Health Promotion and Chronic Disease Prevention in Canada

Research, Policy and Practice

Volume 36 · Number 11 · November 2016

Inside this issue

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.
— Public Health Agency of Canada

Published by authority of the Minister of Health.

ISSN 2368-738X
Pub. 150134
Journal_HPCDP-Revue_PSPMC@phac-aspc.gc.ca

Également disponible en français sous le titre : *Promotion de la santé et prévention des maladies chroniques au Canada : Recherche, politiques et pratiques*

Submission guidelines and information on article types are available at: http://www.phac-aspc.gc.ca/publicat/hpcdp-pspmc/authinfo-eng.php

Indexed in Index Medicus/MEDLINE, SciSearch® and Journal Citation Reports/Science Edition

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

Longitudinal associations of parental and peer influences with physical activity during adolescence: findings from the COMPASS study

E. Y. Lau, PhD (1); G. Faulkner, PhD (1); W. Qian, MS (2); S. T. Leatherdale, PhD (2)

This article has been peer reviewed.

Tweet this article

Abstract

Introduction: To examine temporal variations in parental and peer influences on adolescent physical activity (PA) and whether these variations predicted changes in PA.

Methods: We analyzed data from Years 1, 2 and 3 of the COMPASS study. Participants were 22 909 students in Grades 9 to 12 (mean age [years] = 15.42 ± 1.12, 46% boys, 85% White), who had completed the following survey items on 2 or more consecutive occasions: age, sex, grade, race/ethnicity, moderate-to-vigorous physical activity (MVPA), parental encouragement and parental instrumental support for PA, and number of active peers. We used a linear-mixed model to investigate longitudinal effects of parental and peer influences on changes in square-root transformed average MVPA. We used a generalized-estimating-equations (GEE) model to investigate compliance with Canadian PA guidelines for youth. These models included parental encouragement, instrumental support and number of active peers as time-varying predictors, adjusting for sociodemographic factors and grade as covariates, and accounting for the clustering within children and schools.

Results: We found that adolescents perceived significantly less parental encouragement and instrumental support and reported fewer active peers as they got older. In addition, the adjusted models suggest that, for a one-unit increase in the score of parental encouragement, parental instrumental support and number of active peers, average MVPA significantly increased by 0.22 units, 0.23 units and 0.16 units, respectively. For the same one-unit increase, adjusted odds of an adolescent complying with the PA guidelines increased by 9%, 4% and 6%, respectively.

Conclusion: Promoting parental support and facilitating the formation and maintenance of a physically active friendship network may play an important role in attenuating declines in PA during adolescence.

Keywords: *parental encouragement, parental instrumental support, active peers, physical activity*

Highlights

- This longitudinal study advances current knowledge by demonstrating declining trends in parental encouragement, instrumental support and the number of active peers during adolescence.
- Increases in the number of active peers and in parental support predicted increases in PA.
- Family- and peer-based interventions require further development and evaluation.

Introduction

Regular physical activity (PA) has been shown to have positive effects on health in children and adolescents, including bone health, mental health, weight management, lipid profile and insulin sensitivity.[1,2] Despite the well-recognized benefits of PA, a small proportion of children achieve the goal set out in the national PA guidelines for children and adolescents of accumulating at least 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.[3-5] Compliance is even lower among adolescents.[3-5] Because PA habits during adolescence tend to track into adulthood,[6] which in turn influences the risk of developing chronic diseases later in life,[2] promoting a more physically active lifestyle in this age group is critical.

In order to promote a more physically active lifestyle, it is important that the correlates of PA in adolescents be identified to inform the development of intervention strategies.[7] PA is a complex behaviour because it is influenced by correlates operating at individual, social, environmental and community levels.[8] Although there is an extensive body of research related to individual-level correlates of PA (e.g. self-efficacy and attitude), relatively less research has been focussed on social correlates, including parental and peer influences.[9] For example, social cognitive theory suggests that social support is likely to be a determinant of youth PA.[10]

Cross-sectional evidence consistently shows that adolescents are more likely to participate in PA if they perceive more support for PA from parents and friends.[11,12] However, there are only a few studies that examine these associations using longitudinal study designs.[13-21] Among the few available longitudinal studies, parental and peer influences

---

Author references:

1. School of Kinesiology, University of British Columbia, Vancouver, British Columbia, Canada
2. School of Public Health and Health Systems, University of Waterloo, Waterloo, Ontario, Canada

Correspondence: Erica Y. Lau, School of Kinesiology, University of British Columbia, 2146 Health Sciences Mall, Room 4604, Vancouver, BC V6T 1Z3; Tel: 604-822-4940; Fax: 604-822-6842; Email: erica.lau@ubc.ca

measured at baseline were found to be positively associated with prospective PA levels in adolescents. Additionally, there is limited evidence indicating that variations in parental and peer influences throughout adolescence also significantly predicted changes in adolescent PA over time. Thus far, only three studies have demonstrated that parental influences tend to decline as adolescents age, and that reductions in these influences appear to be associated with steeper decline in PA during adolescence.[22-24] More studies focussing on prospective changes in parental and peer influences and their effects on changes in adolescent PA are needed to strengthen the evidence base.

One of the methodological problems in this line of research is inconsistency in the conceptualization of parental and peer influences.[25] Researchers agree that parents can influence PA of their adolescent children in several ways, including role modelling, encouragement, instrumental support (e.g. transportation and equipment), positive communication and co-participation.[25] However, some studies summarize all of these means of influence into a composite score to reflect parental influences on PA,[18,24,26] while others quantify them separately.[19,21,22] Researchers have noted that not all aspects of parental influence are equally influential on adolescent PA.[25] Evidence from systematic reviews has shown that parental encouragement and instrumental support (e.g. transportation) were more strongly related to adolescent PA. However, these findings were primarily based on cross-sectional studies. Therefore, longitudinal studies are needed to examine the temporal associations of parental encouragement and instrumental support with adolescent PA.[27,28]

In terms of peer influences, previous studies suggest that a youth's friendship network could have a powerful influence on their PA levels by providing various forms of support, such as positive communication, co-participation and role modelling.[12,29] However, a prerequisite is the presence of friends who are physically active. It is, therefore, important to understand the influences of the number of physically active peers on PA participation. To date, no longitudinal study has examined such associations.

In Canada, the effects of parental and peer support on physical activity have not been measured consistently.[30] From 2005 to 2014, Active Healthy Kids Canada released the Report Card on Physical Activity for Children and Youth, and ParticipACTION has released it since 2015.[31] Each annual Report Card assigns letter grades to different influences of PA, including Settings and Sources of Influence (with subcategories of Family and Peers, School, and Community and Environment). Over the years, however, the Report Card has not provided consistent, gradable data for peer and parental influence. The indicator for peer influence was not graded at all. The grade for parental influence was informed by family physical activity data, but this is not a direct measure of parental support, which may include components such as encouragement and instrumental support.

The 2015 Report Card called for prospective research examining whether changes in parental and peer support explain changes in physical activity over time. In order to address this call, the present study aimed to examine 1) variations in parental encouragement for PA, parental instrumental support for PA, and the number of active peers across Grades 9 to 12; and 2) whether these variations predicted changes in PA from Grades 9 to 12 in a sample of Canadian adolescents.

