that jurisdictions that report higher average test scores in school also enjoy far higher growth rates.

Specifically, if one country’s test score performance was 0.5 standard deviations higher than another country’s during the 1960s, the first country’s growth rate was, on average, 0.63 of one percentage point higher annually over the following 40-year period than the growth rate in the second country. Hanushek and colleagues have found that higher cognitive skills accelerate GDP by this value even after controls are in place for the security of a country’s property rights, its openness to international trade, fertility patterns and geographic characteristics. While an additional 0.63 of a percentage point of GDP growth per year may not sound like much and the figure is indeed a conservative projection relative to other estimates of the economic growth generated by increased human capital, over time this additional growth functions like compound interest to multiply GDP dramatically.

The question is: How do we achieve a half standard deviation improvement in school achievement in the population of children aged 9 to 15? The synthetic cohort data in BC provide the answer.

A reduction in early vulnerability from 29% to 10% for the population entering kindergarten will yield slightly more than the half standard deviation improvement in cognitive skills on which Hanushek and colleagues focus during the middle school years. As these children complete high school and enter the labour market, their improved human capital will begin to improve the quality of the total labour supply. Over the working lives of the first cohort of children to benefit from reduced early vulnerability at school entry, the BC simulation shows that the province can conservatively anticipate an increase in GDP by more than 20% (Figure 2).

In BC, the net present value of this 20% acceleration in GDP growth is equivalent to an investment of $401.5 billion along with the interest this capital would earn at 3.5% for 60 years, even after covering the social investment costs required to achieve the necessary improvement to early child development. This enormous dollar figure signals that the cost of biologically unnecessary vulnerability is 10 times greater than the total debt load carried by the Government of British Columbia. Given BC’s share of the national population and GDP, we extrapolate that unnecessary early vulnerability across Canada is equivalent to throwing away today between $2.2 trillion and $3.4 trillion from the economy. The implication is clear: governments, businesses, bankers and citizens have far more reason to worry now about the early child vulnerability debt as they have reason to worry about the fiscal debt. But they don’t. Despite mounting evidence attesting to the influence of early experience on brain development and the salubrious effect of smart family policy for population health and human capital, Canada still resists acting on this knowledge. The result is that the Organisation for Economic Co-operation and Development (OECD) and the United Nations Children’s Fund both rank...
Canada last among rich Western countries in international evaluations of family policy and country support for early child development.

This poor ranking imposes social injustices on our nation’s children, condemning members of the next generation to unequal starting points over which they have no control. But the social justice argument has not proven decisive to Canadian public policy. This article aims to make clear the relation between human development and human capital in the expectation that an economic argument may prove more powerful at the decisive venues, such as the provincial and federal treasury boards. Research about the early stages of population health in BC make clear that our society requires a paradigm shift in how we think about strong economies. We tolerate the status quo in terms of child development at the expense of economic development, because it is clear that we will promote stronger long-term economic growth only if we implement strong family policy now that reduces early vulnerability to below 10%.

Over the last decade, Quebec has led the way in Canada by introducing family policy that has improved parental leave for both mothers and fathers, enriched income support for low-income parents with children and launched full-day child care programs that are particularly popular after the parental leave period. While implementation of the early learning services remains incomplete and there is room to further improve Quebec leave and income-support policy, comparative policy research confirms the value of these new policy trajectories for child development, gender equality and economic growth.12,21,22

Guided by this evidence, Kershaw and colleagues have recently published a comprehensive human capital and family policy framework to reduce child vulnerability from 29% to 10% in BC12 and have adapted the costing of the policy recommendations for all 10 provinces.23 The framework requires an investment of 1.4% of GDP in smart family policy that supports parents in three ways: i) time for fathers and mothers to care personally; ii) resources to lift working-poor families and those on welfare above the low-income cut-off; and iii) community services, coordinated by local planning tables, which provide caregivers with monthly (para)professional expertise to monitor their children’s development* and access to early learning and care services for all families that want or need them as the parental leave period ends.†

Recently, the Ontario government signaled its intention, with the release of the Pascal Report,24 to join Quebec by innovating in all three policy areas. Simultaneously, the government of BC has made a commitment to reduce the provincial rate of child vulnerability to 15% by 2015/16, beginning with the implementation of full-day kindergarten for 5-year-olds.25 This ‘15 by 15’ goal is an ambitious, but reasonable, medium-term target to establish across the country as we work towards reducing vulnerability to 10% by 2020. It is time for Canada to adopt this target – and the smart family policy required to achieve it – as a population health benchmark, a social justice objective and an economic priority.

* For a review of the benefits of these programs, see, for example, Sweet and Appelbaum.23
† For a review of the benefits of these services, see Barnett.24

**REFERENCES**

Neighbourhood Ethnic Diversity Buffers School Readiness Impact in ESL Children

Chassidy Puchala, BSc,1 Lan T.H. Vu, MD, PhD,2 Nazeem Muhajarine, PhD3

ABSTRACT

Objectives: Contextual factors, as measured by neighbourhood characteristics, shape the experiences children have and affect their “school readiness”, i.e., whether they are well or poorly prepared for the transition from home to kindergarten. This study assessed the independent effects of individual and neighbourhood factors on school readiness; specifically, it examined whether and to what degree neighbourhood factors modified children’s language ability and thus their school readiness in a population of children in Saskatoon, Saskatchewan.

Method: The study included all children attending kindergarten in 2001, 2003 and 2005 in Saskatoon. School readiness and child characteristics were measured by the Early Development Instrument (EDI). The EDI measures child development at school commencement in five domains: physical health and well-being, social competence, emotional maturity, cognitive and language development, and communication skills and general knowledge. Data from the 2001 Census were used to characterize Saskatoon’s neighbourhoods. Multilevel modeling examined the independent and buffering or exacerbating effects of individual and neighbourhood factors on the relation between English as a Second Language (ESL) status in children and EDI domain scores.

Results: ESL children had significantly lower scores on all EDI domains compared with non-ESL children. Certain factors (e.g., younger age, male, Aboriginal status, having special needs) were significantly related to lower readiness in terms of the emotional maturity, and communication skills and general knowledge domains. Importantly, children who lived in neighbourhoods that were highly transient (with a higher proportion of residents who had moved in the previous year) had lower EDI scores on both domains, and those in neighbourhoods with lower rates of employment had lower EDI scores on communication skills and general knowledge. Neighbourhood ethnic diversity mitigated the negative impact of ESL status on school readiness for both domains. ESL children from neighbourhoods with a high degree of ethnic diversity had higher EDI scores than ESL children from neighbourhoods with low ethnic diversity.

Discussion: The current study provided insight regarding the impact of contextual factors in addition to individual factors, such as ESL status, on school readiness outcomes. Future research should continue to examine contextual factors related to ESL status and early child developmental outcomes, particularly focusing on the mechanisms of influence.

Key words: Child development; child language; residence characteristics; neighbourhood

Reassuring children’s successful transition from home to school has received much recent attention because of the subsequent impact on academic, social, emotional and mental health outcomes.1,2 School readiness has been defined as “a child’s ability to meet the demands of school”,3 in part indicating a successful transition from home to school. Systematic and consistent differences in school readiness have been linked to characteristics of the child, including male sex, Aboriginal ancestry, being from an ethnic minority and age of school entry.4-7 A child’s lack of facility with the primary language of instruction (which is often English, in Saskatoon), as indicated by English as a second language (ESL) status, is expected to be a strong predictor of school readiness,8 although this is relatively under-explored within the published school readiness literature.

This paper explores factors contributing to poor school readiness among ESL children. Children are classified as ESL if they are currently learning to use and study English, but their mother tongue is a language other than English. Gaining a better understanding of the relation between ESL status and school readiness is of particular importance because of the high proportion of ESL individuals (children and adults) in Canada (approximately 20%), which is consistently rising each year with increasing rates of immigration.9,10 The process of acculturation presents many challenges to

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ESL students entering kindergarten as they must adapt to learning in an environment that uses language practices significantly different from those used in their home and cultural community, in addition to coping with many broader cultural, psychological and socio-economic issues.\textsuperscript{11} Perhaps as a result of such challenges, ESL children are at risk of many negative academic, social and emotional outcomes.\textsuperscript{12,13} In terms of the ability to meet the demands of school, ESL children have poorer school readiness outcomes than their non-ESL counterparts, particularly in the communication skills and general knowledge domain.\textsuperscript{8,16-19} Contextual factors are those that describe the physical, social and economic environment of a geographical place in which people live and, through various mechanisms, that are expected to influence outcomes in the individual. These include safety in neighbourhoods, availability of services or amenities, social variables such as level of unemployment among adults, household income and transiency. Therefore, it is not simply the characteristics of the child that shape his or her school readiness but, rather, the combination of both individual- and contextual-level factors.

The aim of the current study is to examine the individual and contextual factors related to school readiness and to ascertain whether the relation between child ESL status and school readiness may be buffered by contextual factors based on community-defined neighbourhoods in Saskatoon, Saskatchewan. Neighbourhoods in Saskatoon are well defined geographical entities, have known boundaries, are meaningful to residents and are comprehensively planned units that can be efficiently serviced and maintained over the long term.\textsuperscript{20}

**METHOD**

**Setting**

Data were collected for three cohorts of kindergarteners in 2001, 2003 and 2005 in Saskatoon, Saskatchewan. The City of Saskatoon has a total of 86 neighbourhoods, 63 of which are considered residential.

**Measurement**

**School Readiness**

The Early Development Instrument (EDI) is a tool that measures kindergarten students’ school readiness. It consists of 103 questions falling into one of five domains: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge. Scores for each domain range from 0 to 10. The EDI is completed by kindergarten teachers for each student midway into the kindergarten year over a two-week period of time.