Methods

Sample and population

The COMPASS study is an ongoing prospective cohort study that began in 2012/2013. The study was designed to examine longitudinal associations between school policies and programs with youth health behaviours (i.e. physical activity, healthy eating, smoking, and alcohol and marijuana use).[32] The study collects hierarchical longitudinal data from a convenience sample of secondary schools and the Grades 9 to 12 students attending these schools. This study analyzed data for three time points: Years 1 (2012/2013), 2 (2013/2014) and 3 (2014/2015). Extensive details on the COMPASS study, including sampling, data collection and linkage process, are available online (www.compass.uwaterloo.ca).

The study initially recruited 43 Ontario schools in Year 1; 79 Ontario schools (including all Year 1 schools) and 10 Alberta schools in Year 2; and 78 Ontario schools (one Year 2 school left, but two new schools joined the study) and 9 Alberta schools (one left the study) in Year 3. All Grades 9 to 12 students attending these schools were invited to participate in the study and reported data by completing the COMPASS student questionnaire (Cq) annually. The COMPASS study was approved by the Human Research Ethics Board at the University of Waterloo.

In Year 1, the study enrolled 30 147 students in Grades 9 to 12, and 24 173 of them (80.2%) completed the Cq. In Year 2, 57 229 students in Grades 9 to 12 were enrolled, and 45 298 of them (79.1%) completed the Cq. In Year 3, 53 846 students in Grades 9 to 12 were enrolled, and 42 355 of them (78.7%) completed the Cq. Missing respondents resulted primarily from scheduled spares or absenteeism at the time of the Cq, and minimally from student or parent refusal (1%). Self-generated identification codes were used to link data sets for three years and create longitudinal data. In our study, we considered participants who had completed the Cq for at least 2 consecutive years, which resulted in a longitudinal sample of 26 081 participants. Of this group, we excluded 3172 participants who were missing data on PA or parental and peer influences variables, or had inconsistent records on sex or ethnicity across years. This resulted in the final longitudinal sample of 22 909 participants.

Measures

Dependent variable: physical activity

At each time point, participants were asked to respond to two items on the Cq about how many minutes of vigorous and moderate PA they had done on each of the last 7 days. Vigorous PA was defined as activities that "increase your heart rate and make you breathe hard and sweat," such as jogging, team sports, fast dancing or jump-rope. Moderate PA was defined as "lower intensity activities" such as walking, biking to school and recreational swimming. The responses were then used to construct two PA outcomes. The first was a continuous outcome: the average time spent in MVPA (minutes/day). This outcome was calculated as the total of combined vigorous and moderate PA time divided by 7 days. The second was a binary outcome: whether or not the participants complied with the Canadian PA guideline of at least 60 minutes of MVPA per day. These measures have demonstrated a satisfactory 1-week test-retest reliability (intraclass correlation [ICC] = 0.75). The measures were also significantly correlated with accelerometer-measured behaviours (r = 0.31, ICC = 0.25). While correlations between self-report and objective measures were low to modest, the results are comparable to most other studies using accelerometers to validate self-report PA.[33]

Predictor variables

Items for measuring the predictor variables, including parental encouragement, instrumental support and number of active peers, are adopted from the survey used in the School Health Action, Planning and Evaluation System (SHAPES) Physical Activity Module.[34] As described elsewhere, these items are also consistent with the measures used in existing Canadian youth surveillance tools.[32]

Parental encouragement and instrumental support

Parental encouragement was measured annually over the three-year period using a single item: "How much do your parents, stepparents, or guardians encourage you to be physically active?" Responses were recorded on a 5-point Likert scale ranging from "strongly encourage" to "strongly discourage." This item was reverse coded with 1 = strongly discourage to 5 = strongly encourage. Parental instrumental support was also measured annually using the following item from the Cq: "How much do your parents, stepparents, or guardians support you in being physically active (e.g. driving you to team games, buying you sporting equipment?)." Answers were recorded on a 4-point Likert scale ranging from "very unsupportive" to "very supportive."

Number of active peers

The number of active peers was measured annually using the following question from the Cq: "Your closest friends are the friends you like to spend the most time with. How many of your closest friends are physically active?" The response was recorded on a 6-point Likert scale ranging from 0 to 5+.

Covariates

Other potential covariates that have been found to be associated with changes in adolescent PA, including age, grade attended, sex and race/ethnicity during each assessment, were self-reported using the Cq.[35]

Statistical analysis

We calculated descriptive statistics for all the study variables, and compared the differences between included and excluded participants. We used pairwise ***t*** tests to examine temporal variations in parental and peer influences. We conducted preliminary analyses to explore the bivariate relationship between each potential predictor and each of the two dependent variables, and significant variables ($p < .05$) were retained for the longitudinal analyses.

We used a linear-mixed model to examine the longitudinal effects of parental and peer influences on MVPA trajectory. We used a generalized estimation equation (GEE) to estimate the longitudinal effects of parental and peer influences on changes in the probability of complying with Canadian PA guidelines over time. In these models, we used age as the time variable to represent the change in the PA outcomes. Parental encouragement, parental instrumental support and number of active peers were used as time-varying predictors, and sex, ethnicity and grade attended as time-invariant covariates. The parental and peer influence variables were mutually adjusted in the models (e.g. the parental encouragement model controlled parental instrumental support and number of active peers as covariates).

With an accelerated longitudinal design, the effect of the time-varying covariates on the outcome embodies an aggregation of both between-person (cross-sectional effects) and within-person effects (longitudinal effects).[36,37] Therefore, we needed to disaggregate these effects to avoid confounding longitudinal effects with cross-sectional information.

Following the approach suggested by Yu and colleagues,[37] we conducted mean-centred transformations of the time-varying covariates, including age, parental encouragement, parental instrumental support and number of active peers. For each individual, we first calculated a person-mean of the time-varying variable by averaging the values across the three time points. Then, we calculated a person-mean-centred variable by subtracting the person-mean from the individual's time-specific observed values. Using age as an example, if an individual was measured three times at age 15, 16 and 17, then their person-mean of age would be 16 and the person-mean-centred age for the three time points would be coded as −1, 0 and 1, respectively. Both the person-mean and person-mean-centred terms were included in the models. Since we are interested in the longitudinal effects of the time-varying variables, the effects of the person-mean-centred covariates in the specified model are of interest. These models also tested several interaction terms, including sex and age, and sex and the parental and peer influence variable, but none of these attained statistical significance. Therefore, the analyses were not stratified by sex.

We conducted the analyses using the statistical software package SAS version 9.4 (SAS Institute Inc., Cary, NC, USA). To meet the normality assumption, we performed a square-root transformation on the average MVPA minutes per day. We used the PROC MIXED procedure for the linear mixed-effects models and PROC GENMOD for the GEE model. The correlation structure of the GEE model was determined based on quasi-likelihood under the independence model criterion (QIC)—an extension of Akaike's Information Criterion. Residual and studentized residual plots were used to confirm model assumptions and fit. Statistical significance was set at $p < .05$ for all analyses.