**Individual-level Factors**

The EDI also captures basic demographic information for each child as reported by the kindergarten teacher, in part based on school records. Seven individual level characteristics were examined: ESL status, sex, age, Aboriginal status,\textsuperscript{*} special needs status and the presence of special skills\textsuperscript{†} and special problems.\textsuperscript{‡}

**Contextual-level Factors**

The EDI data are analyzed and reported at the population level and can therefore be linked to other population-level databases, such as the national census, conducted by Statistics Canada. The Canadian census collects reliable, detailed data on every resident of Canada, allowing analyses to be conducted for areas, such as a neighbourhoods. The 2001 Census special tabulations provided information on seven characteristics for each of Saskatoon’s neighbourhoods: percentage of families falling below Statistics Canada’s low income cut-off (LICO), ethnic diversity, percentage of the population with Aboriginal status, percentage of the population greater than 19 years with education under grade 9, percentage of the population 24 to 64 years old who are employed, percentage of the population who had moved within the previous year and the percentage of single parents.\textsuperscript{8,16-19} The LICO is a standard used by Statistics Canada to relate family income to living expenses for various sizes of families living in urban and rural settings in Canada. A family falls below the LICO if it spends more than 20% of its average income on basic necessities such as shelter, food and clothing. Neighbourhood ethnic diversity is based on Statistics Canada’s Single and Multiple Ethnic Origin Response table. The diversity index is calculated at the neighbourhood level and indicates the heterogeneity of ethnic group presence in each neighbourhood.\textsuperscript{20} First, the population of each given ethnic group in a neighbourhood is compared with the population of the same ethnic group within the city as a whole to create a ratio. Next, these ratios are summed across ethnic groups to create a diversity index for each neighbourhood. Higher sums are indicative of more ethnically diverse populations.

**Statistical approach**

To test the hypothesis that ESL children have lower EDI scores than non-ESL children, we applied multiple linear models to estimate the adjusted difference in EDI score for all five domains, controlling for age, sex, special needs status, Aboriginal status, special problems and special skills. Multi-level modeling examined the buffering effects of individual risk and neighbourhood factors on the relation between child ESL status and EDI domain scores. Three hierarchical models were estimated using HLM (hierarchical linear modelling) software version 6.07 (Scientific Software International, Inc.), each building on the previous model and thus increasing in complexity and explanatory power.\textsuperscript{21} The interaction between the variable ESL status and individual risk factors and neighbourhood factors was examined.

\textsuperscript{*} The Aboriginal status of the child is proxy-reported by the kindergarten teacher. On the basis of Statistics Canada’s definition of Aboriginal identity, generally, a declaration of Aboriginal status would involve a child having parentage of Aboriginal ancestry (i.e., Registered Indian, Treaty Indian, Métis or Inuit).  
\textsuperscript{†} Developers of the EDI include these skills as special: numeracy, literacy, arts, music, athletics/dance, problem-solving and other. Each of these skills is simply scored as yes or no.  
\textsuperscript{‡} Developers of the EDI consider special problems to include physical disability, visual impairment, hearing impairment, speech impairment, learning disability, emotional problem, behaviour problems and problems at home. These are scored in the same way as special skills.
Table 1. Comparison of EDI Domain Scores Between ESL (n=127) and Non-ESL (n=5,581) Subgroups in a Kindergarten Population, Saskatoon, Saskatchewan, 2001, 2003, 2005

<table>
<thead>
<tr>
<th>EDI Domain</th>
<th>ESL Mean (SD)</th>
<th>95% CI</th>
<th>Non-ESL Mean (SD)</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical health and well-being</td>
<td>8.34 (1.49)</td>
<td>8.07-8.60</td>
<td>8.63 (1.32)</td>
<td>8.60-8.66</td>
<td>0.013</td>
</tr>
<tr>
<td>Social competence</td>
<td>7.71 (1.91)</td>
<td>7.37-8.05</td>
<td>8.29 (1.76)</td>
<td>8.24-8.33</td>
<td>0.000</td>
</tr>
<tr>
<td>Emotional maturity</td>
<td>7.40 (1.32)</td>
<td>7.17-7.64</td>
<td>7.96 (1.57)</td>
<td>7.92-8.00</td>
<td>0.000</td>
</tr>
<tr>
<td>Language &amp; cognitive development</td>
<td>6.61 (2.28)</td>
<td>6.21-7.02</td>
<td>7.69 (2.07)</td>
<td>7.64-7.74</td>
<td>0.000</td>
</tr>
<tr>
<td>Communication skills &amp; general knowledge</td>
<td>4.53 (2.61)</td>
<td>4.07-4.99</td>
<td>7.69 (2.29)</td>
<td>7.63-7.75</td>
<td>0.000</td>
</tr>
</tbody>
</table>

EDI=Early Development Instrument; ESL=English as a Second Language; CI=confidence interval

Table 2. Estimated Coefficients From Final Hierarchical Linear (Multi-level) Modeling: EDI Communication Skills and General Knowledge Domain Score Regressed on Child and Neighbourhood Factors (n=5,722)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child characteristics (level 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.46</td>
<td>0.09</td>
<td>0.002</td>
</tr>
<tr>
<td>Sex (0=female, 1=male)</td>
<td>-0.45</td>
<td>0.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Aboriginal status (0=non-Aboriginal, 1=Aboriginal)</td>
<td>-1.26</td>
<td>0.12</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Special needs status (0=no, 1=yes)</td>
<td>-1.54</td>
<td>0.17</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of special skills</td>
<td>0.52</td>
<td>0.03</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of special problems</td>
<td>-0.99</td>
<td>0.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cross-level interaction between child and neighbourhood characteristics</td>
<td>2.85</td>
<td>0.29</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neighbourhood ethnic diversity</td>
<td>0.71</td>
<td>0.23</td>
<td>0.004</td>
</tr>
<tr>
<td>Neighbourhood characteristics (level 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>7.44</td>
<td>0.06</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Percentage of movers during previous year</td>
<td>-0.22</td>
<td>0.08</td>
<td>0.010</td>
</tr>
<tr>
<td>Percentage employed</td>
<td>0.14</td>
<td>0.05</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Table 3. Estimated Coefficients From Final Hierarchical Linear (Multi-level) Modeling: EDI Emotional Maturity Domain Score Regressed on Child and Neighbourhood Factors (n=5,690)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child characteristics (level 1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>0.21</td>
<td>0.07</td>
<td>0.002</td>
</tr>
<tr>
<td>Sex (0=female, 1=male)</td>
<td>-0.75</td>
<td>0.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Aboriginal status (0=non-Aboriginal, 1=Aboriginal)</td>
<td>-0.43</td>
<td>0.07</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Special needs status (0=no, 1=yes)</td>
<td>-0.22</td>
<td>0.10</td>
<td>0.034</td>
</tr>
<tr>
<td>Number of special skills</td>
<td>0.18</td>
<td>0.02</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of special problems</td>
<td>-0.77</td>
<td>0.04</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Interaction: ESL × sex</td>
<td>0.70</td>
<td>0.21</td>
<td>0.002</td>
</tr>
<tr>
<td>Cross-level interaction between child and neighbourhood characteristics</td>
<td>-0.51</td>
<td>0.11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neighbourhood ethnic diversity</td>
<td>0.23</td>
<td>0.11</td>
<td>0.027</td>
</tr>
<tr>
<td>Neighbourhood characteristics (level 2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>7.88</td>
<td>0.03</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Percentage of movers during previous year</td>
<td>-0.13</td>
<td>0.05</td>
<td>0.008</td>
</tr>
</tbody>
</table>

RESULTS

The average age of the entire study sample (N=6,144) was 5.65 years (SD=0.36); there were 135 ESL children, 5,833 non-ESL children and 176 children whose language status was unknown. ESL children accounted for 2.2% of the entire sample. Children missing two or more domain scores were classified as having non-valid EDI data and were excluded from the analysis. After excluding children with non-valid EDI, 127 ESL children and 5,581 non-ESL children remained in the analysis. Children with non-valid EDI did not differ demographically from those with valid EDI, with the exception of Aboriginal status. Significantly more Aboriginal children (62.9%) than non-Aboriginal children (37.1%) had non-valid EDI. No significant differences were found with respect to demographic characteristics (sex, age, special needs status) between ESL and non-ESL children, with the exception of Aboriginal status. There were significantly more ESL children in the non-Aboriginal group (2.6%) than the Aboriginal group (0.5%). The average number of special skills and special problems for the entire sample was 0.42 and 0.26, respectively. Average EDI domain scores were as follows: 8.63 (SD=1.32) for physical health and well-being, 8.30 (SD=1.77) for social competence, 7.95 (SD=1.57) for emotional maturity, 7.67 (SD=2.09) for language and cognitive development and 7.63 (SD=2.35) for communication and general knowledge. After all other available child characteristics had been controlled for, ESL children had significantly lower scores on all EDI domains, the largest difference being in the communication and general knowledge domain (see Table 1). The association between ESL status and EDI scores was mitigated by individual and contextual factors only for the communication skills and general knowledge, and the emotional maturity domains. The final multilevel models for these two domains are presented in Table 2 and Table 3.

At the individual level, older children and children with more special skills had higher scores on emotional maturity, and communication and general knowledge. Males, children of Aboriginal status and those with special needs or problems had lower domain scores. An interaction between sex and ESL status was found for the emotional maturity domain, meaning that for males, compared with females, there was a larger difference in EDI score between ESL and non-ESL children. At the neighbourhood level, children from neighbourhoods with a lower percentage of employment among adults had lower EDI scores in the communication and general knowledge domain. Children from highly transient neighbourhoods, with a higher percentage of the population who had changed residences within the previous year, had lower EDI scores on the emotional maturity and on the communication and general knowledge domains.
Importantly, children from neighbourhoods with high ethnic diversity had higher scores on communication skills and general knowledge, as well as emotional maturity, even if they were ESL speakers. As shown in Figures 1 and 2, the adjusted mean difference on these domains between ESL and non-ESL children is attenuated for ESL children in neighbourhoods with high ethnic diversity and exacerbated for ESL children in neighbourhoods with low ethnic diversity.