Results

Table 1 presents descriptive statistics. The final longitudinal sample comprised 22 909 participants, of which 4449 participants had complete Cq data for all three years; 5353 for only Year 1 and Year 2; and 13 107 for only Year 2 and Year 3. The included sample is significantly different from the excluded sample in terms of age, sex, race/ethnicity, scores in parental and peer influence variables and MVPA, but there is no difference in the proportion meeting PA guidelines. Findings from pairwise ***t*** tests indicated that parental encouragement, instrumental support and number of active peers were significantly lower in Year 2 than in Year 1, and lower in Year 3 than in Year 2 (Table 2).

Changes in parental and peer influences and changes in MVPA

Table 3 presents results from the linear-mixed models. Coefficients from the

TABLE 1
Differences in the characteristics of the included and excluded participants, COMPASS study, 2012/13, 2013/14 and 2014/15

Variable	Included participants (n = 22 909)	Excluded participants (n = 3 172)	*p*-value
Age (Y2, mean and SD)	15.42 ± 1.12	15.34 ± 1.19	< .001
Sex, n (%)			< .001
Girls	12 328 (53.81)	1 380 (43.53)	
Boys	10 581 (46.19)	1 790 (56.47)	
Race/ethnicity, n (%)			< .001
White	19 428 (84.81)	1 924 (60.66)	
Black	736 (3.21)	270 (8.51)	
Asian	1 245 (5.43)	186 (5.86)	
Aboriginal	500 (2.18)	195 (6.15)	
L. Am./Hisp.	385 (1.68)	117 (3.69)	
Others/mixed/missing	615 (2.68)	480 (15.13)	
Grade (Y2), n (%)			< .001
9	6 405 (27.96)	1 100 (34.68)	
10	7 190 (31.39)	903 (28.47)	
11	6 240 (27.24)	695 (21.91)	
12	3 074 (13.42)	474 (14.94)	
Parental encouragement (Y2, mean and SD)	4.03 ± 0.75	3.91 ± 0.817	< .001
Parental instrumental support (Y2, mean and SD)	3.46 ± 0.63	3.33 ± 0.68	< .001
Number of active peers (Y2, mean and SD)	3.36 ± 1.64	3.26 ± 1.70	.002
MVPA (min/d) (Y2, mean and SD)	119.3 ± 82.33	123.6 ± 96.10	.028
Compliance with PA guideline (Y2), n (%)			.356
Yes	10 875 (47.47)	1 284 (48.42)	
No	12 034 (52.53)	1 368 (51.58)	

Abbreviations: L. Am./Hisp., Latin American/Hispanic; min/d, minutes per day; MVPA, moderate-to-vigorous physical activity; PA, physical activity; SD, standard deviation; Y2, Year 2.

Note: *p*-value < .05 indicates the included and excluded participants were significantly different in a given variable.

TABLE 2
Pairwise comparisons in parental encouragement, parental instrumental support and number of active peers scores across the COMPASS study, years 2012/13, 2013/14 and 2014/15

Variables	Year 2 − Year 1 (n = 9 802)	Year 3 − Year 2 (n = 17 556)
	Difference (95% CI)	Difference (95% CI)
Parental encouragement	− 0.0535 (− 0.0677 to − 0.0393)	− 0.0395 (− 0.0499 to − 0.0291)
Parental instrumental support	− 0.0275 (− 0.0400 to − 0.0151)	− 0.0235 (− 0.0326 to − 0.0144)
Number of active peers	− 0.2427 (− 0.2747 to − 0.2107)	− 0.2395 (− 0.2630 to − 0.2160)

Abbreviation: CI, confidence interval.

cross-sectional parameters (i.e. "average" in Table 3) show that adolescent boys were more likely to engage in MVPA than girls. MVPA was higher among White adolescents than Black, Asian and Latin American/Hispanic youth as well as adolescents in the "Others" race/ethnicity category, but higher among Aboriginal youth than White youth. Attending a lower grade, having higher average scores in parental encouragement and instrumental support and reporting a higher number of active peers were all associated with higher levels of MVPA.

Coefficients from the longitudinal parameters (i.e. "difference" in Table 3) indicate that, after controlling for sex, ethnicity, grade, and parental and peer influences, there was a linear annual decline in adolescents' MVPA over the three-year period ($\beta = -0.28$, 95% CI: 0.16–0.29, $p < .001$). Changes in parental and peer influence variables were positively associated with changes in MVPA trajectory. For a one-unit increase in the score of parental encouragement, parental instrumental support and number of active peers, average MVPA significantly increased by 0.22 units, 0.23 units and 0.16 units, respectively.

Changes in parental and peer influences and changes in probability of meeting PA guidelines

Results from the GEE models are presented in Table 4. Coefficients (i.e. "average" in Table 4) from the cross-sectional parameters show that the odds of complying with the Canadian PA guidelines were higher among adolescent boys than girls. Similar to findings for MVPA, the odds of meeting the guidelines were higher among White youth than Black, Asian and Latin American/Hispanic youth and those in the "Others" race/ethnicity category, but higher among Aboriginal youth than White youth. Attending a lower grade, having higher average scores in parental encouragement and parental instrumental support and reporting a higher number of active peers were associated with higher odds of meeting the guidelines.

Coefficients from the longitudinal parameters (i.e. "difference" in Table 4) show that the odds of an adolescent complying with the Canadian PA guidelines decreased by 5% over the three-year period ($p = .009$), after controlling for sex, race/ethnicity, grade, and parental and peer influences.

TABLE 3
Longitudinal effects of parental and peer influences on moderate-to-vigorous physical activity (MVPA), COMPASS study, years 2012/13, 2013/14 and 2014/15

Characteristic	Category	Coefficient (β)	95% CI	*p*-value
Intercept		3.834	(3.054 to 4.615)	< .001
Time-invariant covariates				
Sex	Girls	Ref	—	—
	Boys	0.848	(0.767 to 0.929)	< .001
Ethnicity	White	Ref	—	—
	Black	−0.005	(−0.226 to 0.216)	.964
	Asian	−0.994	(−1.172 to −0.816)	< .001
	Aboriginal	0.277	(0.005 to 0.548)	.046
	L. Am./Hisp.	−0.132	(−0.426 to 0.163)	.382
	Others	−0.237	(−0.456 to −0.018)	.034
Grade	Average	−0.280	(−0.390 to −0.171)	< .001
Time-varying predictors				
Age	Average	0.164	(0.068 to 0.260)	.001
	Difference	−0.276	(−0.316 to −0.236)	< .001
Parental encouragement	Average	0.486	(0.412 to 0.559)	< .001
	Difference	0.224	(0.159 to 0.290)	< .001
Parental instrumental support	Average	0.702	(0.611 to 0.793)	< .001
	Difference	0.225	(0.151 to 0.300)	< .001
Number of active peers	Average	0.627	(0.597 to 0.658)	< .001
	Difference	0.156	(0.127 to 0.184)	< .001

Abbreviations: CI, confidence interval; L. Am./Hisp., Latin American/Hispanic; Ref, reference group.

Notes: MVPA was square-root transformed. "Average" is the mean value of the time-varying variable of an individual across the three time points. "Difference" is the difference between an individual's mean value of the time-varying variable and the observed value at a specific time point.