**DISCUSSION**

The current study explored the individual and contextual factors associated with poor school readiness and child ESL status. Consistent with past research, ESL children had lower levels of school readiness than non-ESL children on all domains, especially the communication skills and general knowledge domain. Although ESL children are at risk of poor readiness across all domains, only scores on the communication skills and general knowledge, and the emotional maturity domains were mitigated by individual and contextual factors, indicating that different contextual-level factors have varying degrees of association with each domain of school readiness.8,19,23

Male ESL children were at risk of lower emotional maturity scores than non-ESL males, whereas the difference was smaller for females. This may be attributed to the gap in emotional development between males and females wherein females, generally, have higher levels of developmental maturity.24,25 ESL status may further exacerbate this difference if young males are less able to handle the challenges associated with having an ESL status and thus make an even poorer emotional adjustment. Relatively rapid development emotionally among females may actually help them cope with such challenges, which would translate into smaller disparities. In the communication and general knowledge domain no interaction was observed between ESL status and sex. While females have been found to consistently outperform males in this domain, it is likely the challenge of using a language other than one’s own mother-tongue to communicate that places both sexes at the same level of risk.

The significant relation between neighbourhood factors and performance on the communication skills and general knowledge domain aligns with previous studies.8,23 The current study offers a unique contribution to the literature by providing evidence that ethnic diversity mitigates the relation between ESL status and EDI performance. It has been suggested that children raised within “neighbourhood language-based enclaves”, wherein a majority of parents and community members communicate in one dominant language other than English, may be less likely to acquire English language skills.8 However, no research has examined the effects of growing up in a linguistically diverse neighbourhood. If ethnic diversity is used as a proxy for linguistic diversity, it may be that high levels of exposure to varying languages facilitate an ESL child’s ability to understand and communicate in languages other than his or her mother tongue, such as English. It should be noted that while one may speculate that ethnic diversity is related to exposure to multiple languages, the current study was unable to directly examine neighbourhood linguistic composition.
Previous school readiness research has shown that neighbourhood factors are least associated with scores on the emotional maturity domain. However, to our knowledge studies have not examined the neighbourhood factor of ethnic diversity. The identification of neighbourhood buffering effects on the emotional maturity domain is a unique contribution to the literature. We found that ethnic diversity buffers the negative association between ESL status and emotional maturity scores. In fact, mean emotional maturity scores did not differ between ESL and non-ESL children when ESL children lived in the most ethnically diverse neighbourhoods.

This finding points to the importance of community in promoting success among ESL children. Ethnic minority families share similar struggles, in that they must adapt to their new host culture while simultaneously maintaining their own unique identities, which may foster interdependence and community. ESL children from communities with high levels of interdependence may be less likely to experience difficulties emotionally. For instance, for some children the ability to empathize with others and a strong social support system may translate into pro-social and helping behaviours within the classroom setting and protect against negative emotionality or poor psychological adjustment (e.g., being unhappy or sad, anxious or fearful behaviour). Therefore, programs directed towards increasing interconnectedness among ethnic minority communities may increase school readiness.

Although the current study added knowledge to the research literature on school readiness among ESL children, there are limitations that should be addressed. First, a two to four year time difference exists between collection of the EDI data (2001, 2003, 2005) and the census data (2001). Although this difference could affect our findings, there is little evidence in Saskatoon that such significant change has occurred during the four years relevant to this study (2001 to 2005). Second, despite the potential contributions of ethnic diversity, the current study did not examine the specific ethnic composition of the neighbourhoods. A third limitation is the inability to assess the English language proficiency of the neighbourhoods under study, which may have an impact on English language acquisition among their children.

In summary, the current study provided some insight regarding how contextual factors may protect ESL children from poor school readiness outcomes. It is clear that although ESL children are at a disadvantage in many areas, neighbourhood ethnic diversity may buffer against this risk specifically within the communication skills and general knowledge, as well as the emotional maturity domains. As a result, community initiatives should focus on these domains in addition to promoting an ethnically diverse and inclusive environment. On the basis of our findings, future research should continue to examine the contextual factors related to ESL status and early child developmental outcomes, particularly focusing on the role of neighbourhood ethnic and linguistic concentration. Such research is vital in order to help communities work together to foster school readiness and, consequently, promote long-term academic success and positive developmental outcomes in this at-risk population.
The Prevalence of Anxiety Among Middle and Secondary School Students in Canada

Lucia Tramonte, PhD,1 Doug Willms, PhD2

ABSTRACT

Objectives: Adolescents’ anxiety is associated with individual and contextual characteristics. The purpose of this study is to estimate the prevalence of anxiety among adolescent youth in grades 6 to 12 and determine whether it is related to socio-economic status and perceptions of learning skills and challenges.

Methods: Nationally representative cross-sectional data from the Tell Them From Me survey – Fall 2008 assessment – were used for this study. Item response theory estimates and a cut-off point for anxiety were developed from six Likert items pertaining to anxiety. Csikszentmihalyi’s theory of flow was applied to create four different combinations of learning processes and students’ skills.

Results: Females had a higher prevalence of anxiety than males in both middle and secondary schools. The prevalence of anxiety did not vary substantially among schools for either middle or secondary schools. Less than one half of Canadian students can be considered “in flow”, that is, feeling confident in their skills and challenged in their classes. Students who lacked confidence in their skills were nearly twice as likely to experience anxiety.

Conclusion: The relation between students’ skills, the challenges presented to them at school and anxiety problems deserves attention by parents and school staff. Further research could examine the relationship between direct assessments of students’ skills and measures of teaching practices and school policies.

Key words: Anxiety; adolescents; skills; learning challenge; flow; TTFM survey; schools

A bout one half of adult mental health issues start before the mid-teens, and often treatment does not occur or is delayed until well into adulthood.1,2 The number of children experiencing mental health problems is significant, and these problems affect both their quality of life and their ability to benefit from their school experience. For example, results from Canada’s National Longitudinal Survey of Children and Youth (NLSCY) indicate that the prevalence of anxiety problems among children and youth ranges from 2% to 12%, with a lower prevalence among children aged 2 to 11 according to parents’ assessments and a higher prevalence among adolescents aged 10 to 15 according to self-assessment. The 2003 US National Survey of Children’s Health assessed emotional, cognitive and behavioural problems in over 100,000 children and youth 0 to 17 years of age and found that one half of Canadian students can be considered “in flow”, that is, feeling confident in their skills and challenged in their classes. Students who lacked confidence in their skills were nearly twice as likely to experience anxiety.

Children and adolescents constantly face challenges, such as trying to look strong and beautiful to their peers, succeeding in sports and recreational activities, achieving good grades and developing positive relationships. School is the place where children spend most of their daily hours, trying to meet these challenges while they define their identities. Recently, researchers and educators have directed attention to the relation between the quality of learning environments – particularly effective teaching – and problems experienced by students in middle and secondary schools, such as disengagement, dissatisfaction with their schooling experience, and dropping out.4,6 Relatively little attention has been paid to the role of schools in identifying mental health problems or helping to alleviate them. For example, in most countries studied in the Programme for International Student Assessment (PISA), there was considerable variation among schools in students’ academic achievement and sense of belonging at school.3 Some of this variation was attributable to measurable aspects of classroom and school climate, and structural features of the school system. However, PISA and other large-scale international studies do not consider variation in mental health outcomes such as anxiety and depression. In this paper we consider whether schools may be differentially successful in limiting anxiety by developing effective teaching and learning approaches.

Csikszentmihalyi’s theory of flow7 provides a useful tool for considering emotional outcomes resulting from different combinations of learning processes and students’ skills. Csikszentmihalyi8 describes “flow” as deep absorption in an activity that is intrinsically interesting. Flow is believed to occur at the point of balance between the challenge inherent in the task at hand and the skills required to accomplish it. As the theory applies to education,
Csikszentmihalyi suggested four general relations between skills and instructional challenge in students’ experience of learning:

- **Low-skills/low-challenge** – students are more likely to feel apathetic about learning when they find themselves in learning situations that involve tasks for which they have low skills and which are of low challenge. These students tend to give up because school work is inconsequential.

- **Low-skills/high-challenge** – students are more likely to feel worried in learning situations because they have low confidence in their skills and the tasks they are asked to perform are perceived as too challenging.

- **High-skills/low-challenge** – students are more likely to feel that the challenges of learning are too few in relation to their skills, and they are unable to identify how they can make the experience more challenging. This leads to boredom and disengagement because students see little relevance in what they are asked to learn.

- **High-skills/high-challenge** – students generally feel that their skills and the challenges of the tasks they are asked to perform are in balance. These students frequently experience flow.

According to this theory, when students experience flow the relation between skills and challenge is symbiotic, and skills are neither too low nor too high in relation to the challenge at hand. Student engagement is conceived as the culmination of concentration, interest and enjoyment, as opposed to boredom or apathy.

In this study we estimate the prevalence of anxiety among male and female students and determine the extent to which it varies among middle and secondary schools. We use data extracted from the Tell Them From Me (TTFM) survey. TTFM (The Learning Bar Inc., 2009) is an evaluation system designed to meet the ongoing needs of teachers, principals and school district administrators. It includes a set of dynamic, web-based student surveys and a teacher survey, which assesses various aspects of student engagement and wellness together with the most important aspects of a school’s learning climate. From indicators in this survey, we asked whether experiencing anxiety is related to children’s socio-economic status and their perceptions of skills and challenges, as described by Csikszentmihalyi.

**METHODS**

TTFM survey data from the fall term of 2008 were analyzed applying hierarchical linear modelling (HLM) for dichotomous outcomes. TTFM is Canada’s largest school survey, with over 170,000 students completing the survey annually. The data extracted for this study were from 5,650 children attending 70 middle schools and 6,274 children attending 46 secondary schools. A separate analysis of the socio-economic characteristics of the children in the sample, based on a match between their postal codes and census 2006 data, revealed that the TTFM sample had a similar distribution of socio-economic status to that of all Canadian children.

The TTFM measure for anxiety is based on a set of six Likert items to which students respond on a 4-point scale: 0 = “Never or hardly ever”, 1 = “About once a week”, 2 = “About 2 or 3 times a week” and 3 = “Every day or almost every day”. The scores were transformed into a continuous variable using a model from Samejima’s item response theory. The cut-off point for the continuous measure of anxiety was defined as the value corresponding to a response pattern of 222111; for example, a youth was considered anxious if he or she answered “about 2 or 3 times a week” to the three easiest items and answered “about once a week” to the three most difficult items.

Skills and intellectual challenge dimensions were assessed with 12 Likert statements regarding the extent to which students felt challenged in their language arts and math classes, and whether they felt confident in their skills in these subjects. Cut-off points for each scale were used to construct a 2-by-2 matrix of challenge versus skills. The analysis also used the TTFM measure of socio-economic status, which is derived from student data on parents’ education and a set of educational and cultural possessions in the home.

**RESULTS**

Figure 1 illustrates the prevalence of anxiety by grade and sex for the full sample of 11,924 students. It shows that females in middle school displayed much higher levels of anxiety than their male
peers. The prevalence of anxiety among males did not change substantially during middle and secondary school, whereas among females it rapidly declined from grade 7 to grade 12.

Estimates of the prevalence of anxiety in each school were made using a two-level hierarchical logistic regression model. Figure 2 shows the range in the prevalence among middle and secondary schools using notched box plots. The range of prevalence in middle schools was small, with the majority of schools having a prevalence within 2% to 3% of the median prevalence, which was about 13.2%. In secondary schools the range was even smaller; all schools having a prevalence between 10% and 12%. Estimates of the proportions of variation within and among schools revealed that more than 99% of the variance in anxiety was within schools and less than 1% between schools.

Table 1 shows the percentage of middle and secondary school adolescents in each of the quadrants of Csikszentmihalyi’s typology. Even though a large proportion of students in middle and secondary school were “in flow” (high skills and high challenge), more than half of them were located in one of the three suboptimal quadrants.

The percentage of students in flow was approximately 45% in both middle and secondary schools. However, the percentage of females in the high-skills/low-challenge quadrant was higher than that of males in both middle and secondary schools, whereas more males than females were in the low-skills/high-challenge quadrant.

Table 2 provides the results of a two-level hierarchical logistic regression model analysis with anxiety regressed on sex, socio-economic status and skills-challenge profile. The analysis was conducted separately for middle and secondary schools. The results indicate that females were more likely than males to experience anxiety, as was shown in Figure 1. Higher socio-economic status was a protective factor for females in middle schools and for both sexes in secondary schools. Youth who had high skills but low levels of challenge were less likely to experience anxiety in both middle and secondary schools. However, youth with low skills were much more likely to experience anxiety, irrespective of their level of challenge. Those in the low-skills/high-challenge quadrant had the greatest risk of experiencing anxiety, consistent with Csikszentmihalyi’s hypothesis. We also examined interactions between the skills-challenge variables and sex and socio-economic status; although minor changes in the size of the coefficients were observed, the interaction terms were not statistically significant. The results of the model with interaction terms are presented in Table 3; however, we focus on the results displayed in Table 2 in our discussion.

**DISCUSSION**

This study examined the prevalence of anxiety among males and females in a large sample of students who completed the TTFM student survey in the fall of 2008. Four key findings emerged from the analysis.

First, females had a higher prevalence of anxiety than males in both middle and secondary schools. The gap was larger among middle-school students. These results are consistent with previous research based on longitudinal data from the NLS CY.13,14

Second, the prevalence of anxiety did not vary substantially among schools for either middle or secondary schools. The initial goal of our analysis was to assess whether particular school factors, such as classroom disciplinary climate or teacher-student relations, were associated with the prevalence of anxiety across schools. However, the findings provide strong evidence that student anxiety is largely a within-school phenomenon: less than 1% of the variation in the TTFM sample was among schools. This means that school-based interventions aimed at reducing the prevalence of anxiety need to be universal rather than targeted towards a certain set of schools.15

Third, less than one-half of Canadian students could be considered “in flow”, that is, feeling confident in their skills and challenged in their classes. This general finding was reported earlier by the Canadian Education Association as part of its project called, “What did you do in school today?”14 Also, nearly 30% of students reported having low levels of skills, which is consistent with findings from large international studies, such as PISA.

Fourth, students who lacked confidence in their skills were more likely to experience anxiety. Consistent with Csikszentmihalyi’s theory, those with low skills and high challenge were at greatest risk; however, skill level was a much more important risk factor

| Table 1. Percentage of Students in the Four Quadrants of Csikszentmihalyi’s Typology, by School Type and Sex |
| --- | --- |
| **Females** | **Males** |
| **Low Skills** | **High Skills** | **Low Skills** | **High Skills** |
| Middle schools | Secondary schools | Middle School | Secondary School |
| High challenge | High challenge | 14.1 | 16.6 | 19.3 | 21.2 | 35.6 | 47.6 |
| Low challenge | Low challenge | 7.3 | 5.9 | 8.7 | 8.6 | 29.9 | 25.4 |

| Table 2. Odds Ratios for Experiencing Anxiety, by Sex, Socio-economic Status and Skill-Challenge Profile |
| --- | --- |
| **Middle School** | **Secondary School** |
| **Sex** | 1.00 | 1.00 |
| Males (reference category) | 1.61 | 1.95 |
| Females | 0.75 | 0.98 |
| **Socio-economic status (SES)** | 1.00 | 1.00 |
| **Skill-challenge profile** | Low skills-low challenge | 0.81 | 0.81 |
| High skills-high challenge (reference) | 1.00 | 1.00 |
| High skills-low challenge | 1.43 | 1.69 |
| Low skills-high challenge | 1.82 | 1.72 |

Note: Results in bold text are statistically significant (p<0.05).
than level of challenge. A countervailing finding was that among youth with high skills, those with low levels of challenge were less likely to experience anxiety than those with high levels of challenge.

A strength of the data provided by the TTFM evaluation system is that they include the full population of students of schools using the student survey. The system also furnishes data that are longitudinal at the school level, enabling schools to track progress on key outcomes. A limitation of this study is that it was not possible to link data on students’ academic achievement to the data on students’ mental health outcomes. Although this would require a separate study, it would provide a stronger purchase on the relations between skills and challenge and their effects on students’ well-being.

REFERENCES

Inequalities in health across levels of socio-economic status (SES) exist in most physical and psychological outcomes. The graded relation between SES and health (referred to as the “gradient effect”) is remarkably consistent across all levels of wealth. At each rung on the SES ladder, health is better on the rung above and poorer on the rung below. Research has traced the origins of the gradient effect to early childhood experiences and the cumulative effects of SES across the lifespan. Therefore, examination of SES effects on child health sheds light on the social determinants of adult health.

Health is also intricately linked to the social environment. Social capital is a characteristic of communities that includes levels of civic participation, norms of reciprocity and levels of interpersonal trust. Most definitions of social capital include aspects of social cohesion that characterize close-knit communities in which support and information are exchanged. It is an expansive theoretical construct that has garnered much attention from researchers and policy-makers because it is thought to promote public health. Studies of adult populations have shown that living in supportive, cohesive communities where interpersonal trust and civic pride are strong and civic involvement is common relates to better health, less illness and longer life expectancy.

Research has also found direct contributions of social capital to child health. A study of 287 Chicago-area neighbourhoods found higher rates of childhood asthma in areas of lower social capital. Researchers in Australia found that positive perceptions of neighbourhood social capital and social networks among school-aged children related to their levels of physical activity. Data from the Health Behaviour in School-aged Children (HBSC) study have shown that Canadian and British youths who live in high social capital neighbourhoods have better mental health, more health-promoting behaviours, fewer risk-taking behaviours and better overall perceptions of health than youths who live in low social capital neighbourhoods. Other research suggests that social capital indirectly affects child health by buffering (or moderating) the effects of SES. One study found moderating effects of social cohesion and trust on links between neighbourhood SES and children’s use of mental health services. A longitudinal study in Indonesia found that mothers’ involvement in community activities contributed to child physical health in low SES families but not in high SES families.

Although theories and measures of social capital are still under development, the available evidence suggests that social cohesion, interpersonal trust and other elements of social capital could represent opportunities through which public policy can reduce social inequalities in health. However, it is unclear whether social capital

**ABSTRACT**

**Objective:** To examine whether adolescents’ exposure to neighbourhood social capital, which is defined as levels of trust, cohesion and cooperation, reduces socio-economic differences in physical and psychological health outcomes.

**Methods:** Survey data were collected from the 9,717 Canadian youths in grades 6 to 10 participating in the 2006 Health Behaviour of School-aged Children study. Data analyses tested interaction effects of socio-economic status (SES) and social capital on five outcomes: psychological symptoms, somatic symptoms, injuries, fighting and life satisfaction.

**Results:** SES effects on the five health outcomes varied depending on the level of exposure to neighbourhood social capital. High levels of social capital reduced or eliminated SES differences in health. However, in areas of high social capital, more affluent children reported slightly more somatic symptoms, injuries and fighting than less affluent children.

**Conclusion:** Reduction of health inequalities in children and youth is a priority for public policy. Our results suggest that building social capital in neighbourhoods is one avenue for reducing socio-economic disparities in children’s physical and psychological health. However, the findings suggest that there might be a downside to social capital in that it appears to reverse socio-economic differences in some outcomes.

**Key words:** Socioeconomic status; social class; child; adolescent; injuries; health


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moderates SES effects on both positive and negative dimensions of child health. Most studies that have examined social capital and child health have been limited to only one health outcome. Moreover, links between social capital and children’s health in Canada are unclear, given a lack of Canadian research in this area.

In accordance with the World Health Organization’s perspective that health is a resource for everyday living and not just the absence of disease, we explored the moderating effects of social capital on links between SES and multiple outcomes encompassing physical, social and emotional health and well-being in Canadian youths: psychological and somatic symptoms, physical injuries, physical fights and life satisfaction. Adult studies have shown positive effects of SES and social capital on health and well-being. Therefore, we hypothesised that SES gradients in these five indicators of health and well-being would decline with greater exposure to social capital.

METHODS

Participants
The 2006 Canadian HBSC study (see: www.hbsc.org) surveyed 9,717 youths (52.61% female) in all provinces and territories in Canada (Table 1). The survey explored behaviours and social factors that influence physical and psychosocial health. A cluster sample of students in grades 6 to 10 (447 classes in 186 schools) was selected for the HBSC through weighted probability methods to obtain a balanced representation of school population characteristics, such as province/territory, type of school (public or Catholic), language of instruction (English/French) and community size. Students in private and special needs schools and schools for youth in custody were excluded. A university research ethics board approved the study procedures. Active consent was sought from both parents and children, and the consent rate was 74%.