Positive changes in the scores of the parental and peer influence variables increased the odds of complying with the PA guidelines. For a one-unit increase in the score of parental encouragement, parental instrumental support, and number of active peers, adjusted odds of an adolescent complying with the PA guidelines increased by 9%, 4% and 6%, respectively.

Discussion

Our findings showed that parental encouragement, parental instrumental support and number of active peers significantly declined within individuals over the three-year period. This is important because each unit change in these variables was independently and positively associated with changes in adolescent PA levels and the odds of meeting Canadian PA guidelines for children and youth. Adolescents were more likely to engage in MVPA and meet the guideline if they reported more parental encouragement, parental instrumental support and active peers. This new insight is promising as all of those constructs are potentially modifiable. The findings can also inform the grading of peer- and family-related indicators in future iterations of ParticipACTION's Report Card on Physical Activity for Children and Youth.

Parental encouragement and parental instrumental support decreased significantly across Grades 9 to 12. These findings are consistent with previous studies focussing on adolescent girls.[22,24] Davison and Jago showed that girls' perceived parental instrumental support significantly decreased across ages 9 to 15.[22] Dowda et al. found that girls' perceived family support significantly declined from Grade 8 to Grade 12.[24] Our findings contribute to the literature by demonstrating longitudinal effects of parental encouragement and instrumental support on PA in both adolescent boys and girls.

The finding that increments in parental encouragement and instrumental support were significantly associated with increased adolescent PA over time is partially consistent with previous studies.[22,24] Dowda et al. found that an elevated self-reported PA as measured by total Metabolic Equivalent (MET) scores was predicted by an increase in family support from Grade 8 to Grade 12.[24] Davison and Jago demonstrated that adolescent girls had higher odds of meeting PA guidelines across ages 9 to 15 years if they perceived higher levels of parental modelling, but not parental instrumental support.[22] The inconsistent findings could be related to the difference in conceptualization of parental influences across studies (i.e. Dowda et al. used a composite variable, while Davison and Jago quantified specific aspects of parental influences). While more longitudinal studies are needed to disentangle the effects of different kinds of parental influences on PA among adolescents, continued efforts are also required to standardize definitions and measures in the field to allow meaningful comparisons across studies.

For peer influences, other researchers have focussed on temporal variations in children's social networks and found that the number of outgoing and incoming (general) friendships did not predict changes in PA.[16] To the authors' knowledge, no study has specifically examined temporal variations in the number of active peers and their effect on changes in PA. Our study is the first to show that the number of active peers significantly decreased across adolescence. A unit increase in the number of physically active friends significantly increased PA levels and the odds of meeting PA guidelines. The mechanisms explaining these positive relationships remain speculative. It is unclear whether having more physically active peers may have influenced adolescents' PA by increasing their motivation to be physically active, by promoting PA norms among peers or by providing companions for PA, or whether other mechanisms were involved.[29,38] Future studies should

TABLE 4
Longitudinal effects of changes in parental and peer influences on changes in compliance with Canadian physical activity guidelines, COMPASS study, years 2012/13, 2013/14 and 2014/15

Variables	Category	Odds ratio (OR)	95% CI	*p*-value
Intercept		0.154	(0.097–0.244)	< .001
Time-invariant covariates				
Sex	Girls	Ref	—	—
	Boys	1.676	(1.596–1.761)	< .001
Ethnicity	White	Ref	—	—
	Black	0.783	(0.692–0.885)	< .001
	Asian	0.593	(0.518–0.680)	< .001
	Aboriginal	1.143	(1.006–1.299)	.041
	L. Am./Hisp.	0.737	(0.642–0.847)	< .001
	Others	0.845	(0.746–0.958)	.008
Grade	Average	1.062	(1.009–1.118)	.022
Time-varying predictors				
Age	Average	0.904	(0.851–0.961)	.001
	Difference	0.948	(0.911–0.987)	.009
Parental encouragement	Average	1.190	(1.145–1.237)	< .001
	Difference	1.088	(1.046–1.133)	< .001
Parental instrumental support	Average	1.099	(1.039–1.162)	.001
	Difference	1.039	(0.991–1.090)	.113
Number of active peers	Average	1.227	(1.207–1.248)	< .001
	Difference	1.058	(1.037–1.079)	< .001

Abbreviations: CI, confidence interval; L. Am./Hisp., Latin American/Hispanic; Ref, reference group.

Notes: "Average" is the mean value of the time-varying variable across the three time points. "Difference" is the difference between the mean value and the reported value.

also examine factors that influence adolescents to form or dissolve friendships with physically active peers. Also, specific characteristics of the PA friendship network should be explored, such as composition and type of activities in which active peers participate, both of which are associated with changes in adolescent PA over time.[39]

Declines in PA during adolescence are commonly reported.[40,41] Our findings suggest that interventions to attenuate these declines should include encouraging parents to provide more encouragement and increase instrumental support for PA to their children, and should consider the role peers may play. While best practices for family-based PA interventions for youth remain to be identified,[42,43] limited evidence suggests that public health professionals could increase parental support for PA using parent–child targeted training, family counselling and preventive messages during family visits.[42] Social marketing campaigns (such as the ParticipACTION "Think Again" campaign)[44] may also have a role to play in educating parents about their important role in providing support.

Likewise, there is little available evidence on peer-based PA interventions. To our knowledge, there are no interventions aimed at increasing the number of physically active friends of an adolescent. One age-appropriate channel for meeting more physically active friends is social media (e.g. Facebook).[45] Another possible intervention is to increase the number of physically active friends within an existing friendship network. This can be done by changing peer PA norms using social marketing campaigns, such as the VERB campaign,[46] to communicate that physical activity is something that friends do together. Encouraging adolescents to participate in group-based physical activities (organized or recreational) could also help them increase the number of their active peers and/or friends.[47]

Strengths and limitations

This study has considerable strengths. The longitudinal design allowed us to determine temporal sequences and patterns of change in these parental and peer influences, providing important insight informing the design and timing of future interventions. Using the multilevel mixed-effect models allowed us to incorporate individual and school-level variations in the analyses, which increased the accuracy of parameter estimations. The large sample size (children were recruited from nearly 90 schools) increased the precision of population parameter estimations.

This study is limited in that all measures were self-reported and PA assessment is particularly prone to reporting error. Also, given the need for developing a comprehensive yet brief survey for the COMPASS platform, there were only two parental influences (parental encouragement and parental instrumental support) and one measure of active peers included. Although these influences have been found to be more strongly associated with adolescent PA than parental role modelling, positive communication and co-participation,[25,27,28,48] there are likely other important dimensions we did not consider.

In our study, we asked participants to self-report the number of closest friends that are physically active. This approach provides only an indirect measure of the PA levels of friends. We recommend that future studies use a more comprehensive social network measure (such as that used by Sawka et al.[49]). For example, participants could be provided with a class list and asked to identify their active peers. The self-reported activity levels of those identified could then be linked.