Measures and procedures
The HBSC survey was anonymous and administered by teachers in classrooms following an international protocol. Assessments took approximately 45 minutes to complete. The questionnaire included measures of SES, social capital, psychosomatic symptoms, injuries, physical fighting and life satisfaction.

SES was measured using the HBSC Family Affluence Scale (FAS), which comprised four items that address family assets or conditions indicating wealth: Does your family have a car or a van? (0=none; 1=one; 2=two, or more); Do you have your own beds? (0=none; 1=one; 2=two, or more); During the past 12 months, how many times did you travel away on holiday/vacation with your family? (0=not at all, 1=once, 2=twice, 3=more than twice); How many computers does your family own? (0=none, 1=one, 2=two, 3=more than two). Responses were summed on a 0 to 9 point scale with higher scores indicating greater affluence. The FAS has better criterion validity and is less affected by non-response bias than longer SES assessments that rely on child reports of household income or parental occupation.

Social capital was measured using a 5-item scale (a=0.74): People say “hello” and often stop to talk to each other in the street; It is safe for younger children to play outside during the day; You can trust people around here; There are good places to spend your free time; I could ask for help or a favour from neighbours (1=strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree). Responses were summed on a 5 to 25 point scale with higher scores indicating more social capital. This scale was extensively piloted during HBSC development and used in previous studies of risk behaviour.

An 8-item symptom checklist measured four psychological symptoms: feeling low, irritability or bad temper, feeling nervous, difficulty sleeping, and four somatic symptoms, headache, stomach ache, back ache and feeling dizzy. For each item, respondents reported how often they had experienced the symptom in the previous six months (0=rarely or never, 1=every month, 2=every week, 3=more than once a week, 4=every day). Responses were summed on two 0 to 16 point scales (psychological and somatic) with higher scores reflecting more symptoms.

Respondents reported the frequency of injury events in the previous 12 months that had required medical attention from a doctor or a nurse (0=never, 1=once, 2=twice, 3=three times, 4=four times or more) and the number of times they had been involved in a physical fight in the previous 12 months (0=never, 1=once, 2=twice, 3=three times, 4=four times or more).

The survey also included Cantril’s self-anchoring measure of life satisfaction. Respondents rated how they felt about their life at that time on an 11-point scale ranging from 0 (worst possible life) to 10 (best possible life).

Data analysis
Stata 10 (StataCorp LP, College Station, TX) was used to test linear regression models of psychological symptoms, somatic symptoms and life satisfaction, predicted by gender, grade level, SES and social capital. Poisson regression was used to test similar models of rate of injury and rate of physical fights given that these data were heavily skewed. These models were adjusted for the design effects of
RESULTS

Gender and grade level interaction effects were found on all five outcomes \((p<0.01, \text{see Table 2})\). As shown in Figure 1, psychological and somatic symptoms were more common among females than males but only in grades 7 to 10. Gender was unrelated to psychological and somatic symptoms among grade 6 students. Conversely, injuries and physical fights were more common among males than females, and life satisfaction was higher among males than females; however, these gender differences were smaller in the higher grades than the lower grades. Grade 10 students showed no gender difference in their number of injuries. Additionally, life satisfaction was higher among females than males in grade 6, but this gender difference was reversed in grades 7 to 10. Life satisfaction was significantly lower among females and males in grades 7 through 10. As shown in Table 2, each interaction effect of gender and grade level was statistically significant and therefore controlled in analyses of SES and social capital.

Milded (interaction) effects of SES and social capital were also found in all five outcomes \((p<0.05, \text{see Table 2})\). Simple slopes analyses of these interactions were carried out by plotting regression lines of SES at high and low levels of social capital (Figure 2). In all health outcomes, the effects of SES were greater at low than at high levels of social capital. In areas of low social capital, high SES related to fewer psychological symptoms \((B=–1.65, p<0.01)\), somatic symptoms \((B=–1.80, p<0.01)\), injuries \((B=–0.38, p<0.05)\) and fights \((B=–0.39, p<0.05)\) and higher life satisfaction \((B=1.19, p<0.01)\). In areas of high social capital, however, no SES effects were found on psychological symptoms or life satisfaction, but high SES related to more somatic symptoms \((B=0.21, p<0.05)\), injuries \((B=0.15, p<0.05)\) and fights \((B=0.11, p<0.05)\).

DISCUSSION

We found that SES effects on physical and psychological health in youths varied according to their perceptions of social capital in their community\(^{19,20}\). Social capital nullified SES effects on psychological symptoms and life satisfaction and narrowed SES differences in somatic symptoms, injuries and fighting. These findings support the notion that social cohesion and cooperation in communities act as a health resource for youth and represent opportunities for public policy to close the gap in health disparities that are defined by material affluence. The underlying mechanisms involved in

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**Table 2. Regression Analysis of Psychological and Somatic Symptoms, Injury and Life Satisfaction by SES and Social Capital**

<table>
<thead>
<tr>
<th>Unstandardized Coefficients</th>
<th>95% Confidence Interval</th>
<th>t</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>5.34</td>
<td>3.79 to 6.90</td>
<td>2.83</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>-1.40</td>
<td>-2.38 to -0.43</td>
<td>-2.39</td>
</tr>
<tr>
<td>Grade level</td>
<td>0.23</td>
<td>-0.42 to -0.04</td>
<td>-2.16</td>
</tr>
<tr>
<td>SES</td>
<td>-0.73</td>
<td>0.18 to 0.42</td>
<td>4.99</td>
</tr>
<tr>
<td>SES × grade level</td>
<td>0.95</td>
<td>-1.23 to -0.23</td>
<td>-2.88</td>
</tr>
<tr>
<td>Social capital (SC)</td>
<td>0.74</td>
<td>-1.27 to -0.63</td>
<td>-5.88</td>
</tr>
<tr>
<td>SES × SC</td>
<td>0.32</td>
<td>0.12 to 1.36</td>
<td>2.36</td>
</tr>
<tr>
<td>Somatic symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>3.19</td>
<td>1.94 to 4.44</td>
<td>-3.19</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>-1.29</td>
<td>-2.08 to -0.49</td>
<td>-5.16</td>
</tr>
<tr>
<td>Grade level</td>
<td>0.17</td>
<td>-0.32 to -0.01</td>
<td>-2.16</td>
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<tr>
<td>SES</td>
<td>-0.68</td>
<td>0.20 to 0.40</td>
<td>6.09</td>
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<td>Social capital (SC)</td>
<td>-0.82</td>
<td>-1.17 to -0.20</td>
<td>-2.79</td>
</tr>
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<td>SES × SC</td>
<td>0.90</td>
<td>-1.12 to -0.52</td>
<td>-5.46</td>
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<tr>
<td>Injuries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.93</td>
<td>0.66 to 1.19</td>
<td>7.72</td>
</tr>
<tr>
<td>Sex (female)</td>
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<td>2.93</td>
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<tr>
<td>Grade level</td>
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<td>-0.06 to 0.01</td>
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</tr>
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<td>SES</td>
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<td>2.79</td>
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<td>-0.13 to -0.02</td>
<td>5.19</td>
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<tr>
<td>SES × SC</td>
<td>0.16</td>
<td>0.29 to 1.50</td>
<td>2.94</td>
</tr>
<tr>
<td>Physical fights</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.86</td>
<td>1.58 to 2.15</td>
<td>7.72</td>
</tr>
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<td>Sex (female)</td>
<td>-0.52</td>
<td>-0.70 to -0.34</td>
<td>5.69</td>
</tr>
<tr>
<td>Grade level</td>
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<td>-0.14 to -0.07</td>
<td>5.73</td>
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<tr>
<td>SES</td>
<td>0.03</td>
<td>0.01 to 0.05</td>
<td>2.77</td>
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<tr>
<td>Social capital (SC)</td>
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<td>-0.18 to -0.01</td>
<td>2.19</td>
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<tr>
<td>SES × SC</td>
<td>0.13</td>
<td>-0.19 to -0.09</td>
<td>5.19</td>
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<tr>
<td>Life satisfaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>6.96</td>
<td>6.21 to 7.72</td>
<td>2.72</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>0.64</td>
<td>0.15 to 1.13</td>
<td>2.55</td>
</tr>
<tr>
<td>Grade level</td>
<td>0.09</td>
<td>0.00 to 0.18</td>
<td>2.01</td>
</tr>
<tr>
<td>SES</td>
<td>0.10</td>
<td>-0.16 to -0.04</td>
<td>3.49</td>
</tr>
<tr>
<td>Social capital (SC)</td>
<td>0.59</td>
<td>0.32 to 0.87</td>
<td>4.22</td>
</tr>
<tr>
<td>SES × SC</td>
<td>0.71</td>
<td>0.54 to 0.88</td>
<td>8.08</td>
</tr>
</tbody>
</table>

Note: Shown are linear regression analysis of psychological symptoms, somatic symptoms and life satisfaction, as well as Poisson regression analysis of rates of injuries and physical fights.

SES=socio-economic status.
these effects are unclear. Social capital might produce health benefits by diffusing knowledge about health-related issues and by invoking social sanctions against risk behaviour.8 Youth living in areas of greater social capital might also be more likely to access health services and a lay referral network of family, friends and acquaintances that provide medical attention and advice when health concerns arise.16

Unexpectedly, we also found that SES was positively related to somatic health complaints, injuries and physical fights where perceptions of social capital were high. The availability of social capital reversed SES gradients in these three outcomes. Caughy et al. reported a similar interaction of SES and social capital on somatic health complaints in a study of child internalized symptoms.26 Our results suggest that a potential downside to social capital is that it might expose affluent youth to an increased risk of physical fights and injuries. While an in-depth analysis of this interaction falls beyond the scope of the current study, other evidence suggests that these findings are partially attributable to youth sport participation.27,28 The most compelling result of the study, however, was the narrowing of SES differences in health where social capital was greater (Figure 2).