In addition, although there are other covariates that might confound the associations of interest, such as child's self-efficacy, self-esteem, perceived competence and subjective values,[25] we did not adjust for those. Finally, characteristics of students included in the analytical sample were different from the excluded sample, which suggests the possibility of attrition biases. Nonetheless, attrition is an inherent limitation in prospective observational studies.

Conclusion

This study found significant declining trends in parental encouragement, instrumental supports and number of active peers from Grades 9 to 12, which was associated with reductions in PA levels and decreased odds of meeting PA guidelines. Promoting parental encouragement and instrumental support and facilitating the formation and maintenance of a physically active friendship network may be important for attenuating the decline in PA during adolescence.

Acknowledgements

The COMPASS study was supported by a bridge grant from the Canadian Institutes of Health Research (CIHR) Institute of Nutrition, Metabolism and Diabetes (INMD) through the “Obesity—Interventions to Prevent or Treat” priority funding awards (OOP-110788; grant awarded to S. T. Leatherdale) and an operating grant from the CIHR Institute of Population and Public Health (IPPH) (MOP-114875; grant awarded to S. T. Leatherdale). Drs. Faulkner and Leatherdale are Chairs in Applied Public Health Research funded by the Public Health Agency of Canada in partnership with CIHR.

References

1. Janssen I, LeBlanc A. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. Int J Behav Nutr Phys Act. 2010;7(1):40.
2. Hallal P, Victora C, Azevedo M, Wells JK. Adolescent physical activity and health. Sports Med. 2006;36(12): 1019-30.
3. United States Department of Health and Human Services. Youth risk behavior surveillance–United States, 2013. Morb Mortal Wkly Rep. 2014; 63(4).
4. Statistics Canada. Canadian Community Health Measures Survey–Cycle 3, 2012 to 2013. Ottawa (ON): Statistics Canada; 2014.
5. Tremblay MS, Gray CE, Akinroye K, Harrington DM, Katzmarzyk PT, Lambert EV, et al. Physical activity of children: a global matrix of grades comparing 15 countries. J Phys Act Health. 2014;11 Suppl 1:S113-25.
6. Azevedo MR, Araújo CL, Cozzensa da Silva M, Hallal PC. Tracking of physical activity from adolescence to adulthood: a population-based study. Revista de Saúde Pública. 2007;41: 69-75.
7. Sallis JF, Owen N, Fotheringham MJ. Behavioral epidemiology: a systematic framework to classify phases of research on health promotion and disease prevention. Ann Behav Med. 2000;22(4):294-8.
8. Spence JC, Lee RE. Toward a comprehensive model of physical activity. Psychol Sport Exerc. 2003;4(1):7-24.
9. Craggs C, Corder K, van Sluijs EMF, Griffin SJ. Determinants of change in physical activity in children and adolescents: a systematic review. Am J Prev Med. 2011;40(6):645-658.
10. Bandura A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs (NJ): Prentice Hall; 1986.
11. Trost SG, Loprinzi PD. Parental influences on physical activity behavior in children and adolescents: a brief review. Am J Lifestyle Med. 2011;5(2):171-81.
12. Maturo CC, Cunningham SA. Influence of friends on children’s physical activity: a review. Am J Public Health. 2013;103(7):e23-38.
13. Bergh IH, Bjelland M, Grydeland M, et al. Mid-way and post-intervention effects on potential determinants of physical activity and sedentary behavior, results of the HEIA study – a multi-component school-based randomized trial. Int J Behav Nutr Phys Act. 2012;9:63.
14. Bergh IH, van Stralen MM, Grydeland M, et al. Exploring mediators of accelerometer assessed physical activity in young adolescents in the Health In Adolescents Study – a group randomized controlled trial. BMC Public Health. 2012;12:814.
15. Corder K, Craggs C, Jones A, Ekelund U, Griffin S, van Sluijs E. Predictors of change differ for moderate and vigorous intensity physical activity and for weekdays and weekends: a longitudinal analysis. Int J Behav Nutr Phys Act. 2013;10(1):69.
16. Gesell SB, Tesdahl E, Ruchman E. The distribution of physical activity in an after-school friendship network. Pediatrics. 2012;129(6):1064-1071.
17. Hearst M, Patnode C, Sirard J, Farbakhsh K, Lytle L. Multilevel predictors of adolescent physical activity: a longitudinal analysis. Int J Behav Nutr Phys Act. 2012;9(1):8.
18. Kirby J, Levin KA, Inchley J. Parental and peer influences on physical activity among Scottish adolescents: a longitudinal study. J Phys Act Health. 2011;8(6):785-793.
19. Ornelas IJ, Perreira KM, Ayala GX. Parental influences on adolescent physical activity: a longitudinal study. Int J Behav Nutr Phys Act. 2007;4:3.
20. van Stralen MM, de Meij J, Te Velde SJ, et al. Mediators of the effect of the JUMP-in intervention on physical activity and sedentary behavior in Dutch primary schoolchildren from disadvantaged neighborhoods. Int J Behav Nutr Phys Act. 2012;9:131.
21. Bauer K, Nelson M, Boutelle K, Neumark-Sztainer D. Parental influences on adolescents’ physical activity and sedentary behavior: longitudinal findings from Project EAT-II. Int J Behav Nutr Phys Act. 2008;5(1):12.
22. Davison KK, Jago R. Change in parent and peer support across ages 9 to 15 yr and adolescent girls’ physical activity. Med Sci Sports Exerc. 2009;41(9): 1816-1825.
23. Morrissey JL, Janz KF, Letuchy EM, Francis SL, Levy SM. The effect of family and friend support on physical activity through adolescence: a longitudinal study. Int J Behav Nutr Phys Act. 2015;12(1):103.
24. Dowda M, Dishman RK, Pfeiffer KA, Pate RR. Family support for physical activity in girls from 8th to 12th grade in South Carolina. Prev Med. 2007; 44(2):153-159.

25. Beets MW, Cardinal BJ, Alderman BL. Parental social support and the physical activity-related behaviors of youth: a review. Health Educ Behav. 2010; 37(5):621-644.

26. Dishman RK, Saunders RP, Motl RW, Dowda M, Pate RR. Self-efficacy moderates the relation between declines in physical activity and perceived social support in high school girls. J Pediatr Psychol. 2009;34(4): 441-451.

27. Beets MW, Vogel R, Forlaw L, Pitetti KH, Cardinal BJ. Social support and youth physical activity: the role of provider and type. Am J Health Behav. 2006;30(3):278-289.

28. Edwardson CL, Gorely T. Parental influences on different types and intensities of physical activity in youth: a systematic review. Psychol Sport and Exerc. 2010;11(6):522-535.

29. Fitzgerald A, Fitzgerald N, Aherne C. Do peers matter? A review of peer and/or friends' influence on physical activity among American adolescents. J Adolesc. 2012;35(4):941-958.

30. ParticipACTION. The 2015 ParticipACTION report card on physical activity for children and youth: the biggest risk is keeping kids indoors. Toronto (ON): ParticipACTION; 2015.

31. Tremblay MS, Barnes JD, Cowie Bonne J. Impact of the Active Healthy Kids Canada Report Card: a 10-year analysis. J Phys Act Health. 2014;11 Suppl 1:S3-s20.