The strengths of the study are its large representative sample and measurement of multiple health outcomes. Limitations included the cross-sectional design of the study, which precludes strong conclusions about the direction of effects between social capital and health. As well, the measures of SES and social capital were brief and relied solely on child reports. Corroborating individual perceptions of social capital with ecological data on community structures and activities might have led to more comprehensive accounts of social capital.

The potential contribution of social capital to public health has engendered much enthusiasm among researchers and policymakers. Critics of this research point to narrow definitions of social capital and ambiguous descriptions of its health effects.29,30 We posit that reducing social inequalities in children’s health is one way that social capital contributes to public health. An implication of these findings is that community-building initiatives that increase cohesion, cooperation and interpersonal trust, especially among low-SES youth, are a means of flattening the gradient effect and reducing social inequalities in health.

REFERENCES

Socio-economic status (SES) is strongly related to health, lower SES being associated with both higher mortality and morbidity. The relation between health and SES is generally referred to as a “socio-economic gradient”, emphasizing the idea that the change in outcomes is gradual and occurs across the full range of SES. It is not just the case that individuals living in poverty have poorer outcomes when compared with individuals not living in poverty but, rather, that each increase in SES is associated with an increase in positive outcomes. There has been considerable interest in the research literature on investigating changing SES gradients in health over time; however, most of this research has focused on adult populations. The few studies that have examined changes in SES gradients in children have produced mixed results: a study of childhood injury deaths in Great Britain found an increase in socio-economic disparity between 1981 and 1991; a study of all-cause mortality disparities among females in the same age range; however, most of this research has focused on adult populations. The few studies that have examined changes in SES gradients in children have produced mixed results: a study of childhood injury deaths in Great Britain found an increase in socio-economic disparity between 1981 and 1991; a study of all-cause mortality disparities among females in the same age range; and a study from Australia examining changes between 1985–87 and 1995–97 found increases in all-cause mortality disparities among males 0-25 years old but decreases in all-cause mortality disparities among females in the same age range. The World Health Organization (WHO) report on health equity has called for the elimination of the socio-economic gradient in health outcomes within a generation, and in response to the report the Canadian Public Health Association has made a commitment to, among other things, helping develop a process to measure changes in the social gradient. The purpose of the current study was to measure changes in the socio-economic gradient for hospitalizations for childhood injury over a 20-year period in Manitoba. The results can be used not only to measure progress in reducing disparities in the past but also to provide an example of how disparities in health status can be monitored over time.

**METHODS**

**Population and data sources**

This study examined all hospitalizations for injuries that occurred from April 1, 1986, through March 31, 2006, to children under 20 years of age who were residents of Manitoba, Canada. The yearly number of hospitalizations ranged from 316,591 to 335,737, with an annual average of 326,357.
Data on inpatient hospitalizations came from de-identified population-based administrative databases housed in the Manitoba Centre for Health Policy's Data Repository. Counts of injury hospitalizations were taken from hospital discharge abstracts, and population counts came from a population registry of those registered for universal health care services, representing 99% of the Manitoba child population. Information on SES was developed from area-level Canada census information. All linkages across datasets were made using anonymized identifiers.

Variable definition
Hospitalized injuries were defined as hospital discharges with an external cause of injury code (ICD-9-CM E-codes for 1985/86-2003/04; ICD-10 V, W, X and Y codes for 2004/05-2005/06). All-cause injuries were examined as well as the following types: motor vehicle collisions (MVCs), other vehicle injuries, self-inflicted injuries, assault, poisoning, injuries caused by machinery, sports injuries and falls. The specific codes used are available from the authors on request.

The main independent variable was SES, which was defined using a composite score based on census information from dissemination area (about 400-700 people), assigned according to each child’s residential postal code. The information consisted of level of education, unemployment, lone-parent status and female labour force participation. Because SES remained stable for 86.3% of the dissemination areas over the study period and the 2001 census had improved data quality, the SES score was based on the 2001 census but assigned to the study population from 1986/87 through 2005/06. SES composite scores were grouped into 10 classes whose median values ranged from -1.66 (highest SES) to 3.76 (lowest SES). Covariates included age (grouped into 0-4, 5-9, 10-14 and 15-19 years), sex and geographic region (Winnipeg, North Manitoba and South Manitoba), all taken from the population registry.

Analysis
Crude annual rates of hospitalization for injury were calculated over a 20-year period. Generalized linear models with generalized estimating equations (GEE) to account for the correlated nature of the data were employed to describe the relation between SES and injury rates and whether this relation changed over time. SES was entered into the models as a continuous measure. To reduce variability in yearly injury counts, which was a particular concern when analyzing by injury type, fiscal years were grouped into five groups of four years each. Other variables entered into the models were age, sex and geographic region. Interactions between each of the variables and SES were assessed. Model fit was assessed prior to applying GEE, using deviance to degrees of freedom ratio.

RESULTS
The percentage of Manitoba children hospitalized for injury decreased steadily over the study period, from 1.07% to 0.51%; decreases were observed in all SES groups (Figure 1). The deviance to degrees of freedom ratio for the regression model for all-cause injury hospitalizations was 1.10, indicating a good fit. A model run without interaction terms revealed that SES was a significant predictor of injury hospitalizations (p<0.0001), children with lower SES having higher rates of injury hospitalization. The model with the interaction terms entered revealed a significant SES by year interaction (p<0.0001), indicating that the SES gradient for injury hospitalizations changed over the study period (Table 1). Contrast estimates indicated that the effect of SES on injury increased over time: with every decrease in SES (indicated by an increase in the composite SES score) the relative risk (RR) of injury increased by 1.18 (confidence interval [CI]=1.16, 1.20) in 1986/87-1989/90, whereas this increase in RR was 1.28 (CI=1.25, 1.31) in 2002/03-2005/06. Other significant interactions indicated that the SES gradient was steeper for females than for males (RR of injury increased by 1.26 for every decrease in SES for females, whereas RR increased by only 1.19 for males) and steeper for the youngest (RR = 1.26 for 0-4 years) and oldest (RR = 1.25 for 15-19 years) age groups than for the middle age groups (RR = 1.19 for 5-9 years, RR = 1.20 for 10-14 years). Relative risks and 95% CIs for the all-cause injury hospitalization model are shown in Table 2.

Analysis by type of injury found a significant SES by year interaction only for MVCs, self-inflicted injuries and falls (SES by year
SOcio-economic inequities in children’s injury rates

Table 1. Statistics for Type III Generalized Estimating Equations Analysis of Injury Hospitalization Rate, Manitoba Children, 1986/87-2005/06

<table>
<thead>
<tr>
<th>Variable</th>
<th>DF</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td>106.53*</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td>74.92*</td>
</tr>
<tr>
<td>Geographic region</td>
<td></td>
<td>120.67*</td>
</tr>
<tr>
<td>SES</td>
<td></td>
<td>56.75*</td>
</tr>
<tr>
<td>Fiscal year</td>
<td></td>
<td>148.85*</td>
</tr>
<tr>
<td>SES × age group</td>
<td></td>
<td>15.41*</td>
</tr>
<tr>
<td>SES × geographic region</td>
<td></td>
<td>15.53**</td>
</tr>
<tr>
<td>SES × fiscal year</td>
<td></td>
<td>1.37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.42*</td>
</tr>
</tbody>
</table>

*p<0.001; **p<0.01
DF=degrees of freedom; SES=socio-economic status

Table 2. Relative Risks (RR) and Confidence Intervals (CIs) for All-Cause Injury Hospitalization, Manitoba Children, 1986/87-2005/06, by Interaction Terms

<table>
<thead>
<tr>
<th>Variables by SES</th>
<th>Variable Level</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex by SES</td>
<td>Male by SES</td>
<td>1.19</td>
<td>1.17, 1.21</td>
</tr>
<tr>
<td></td>
<td>Female by SES</td>
<td>1.26</td>
<td>1.24, 1.28</td>
</tr>
<tr>
<td>Age group by SES</td>
<td>0 to 4 by SES</td>
<td>1.26</td>
<td>1.23, 1.30</td>
</tr>
<tr>
<td></td>
<td>5 to 9 by SES</td>
<td>1.19</td>
<td>1.16, 1.22</td>
</tr>
<tr>
<td></td>
<td>10 to 14 by SES</td>
<td>1.20</td>
<td>1.17, 1.22</td>
</tr>
<tr>
<td></td>
<td>15 to 19 by SES</td>
<td>1.25</td>
<td>1.22, 1.28</td>
</tr>
<tr>
<td>Year by SES</td>
<td>1986/87-1989/90</td>
<td>1.18</td>
<td>1.16, 1.20</td>
</tr>
<tr>
<td></td>
<td>1990/91-1993/94</td>
<td>1.19</td>
<td>1.16, 1.21</td>
</tr>
<tr>
<td></td>
<td>1994/95-1997/98</td>
<td>1.26</td>
<td>1.23, 1.28</td>
</tr>
<tr>
<td></td>
<td>1998/99-2001/02</td>
<td>1.22</td>
<td>1.20, 1.24</td>
</tr>
<tr>
<td></td>
<td>2002/03-2005/06</td>
<td>1.28</td>
<td>1.25, 1.31</td>
</tr>
</tbody>
</table>

Interaction for each was p<0.05. For MVCs and self-inflicted injuries, the pattern of the SES by year interaction was similar to that of all-cause injury hospitalizations, indicating an increasing gradient over time. For falls, there was no clear pattern for the SES gradient. For MVCs, in 1986/87-1989/90 the RR for hospitalized injury was 1.13; the RR was 1.20 in 2002/03-2005/06. For self-inflicted injuries, in 1986/87-1989/90 the RR for hospitalized injury was 1.38; in 2002/03-2005/06 the RR was 1.44. For falls, the significant SES by year interaction appears to have been driven by an increased gradient in the middle of the time period, with similar RRs in the beginning and end of the study period (RR=1.12 for 1986/87-1989/90, RR=1.10 for 2002/03-2005/06). Relative risks and 95% CIs for the SES by year interactions for these three injury types are shown in Table 3.