32. Leatherdale ST, Brown KS, Carson V, et al. The COMPASS study: a longitudinal hierarchical research platform for evaluating natural experiments related to changes in school-level programs, policies and built environment resources. BMC Public Health. 2014; 14:331.

33. Leatherdale ST, Laxer R, Faulkner G. Reliability and validity of physical activity and sedentary behavior measures in the COMPASS study. Waterloo (ON): University of Waterloo; 2014.

34. Leatherdale ST, Manske S, Wong SL, Cameron R. Integrating research, policy, and practice in school-based physical activity prevention programming: the School Health Action, Planning, and Evaluation System (SHAPES) Physical Activity Module. Health Promot Pract. 2009;10(2):254-261.

35. Sterdt E, Liersch S, Walter U. Correlates of physical activity of children and adolescents: a systematic review of reviews. Health Educ J. 2014; 73(1):72-89.

36. Curran PJ, Bauer DJ. The disaggregation of within-person and between-person effects in longitudinal models of change. Ann Rev Psychol. 2011;62: 583-619.

37. Yu O, Sheppard L, Lumley T, Koenig JQ, Shapiro GG. Effects of ambient air pollution on symptoms of asthma in Seattle-area children enrolled in the CAMP study. Environ Health Perspect. 2000;108(12):1209-1214.

38. Salvy S-J, de la Haye K, Bowker JC, Hermans RCJ. Influence of peers and friends on children's and adolescents' eating and activity behaviors. Physiol behav. 2012;106(3):369-378.

39. Marks J, de la Haye K, Barnett LM, Allender S. Friendship network characteristics are associated with physical activity and sedentary behavior in early adolescence. PloS One. 2015; 10(12):e0145344.

40. Basterfield L, Adamson AJ, Frary JK, et al. Longitudinal study of physical activity and sedentary behavior in children. Pediatrics. 2011;127(1):e24-30.

41. Dumith SC, Gigante DP, Domingues MR, Kohl HW. Physical activity change during adolescence: a systematic review and a pooled analysis. Int J Epidemiol. 2011;40(3):685-698.

42. O'Connor TM, Jago R, Baranowski T. Engaging parents to increase youth physical activity: a systematic review. Am J Prev Med. 2009;37(2):141-149.

43. Van Lippevelde W, Verloigne M, De Bourdeaudhuij I, et al. Does parental involvement make a difference in school-based nutrition and physical activity interventions? A systematic review of randomized controlled trials. Int J Public Health. 2012;57(4): 673-678.

44. Gainforth HL, Jarvis JW, Berry TR, et al. Evaluating the ParticipACTION "Think Again" Campaign. Health Educ Behav. 2016;43(4):434-41.

45. Cavallo DN, Tate DF, Ries AV, Brown JD, DeVellis RF, Ammerman AS. A social media-based physical activity intervention: a randomized controlled trial. Am J Prev Med. 2012;43(5): 527-532.

46. Huhman ME, Potter LD, Duke JC, Judkins DR, Heitzler CD, Wong FL. Evaluation of a national physical activity intervention for children: VERB campaign, 2002-2004. Am J Prev Med. 2007;32(1):38-43.

47. Ginis KAM, Nigg CR, Smith AL. Peer-delivered physical activity interventions: an overlooked opportunity for physical activity promotion. Transl Behav Med. 2013;3(4):434-443.

48. Yao C, Rhodes R. Parental correlates in child and adolescent physical activity: a meta-analysis. Int J Behav Nutr Phys Act. 2015;12(1):10.

49. Sawka KJ, McCormack GR, Nettel-Aguirre A, Blackstaffe A, Perry R, Hawe P. Associations between aspects of friendship networks, physical activity, and sedentary behaviour among adolescents. J Obes. 2014; 2014:632689. doi: 10.1155/2014/632689.

Suicide and self-inflicted injury hospitalizations in Canada (1979 to 2014/15)

R. Skinner, MSP; S. McFaull, MSc; J. Draca, BHSc; M. Frechette, MSc; J. Kaur, BHSc; C. Pearson, MA; W. Thompson, MSc

This article has been peer reviewed.

Tweet this article

Abstract

Introduction: The purpose of this paper is to describe the trends and patterns of self-inflicted injuries, available from Canadian administrative data between 1979 and 2014/15, in order to inform and improve suicide prevention efforts.

Methods: Suicide mortality and hospital separation data were retrieved from the Public Health Agency of Canada (PHAC) holdings of Statistics Canada's Canadian Vital Statistics: Death Database (CVS:D) (1979 to 2012); Canadian Socio-Economic Information Management System (CANSIM 2011, 2012); the Hospital Morbidity Database (HMDB) (1994/95 to 2010/11); and the Discharge Abstract Database (2011/12 to 2014/15). Mortality and hospitalization counts and rates were reported by sex, 5-year age groups and method.

Results: The Canadian suicide rate (males and females combined, all ages, age-sex standardized rate) has decreased from 14.4/100 000 (n = 3355) in 1979 to 10.4/100 000 (n = 3926) in 2012, with an annual percent change (APC) of −1.2% (95% CI: −1.3 to −1.0). However, this trend was not observed in both sexes: female suicide rates stabilized around 1990, while male rates continued declining over time—yet males still accounted for 75.7% of all suicides in 2012. Suffocation (hanging and strangulation) was the primary method of suicide (46.9%) among Canadians of all ages in 2012, followed by poisoning at 23.3%.

In the 2014/15 fiscal year, there were 13 438 hospitalizations in Canada (excluding Quebec) associated with self-inflicted injuries—over 3 times the number of suicides. Over time females have displayed consistently higher rates of hospitalization for self-inflicted injury than males, with 63% of the total. Poisoning was reported as the most frequent means of self-inflicted harm in the fiscal year 2014/15, at 86% of all hospitalizations.

Conclusion: Suicides and self-inflicted injuries continue to be a serious—but preventable—public health problem that requires ongoing surveillance.

Keywords: *suicide, self-inflicted injuries, intentional injuries, self-harm, suicide attempts, trends, Canada*

Highlights

- The aim of this study was to describe the trends and patterns of self-inflicted injuries, with both fatal and non-fatal outcomes, from 1979 to 2014/15, based on Canadian administrative data.
- While the Canadian suicide rate (males and females combined) has decreased slightly between 1979 and 2012, rates for females have not improved since around 1990, while male rates have continued declining.
- Suicide rates are higher among males, while hospitalizations for self-inflicted injuries are predominantly among females.

Introduction

Self-inflicted injury can result in hospitalization or death and is a serious public health problem in Canada, as well as internationally.[1-2] Non-fatal self-inflicted injuries are a significant risk factor for suicide,[3-5] making the monitoring of these outcomes critical in suicide prevention.[6]

The World Health Organization (WHO) estimated that in 2012 the age-standardized suicide rate was 11.4/100 000 or 804 000 suicides worldwide, but acknowledges that this is likely an underestimation.[2] International suicide rates in 2014 were reported at 10.8/100 000 in the United Kingdom,[7] 12.0 in Australia,[8] and 13.0 in the United States,[9] with varying trends over time by age, sex and method. In Canada, the most current age-standardized suicide rate (2012) was 10.4/100 000, with around 4000 deaths each year, ranking it as the ninth leading cause of death by Statistics Canada.[10] The accuracy of these rates is challenged by issues such as stigma and death certification validity.[11-16]

Reporting on suicide attempts in Canada, as well as in other countries, is challenging and subject to underreporting. The main sources of statistical information are databases that collect self-inflicted injury hospital presentations, but these are designed for administrative rather than surveillance purposes, and do not indicate intent.[17-22] Estimates using Canadian hospitalization data indicate that there are around 16 000 hospital separations associated with self-inflicted injuries, with a total economic burden of suicide and self-harm to Canadians estimated at $3 billion in 2010.[23]

Author reference:

Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence: Robin Skinner, Surveillance and Epidemiology Division, Public Health Agency of Canada, 785 Carling Avenue, A/L 6807B, Ottawa, ON K1A 0K9; Tel: 613-799-5434; Email: robin.skinner@phac-aspc.gc.ca

Prevention of self-inflicted injuries using a public health approach requires effective surveillance to define and monitor the problem, identify risk and protective factors, and ultimately support and advance effective suicide prevention efforts.[6] There is at present no Canadian literature available which presents both mortality and hospitalization surveillance data associated with self-inflicted injuries. The objective of this study is to provide an updated, comprehensive and singularly descriptive analysis of the trends and patterns of self-inflicted injuries in Canada, with both fatal and non-fatal outcomes, by using Canadian administrative data from 1979 to 2014/15.

Methods

Suicide mortality data were retrieved from the Public Health Agency of Canada (PHAC) holdings of Statistics Canada's Canadian Vital Statistics: Death Database (CVS:D) from 1979 to 2012, and the Canadian Socio-Economic Information Management System (CANSIM) (2011, 2012), where cause of death was categorized according to WHO's *International Classification of Diseases* (ICD). The external cause of injury or poisoning was classified by each provincial Vital Statistics Registry according to the ICD, Ninth Revision (ICD–9) for deaths before 2000 (codes E950–E959) and ICD, Tenth Revision (ICD–10), for subsequent years (codes X60–X84, Y87.0). Comparability studies describing the implementation of ICD–10 in 2000 to understand the impact of the transition from ICD–9 concluded that there was no effect on the continuity of suicide data.[24,25] Causes of death were grouped by ICD–10 chapters (1–20) for the purpose of comparing leading causes across age groups. Events associated with injury and poisoning were subdivided by intent (unintentional injury, intentionally self-inflicted injury or injury due to assault).

There is no single source for suicide attempt counts in Canada. Hospital separation data coded using ICD–10–CA* as self-inflicted injury (codes X60–X84, Y87.0) will be used as a proxy for the purposes of this study,[17] and were extracted from the PHAC holdings of the Hospital Morbidity Database (HMDB) for the fiscal years (April–March) 1994/95 to 2010/11 (all provinces and territories), and the Discharge Abstract Database (DAD) for the fiscal years 2011/12 to 2014/15 (excluding Quebec). The HMDB and DAD databases are available beginning in the fiscal year 1994/95 and are administered by the Canadian Institute for Health Information.

This study included hospital inpatient events recorded as self-inflicted in acute-care hospitals (includes both suicide attempts and self-inflicted injury without intent to die), but excluded people presenting to emergency departments (and not admitted for treatment), to psychiatric facilities or to private practice physicians, as well as those self-inflicted injury events for which treatment was not sought.

Mortality and hospitalization counts were disaggregated by sex and by 5-year age groups. The age-standardized rates were calculated using the direct method (Canada 1991).

The annual percent change (APC) in the suicide rate per 100 000 population was calculated to assess temporal trends. The APC was calculated with 95% confidence intervals separately for age, sex and method of suicide using the following equation:

$$\text{APC} = [e^{\beta\,-1}] \times 100$$

where β is the slope from a regression of log rates on year.

The potential years of life lost (PYLL) were calculated specifically for suicide mortality in 2012, for males and females combined, and separately, considering premature death as occurring before age 75.[26,27] The potential years of life lost for an age group are calculated by multiplying the number of suicides in each 5-year age group by the difference between the age group midpoint and 75.

Results

Suicide

The suicide rate in Canada (males and females combined, all ages, age- and sex-standardized rate) has decreased from 14.4/100 000 (n = 3355) in 1979 to 10.4/100 000 (n = 3926) in 2012 (APC = −1.1%, 95% CI: −1.3 to −1.0). Despite a decreasing suicide rate, in 2012 alone, we estimate suicides accounted for 115 723 PYLL for males and females combined and separately, 89 756 years for males, and 28 967 for females. Figure 1 compares male and female suicide rates in decline since 1979, with APCs that are significant over the entire timeframe. However, it is evident from the trend line that the female suicide rate shows no further improvement after 1990, while the male rate continues dropping.

Age and sex

Figure 2 illustrates 2012 age-specific suicide rates by 5-year age group, for males and females, both combined and separately. The suicide rate peaks between 45 and 59 years of age, with the highest point at 17.4/100 000 among those aged 55 to 59 years, for both sexes combined, with the highest overall rate being 26.7/100 000 for males. Male suicide rates are substantially higher than female rates across the life course, representing 76% of all suicide cases. There are notable points among those aged 10 to 14 years where rates show no important difference between sexes. At the other extreme, rates for males over 85 years old are 6 to 10 times as high as those for females.

Table 1 provides leading causes of death across age groups. Suicide is the second leading cause of death for each of the 15 to 19, 20 to 24, and 25 to 34 age groups, accounting for 21.9% of all deaths between ages 15 and 34 years combined. Suicide drops to the third leading cause among those aged 35 to 44 years. The percentage of suicide-related deaths continues decreasing in rank as age increases, when compared to other important causes.

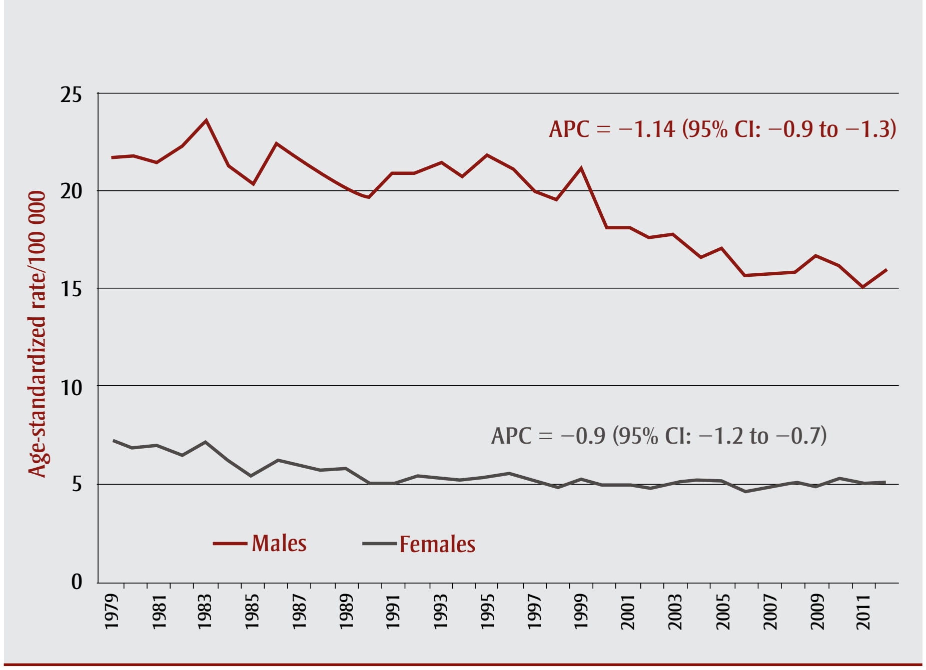
Provincial/territorial comparison

Suicide rates differ across the provinces and territories (P/Ts), as illustrated in Figure 3. Using the Canadian 1991 population's age structure for comparisons across geographic regions, Nunavut observed the highest rate of suicide (standardized rate of 63.5/100 000, n = 24) and Prince Edward Island observed the lowest rate (5.8/100 000, n = 11) (cautious interpretation advised due to low counts).