**Discussion**

There has been a steady and substantial decrease in hospitalization rates for injury over the past two decades. In Manitoba, the rate among children 0 to 19 years dropped by over one half between 1986/87 and 2005/06. The decrease in serious injuries has not been shared equally among all children, however; children from lower SES groups had consistently higher rates of hospitalized injuries over time compared with children from higher SES groups and, despite a decrease in injury rates for all SES groups, the socio-economic gradient in childhood injuries actually widened during the study period.

Other research confirms the drop in childhood injury rates in Canada and the US over the last two decades, but little research has examined changes in the socio-economic gradient for injury rates, and the few studies that have done so focused on injury mortality. To our knowledge, this is the first study to examine changes in the gradient for injury hospitalizations. While injury mortality is certainly important to study, rates of hospitalization for injury in childhood are over 25 times higher than rates of death from injury and so need to be considered when attempting to determine whether socio-economic gradients in childhood injuries have changed over time.

Why have injury hospitalizations in childhood declined so much over the past 20 years? Heinin et al. suggest that along with advances in technology and changes in health care utilization and resources, some of the observed decrease in the US may be due to public and private sector programs developed to prevent serious injuries. Examples of such injury prevention activities in Canada that may have contributed to the decline in childhood injuries include promotion of seat belt use, child safety seats and air bags in automobiles; improved road safety; graduated licensing programs; promotion of safety equipment in the home, such as baby gates and smoke detectors; safer playground equipment; promotion of bicycle helmet use and water safety; and suicide prevention programs.

However, injury prevention activities appear to have had a less pronounced impact on childhood injury hospitalizations in lower than in higher SES groups. Organizations focusing on the health and safety of children in Canada have called for a National Injury Prevention Strategy for Children and Youth as a means of further reducing childhood injuries. If the federal government implements such a strategy, it will be essential to integrate reduction in injury disparities as a key element in this strategy. Several studies suggest that reducing disparities in childhood injury may mean that some programs need to be targeted specifically at low income and other disadvantaged groups. On the other hand, Kendrick et al. found that reducing the cost and barriers to installation of safety equipment for targeted disadvantaged groups did not necessarily reduce disparities in use of this equipment. Furthermore, targeting injury prevention at disadvantaged groups ignores the graded association across all income levels; middle SES groups would thus be missed by targeted efforts. The recent WHO report and those who focus on increasing health equity would argue that the elimination of the social gradient in childhood injury will require addressing the broader determinants of injury, including the inequitable distribution of social resources.

<table>
<thead>
<tr>
<th>Injury Type</th>
<th>Year by SES Interaction</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>MVCs</td>
<td>1986/87-1989/90</td>
<td>1.13</td>
<td>1.08, 1.19</td>
</tr>
<tr>
<td></td>
<td>1990/91-1993/94</td>
<td>1.17</td>
<td>1.11, 1.22</td>
</tr>
<tr>
<td></td>
<td>1994/95-1997/98</td>
<td>1.22</td>
<td>1.17, 1.29</td>
</tr>
<tr>
<td></td>
<td>1998/99-2001/02</td>
<td>1.11</td>
<td>1.05, 1.18</td>
</tr>
<tr>
<td></td>
<td>2002/03-2005/06</td>
<td>1.20</td>
<td>1.14, 1.27</td>
</tr>
<tr>
<td>Self-inflicted</td>
<td>1986/87-1989/90</td>
<td>1.38</td>
<td>1.30, 1.45</td>
</tr>
<tr>
<td></td>
<td>1990/91-1993/94</td>
<td>1.35</td>
<td>1.27, 1.43</td>
</tr>
<tr>
<td></td>
<td>1994/95-1997/98</td>
<td>1.45</td>
<td>1.39, 1.52</td>
</tr>
<tr>
<td></td>
<td>1998/99-2001/02</td>
<td>1.34</td>
<td>1.28, 1.40</td>
</tr>
<tr>
<td></td>
<td>2002/03-2005/06</td>
<td>1.44</td>
<td>1.36, 1.52</td>
</tr>
<tr>
<td>Falls</td>
<td>1986/87-1989/90</td>
<td>1.12</td>
<td>1.08, 1.15</td>
</tr>
<tr>
<td></td>
<td>1990/91-1993/94</td>
<td>1.11</td>
<td>1.08, 1.14</td>
</tr>
<tr>
<td></td>
<td>1994/95-1997/98</td>
<td>1.17</td>
<td>1.13, 1.20</td>
</tr>
<tr>
<td></td>
<td>1998/99-2001/02</td>
<td>1.15</td>
<td>1.11, 1.18</td>
</tr>
<tr>
<td></td>
<td>2002/03-2005/06</td>
<td>1.10</td>
<td>1.06, 1.15</td>
</tr>
</tbody>
</table>

MVC=motor vehicle collision
There are several limitations of the current study that warrant discussion. The relatively small number of hospitalizations for several of the specific types of injury may have limited our ability to detect changes in the gradient for these injury types. The three injury types in which we found significant gradient changes are the top three causes of hospitalization for injury, accounting for over 40% of such hospitalizations in childhood.\(^2\) Future studies using larger populations should be considered for examining gradient changes in less common types of injury.

During the course of the study period, the coding of hospitalized injuries shifted from ICD-9-CM to ICD-10. While this would not have affected the patterns observed in overall injury hospitalizations, it may have had an impact on the injury type analyses. Overall, all time trends for MVCs, self-inflicted injuries and falls may have been influenced by the coding changes, but there is no reason to expect that coding changes would affect SES groups differently, so the observed patterns of gradient changes were unlikely due to the ICD shift.

Our measure of SES was not an individual but, rather, an area-level measure, attributed to individual children, thus an ecologic fallacy is possible: that is, an incorrect conclusion that associations found for aggregate level data apply at the individual level.\(^2\) How-fallacy is possible: that is, an incorrect conclusion that associations found for aggregate level data apply at the individual level.\(^2\) How-fallacy is possible: that is, an incorrect conclusion that associations found for aggregate level data apply at the individual level.\(^2\) However, area-level measures have been shown to closely approximate individual level SES,\(^2\) and studies have demonstrated that area-level deprivation is associated with childhood injury risk independent of individual-level SES.\(^2\) \(^2\) \(^2\)

### CONCLUSION

The substantial reduction in hospitalizations for injury over time may provide evidence of the effectiveness of policies and programs aimed at injury prevention. However, the increasing SES gradient suggests that despite the gains from injury prevention efforts, inequalities in hospitalized injury rates have increased. A combination of universal and targeted prevention programs may reduce the inequalities in injury hospitalizations; the elimination of the SES gradient for childhood injuries will likely require attention to the broader determinants of health. The current study not only provides an account of how the gradient for childhood injuries has increased over the past two decades in Manitoba but also demonstrates how provincial databases can be used to measure progress on reducing disparities, one of the overarching recommendations of the WHO report.\(^1\) \(^1\) \(^1\)

### REFERENCES

Aline Simen-Kapeu, MD, PhD, Paul J. Veugelers, PhD

ABSTRACT

Background: The socio-economic gradient in health does not seem to apply to overweight among Canadians adults. In the present study, we sought to determine the socio-economic gradient in overweight among Canadian children in distinct economic settings. We further examined socio-economic gradients in underlying behaviours, healthy eating and active living, as well as parental support for these behaviours.

Methods: We surveyed 6,430 grade five students and their parents in Alberta and Nova Scotia. Students completed dietary and activity questionnaires and had their height and weight measured. Parents completed questions on socio-economic background and their support for their child’s health behaviours. We applied multi-level regression methods to characterize the socio-economic gradients.

Results: In both Alberta and Nova Scotia, we observed socio-economic gradients whereby children with parents who were more highly educated and had higher earnings were more physically active and less likely overweight. In contrast, we did not observe a socio-economic gradient with respect to healthy eating. Relative to socio-economically disadvantaged parents, those with better education and higher income were more likely to report encouraging their children’s healthy eating and physical activity. Socio-economically disadvantaged parents, though, reported more engagement in physical activities with their children.

Conclusion: Whereas the socio-economic gradient in overweight among Canadian adults is fading, we did not observe such a phenomenon among children. The mechanism preserving the socio-economic gradient among children may be related to more encouragement given to healthy eating and physical activity in the more socio-economically advanced families.

Key words: Childhood overweight; nutrition; physical activity; socio-economic gradient; public health; social environment

METHODS

Sociodemographic Characteristics

The Raising Healthy Eating and Active Living Kids in Alberta (REAL Kids Alberta) survey aims to evaluate a comprehensive initiative by Alberta Health and Wellness to promote healthy body weights among children and youth. A survey conducted in 2008 employed a one-stage stratified random sampling design. Of the 184 randomly selected schools, 148 (80.4%) schools and 3,421 grade five students participated. Observations were weighted such that they represent provincial estimates.12

In 2005, the Annapolis Valley Regional School Board in Nova Scotia moved to implement comprehensive school health in all its schools. The present study includes data from all 22 elementary schools that started implementing comprehensive school health in 2005. The study includes observations of 3,009 grade five students in the school years from 2005/2006 to 2008/2009.

In both provinces, grade five students received an envelope with parent/guardian consent information and a survey to take home. The percentage of grade five students that participated following active consent was 61.2% in Alberta. In Nova Scotia, where we had applied a passive consent procedure, participation rates varied by school year between 84.5% and 86.8%.

Body Weight

In both surveys, staff measured standing height to the nearest 0.1 cm after students had removed their shoes, and body weight to the nearest 0.1 kg on calibrated digital scales. Body mass index (BMI) was calculated by dividing weight (in kilograms) by height (in metres) squared. We applied the age- and sex-specific cut-offs developed by the International Obesity Task Force to categorize the measures as normal, overweight or obese.11

Physical Activity

In both surveys, we determined physical activity levels of students on the basis of parent/guardian responses to the following questions: What is the 1) frequency of sports or physical activity without a coach and 2) frequency of sports or physical activity with a coach. These two items were summed, and participants engaged in sports or physical activities more than three times a week were classified as being “physically active”.12

Nutrition

According to students’ responses to the Harvard Food Frequency Questionnaire14 administered in both surveys, we categorized students as meeting the recommendations if their diet included six or more daily servings of vegetables and fruits.12

Socio-economic Factors

The questionnaire completed by the parents/guardians provided information on their educational attainment (secondary school or less, community college and graduate university) and household income. As income levels in the two provinces are different, household income was categorized differently: in Alberta household income categories were ≤$50,000; $50,001-$75,000; $75,001-$100,000 and ≥$100,001. In the Annapolis Valley survey these were ≤$40,000; $40,001-$60,000; $60,001-$80,000 and ≥$80,001.

Table 1. Characteristics of Grade Five Students in Alberta and Nova Scotia

<table>
<thead>
<tr>
<th></th>
<th>Alberta</th>
<th>Nova Scotia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight</td>
<td>28.5</td>
<td>36.1</td>
</tr>
<tr>
<td>Meet guidelines for vegetable and fruit consumption (≥6 servings/day)</td>
<td>26.7</td>
<td>31.1</td>
</tr>
<tr>
<td>Physically active with or without a coach (&gt;3 times a week)</td>
<td>83.8</td>
<td>85.3</td>
</tr>
<tr>
<td>Parental educational attainment</td>
<td>26.5</td>
<td>27.6</td>
</tr>
<tr>
<td>Secondary school or less</td>
<td>39.9</td>
<td>47.6</td>
</tr>
<tr>
<td>College diploma</td>
<td>33.6</td>
<td>24.8</td>
</tr>
<tr>
<td>University degree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Household income*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level 1</td>
<td>23.4</td>
<td>34.3</td>
</tr>
<tr>
<td>Level 2</td>
<td>17.5</td>
<td>26.2</td>
</tr>
<tr>
<td>Level 3</td>
<td>22.2</td>
<td>18.0</td>
</tr>
<tr>
<td>Level 4</td>
<td>36.9</td>
<td>21.5</td>
</tr>
<tr>
<td>Girls</td>
<td>51.4</td>
<td>50.5</td>
</tr>
<tr>
<td>Parental support and encouragement</td>
<td>87.4</td>
<td>n.a.</td>
</tr>
<tr>
<td>Care about eating healthy food</td>
<td>89.7</td>
<td>n.a.</td>
</tr>
<tr>
<td>Encourage your child to eat healthy food</td>
<td>18.0</td>
<td>n.a.</td>
</tr>
<tr>
<td>Eat supper in front of TV</td>
<td>73.8</td>
<td>n.a.</td>
</tr>
<tr>
<td>Care about staying fit and exercising</td>
<td>83.7</td>
<td>n.a.</td>
</tr>
<tr>
<td>Encourage your child to be physically active</td>
<td>7.8</td>
<td>n.a.</td>
</tr>
<tr>
<td>Engage in physical activities with your child</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Alberta: level 1=≤$50,000, level 2=$50,001-75,000, level 3=$75,001-100,000, level 4=≥$100,001. Nova Scotia: level 1=≤$40,000, level 2=$40,001-60,000, level 3=$60,001-80,000, level 4=≥$80,001. n.a.=not available.

Parental Support and Encouragement

This information was only available for participants in Alberta. Parents/guardians were asked about 1) personally caring about eating healthy food; 2) encouraging their child in healthy eating; and 3) eating supper in front of TV (as a measure of poor nutritional practice at home). They were also asked about 4) personally caring about staying fit and exercising; 5) encouraging their child to be physically active; and 6) engaging in physical activities together with their grade five child (as a measure of positive practice at home). More details on the surveys are reported elsewhere,6,12 and the questionnaires used are available at REALKidsAlberta.ca.

Analytic approach

Given the sex-specific socio-economic patterns among adults,11 we performed sex-stratified analyses. We applied multivariate multi-level logistic regression to assess the associations of socio-economic factors with overweight, nutrition, physical activity, and parental support and encouragement. Multi-level methods accommodate clustering of student observations within their school communities.8 Analyses pertaining to dietary outcomes were further adjusted for calorie intake, as is recommended for food frequency data. Our regression analyses without stratification were adjusted for the confounding influence of sex. Missing values for income were treated as a separate covariate category. Stata Version 10 (Stata Corp, TX, USA) was used.

RESULTS

In Alberta in 2008, the prevalence of overweight was 28.5% among grade five students, and 6.7% were obese (Table 1). Of Alberta students, 26.7% met the nutrition guidelines and consumed six or more servings of vegetables and fruits per day, and 83.8% reported engaged three times or more per week in physical activity. In the 22 Annapolis Valley schools, the prevalence of overweight was 36.1%, and 13.0% of the students were obese. Here, 31.1% met the vegetables and fruit guidelines, and 85.3% engaged three times or more per week in physical activity (Table 1).
The socio-economic gradient of health behaviours and overweight of grade five students is displayed in Table 2. Overweight prevalence decreased with increase in household income, both in Alberta and Nova Scotia. For boys in Nova Scotia, though, the differences by income did not reach statistical significance. The educational attainment of parents was not significantly associated with children’s body weights. A pronounced socio-economic gradient for both parental education and income in relation to physical activity was observed in both Alberta and Nova Scotia (Table 2). With respect to nutrition, we did not observe consistent socio-economic gradients. We did observe lower consumption of vegetables and fruits among Albertan girls of parents who reported college education and among Nova Scotian boys of lower income families (Table 2).

Table 3 shows the socio-economic gradient with respect to parental support and encouragement for healthy eating and physical activity. Relative to those with socio-economic disadvantaged backgrounds, parents with better education and higher income did care more about healthy eating, staying fit and exercising, and they encouraged their children more in healthy eating and physical activity. Socio-economically advantaged parents also reported practising healthier eating habits by engaging less in eating supper in front of the TV. In contrast, they engaged less in physical activities with their children as a means to role model active living at home (Table 3).

**DISCUSSION**

The present study shows for two economically distinct settings a socio-economic gradient whereby children of families with less income were more likely to be overweight. No overweight differentials were observed with respect to parental education. Further, no socio-economic gradient was observed with respect to the number of vegetables and fruits consumed, whereas both increasing levels of household income and parental education were associated with higher activity levels among grade five children.

Our finding regarding the negative association of income and body weight is congruent with studies among children and adolescents in North America1,8,9,15 and around the world.5-7 This, presumably, results from income differentials with respect to nutrition and physical activity. Whereas the present study did show a strong positive association of socio-economic status with physical activity, it did not show an association between socio-economic status and consumption of vegetables and fruits. Although several studies have confirmed a positive association between socio-economic status and physical activity,16,17 others have found no association18,19 or an inverse association.20 Previous studies involving Canadian children and youth that have examined the influence of socio-economic status have revealed that parental education was positively associated with vegetable and fruit consumption.21,22 Education may provide mothers with knowledge of the role of nutrition in health, awareness of child weight as a health risk factor and an understanding of feeding practices conducive to healthy weight.22

Educational attainment and income are widely acknowledged as essential determinants of health. However, we had previously reported that this socio-economic gradient in health does not apply to overweight in adult Canadians, an observation also made in...
**Table 3. Socio-economic Gradients With Respect to Parental Support and Encouragement of Grade Five Students in Alberta**

<table>
<thead>
<tr>
<th>Boys*</th>
<th>Girls*</th>
<th>All†</th>
<th>Boys*</th>
<th>Girls*</th>
<th>All†</th>
<th>Boys*</th>
<th>Girls*</th>
<th>All†</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
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<tr>
<td><strong>Nutrition</strong></td>
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<tr>
<td>Care about eating healthy food</td>
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<tr>
<td>Encourage your child to eat healthy food</td>
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<tr>
<td>Eat supper in front of TV</td>
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<tr>
<td><strong>Parental educational attainment</strong></td>
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<tr>
<td>Secondary school</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
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<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
</tr>
<tr>
<td>College diploma</td>
<td>0.74 (0.69, 0.80)</td>
<td>0.84 (0.78, 0.90)</td>
<td>0.80 (0.75, 0.87)</td>
<td>0.79 (0.67, 0.94)</td>
<td>0.82 (0.74, 0.92)</td>
<td>0.85 (0.77, 0.94)</td>
<td>0.80 (0.68, 0.94)</td>
<td>0.82 (0.74, 0.92)</td>
</tr>
<tr>
<td>University degree</td>
<td>1.65 (1.50, 1.82)</td>
<td>2.01 (1.83, 2.22)</td>
<td>1.83 (1.68, 2.00)</td>
<td>2.46 (2.06, 2.95)</td>
<td>2.12 (1.80, 2.51)</td>
<td>2.38 (2.01, 2.82)</td>
<td>2.07 (1.65, 2.58)</td>
<td>2.12 (1.80, 2.51)</td>
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<tr>
<td><strong>Household income</strong></td>
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<tr>
<td>≤ $50,000</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
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<tr>
<td>$50,000-75,000</td>
<td>0.94 (0.88, 1.00)</td>
<td>0.97 (0.91, 1.03)</td>
<td>0.96 (0.91, 1.03)</td>
<td>0.84 (0.74, 0.95)</td>
<td>0.89 (0.82, 0.97)</td>
<td>0.93 (0.86, 1.01)</td>
<td>0.89 (0.81, 0.98)</td>
<td>0.90 (0.82, 0.97)</td>
</tr>
<tr>
<td>$75,001-100,000</td>
<td>0.92 (0.86, 0.99)</td>
<td>0.88 (0.82, 0.94)</td>
<td>0.90 (0.85, 0.96)</td>
<td>0.76 (0.66, 0.89)</td>
<td>0.81 (0.73, 0.91)</td>
<td>0.86 (0.78, 0.94)</td>
<td>0.80 (0.70, 0.92)</td>
<td>0.83 (0.75, 0.93)</td>
</tr>
<tr>
<td>≥ $100,001</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
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<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
<td>1.00 (1.00, 1.00)</td>
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</tbody>
</table>

* Odds ratios (OR) adjusted for parental education and household income.
† Odds ratios (OR) adjusted for sex, parental education and household income.

In conclusion, we observed a socio-economic gradient for overweight among children with no major differences between boys and girls. The present findings call for strengthening of preventive initiatives aimed at promoting healthy eating and active living among children. These initiatives should acknowledge the distinct needs of populations living in low socio-economic conditions in order to reduce health inequalities and effectively prevent childhood obesity.

**REFERENCES**