---

* ICD–10–CA is an enhanced version for use with morbidity classification in Canada. Beginning in 2001/02 some provinces and territories began implementing ICD–10–CA to replace ICD–9 and ICD–9–CM. By 2004/05, all provinces and territories (excluding Quebec) had completed the transition.

FIGURE 1
Age-standardized suicide rates/100 000, by year and sex, Canada 1979 to 2012



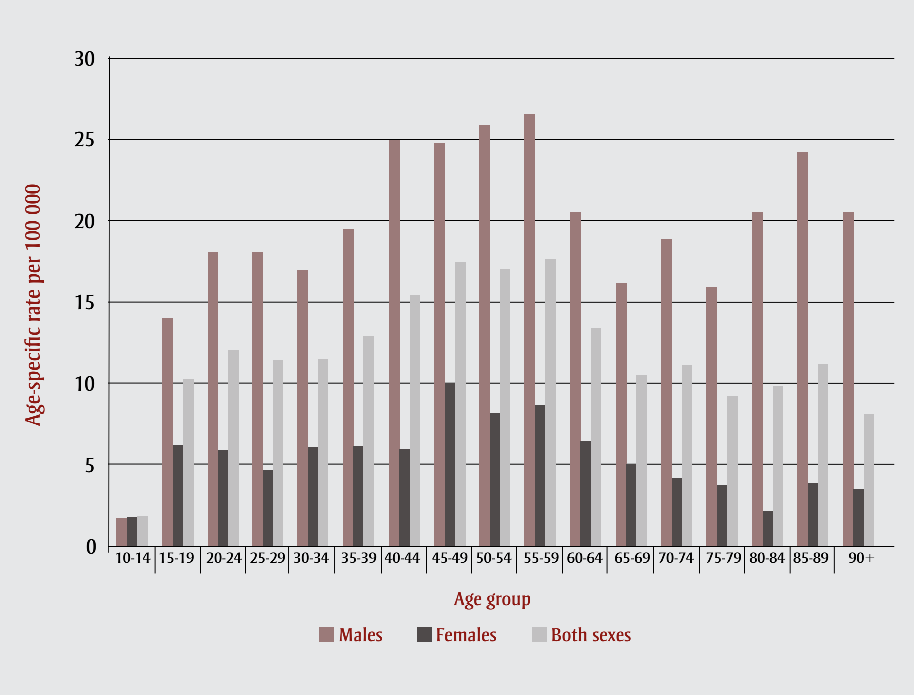
Source: Statistics Canada, Canadian Vital Statistics: Death Database (1979-2012).

Abbreviation: APC, annual percent change.

Methods of suicide

Suffocation (asphyxiation by hanging or strangulation) accounted for nearly half of the suicides among Canadians in 2012, regardless of sex. Among males, both poisoning and firearms ranked in equal proportion (18%) in contrast to females, where poisoning accounted for 40% and firearms only 2%. Falls and drowning were less frequent methods for both sexes (Table 2).

FIGURE 2
Age-specific suicide rates by sex and age group, Canada, 2012



Source: Statistics Canada, Canadian Vital Statistics: Death Database (2012).

Trends in hospitalizations for self-inflicted injuries

In 2014/15, there were 13 438 hospitalizations associated with self-inflicted injuries in Canada (excluding Quebec)—over 3 times the number of suicides. The age-standardized rates of hospitalizations related to self-inflicted injury in Canada (males and females combined) have been declining from 86.6/100 000 in 1994/95 to 50.2/100 000 in 2014/15; however, interpretation of trend data is not advised due to the exclusion of Quebec from 2011/12 onwards.

Age and sex

From 1994/95 to 2014/15, females have displayed consistently higher rates of hospitalizations for self-inflicted injury than males, accounting for 62% of the total as illustrated in Figure 4. Both sexes experienced a similar downward trend averaging 4% annually, between 1994/95 and 2010/11, levelling off around 2006/07.

Focussing on the most recent year of data by age group, females aged 15 to 19 years display a disproportionately high rate of hospitalizations associated with self-inflicted injuries in 2014/15 of 231.8/100 000 (n = 1897) (Figure 5), which is almost 3.5 times that of males in the same age group. Females continue to self-injure at a rate greater than males peaking again in the 45 to 49 year age range, at which point the rates decline steadily over the life course. Male hospitalizations for self-inflicted injuries are generally lower among all age groups until the 75 to 79 year age group, at which point the trend reverses for the subsequent age groups.

Provincial/territorial comparison

Figure 6 provides rates of hospitalizations associated with self-inflicted injury by province and territory. The territories combined (Yukon, Nunavut and the Northwest Territories) have the highest rate of hospitalizations associated with self-inflicted injury (155.7/100 000, n = 185) in 2014/15. Ontario has the lowest rate with 38.5/100 000 (n = 5203).

Methods of self-inflicted injury

Poisoning was reported as the most frequent means of self-inflicted injury in fiscal year 2014/15, accounting for 86% of all hospitalizations for self-inflicted injuries; of these, 66% were females (see Table 3). Hospitalizations associated with

TABLE 1
Leading causes of death in Canada, males and females combined, by age group (counts and percentages), 2012

Rank	10–14 years	15–19 years	20–24 years	25–34 years	35–44 years	45–54 years	55–64 years	≥ 65 years
1	Unintentional injuries (54, 26.6%)	Unintentional injuries (339, 41.4%)	Unintentional injuries (513, 40.5%)	Unintentional injuries (848, 30.4%)	Cancer (1242, 26.4%)	Cancer (5287, 39%)	Cancer (13 023, 47.6%)	Circulatory (57 813, 29.8%)
2	Cancer (38, 19%)	Suicide (227, 27.7%)	Suicide (291, 23.0%)	Suicide (548, 19.7%)	Unintentional injuries (857, 18.2%)	Circulatory (2526, 19%)	Circulatory (5719, 20.9%)	Cancer (55 615, 28.7%)
3	Suicide (34, 16.7%)	Cancer (62, 7.5%)	Cancer (85, 6.7%)	Cancer (400, 14.4%)	Suicide (662, 14.1%)	Unintentional injuries (1197, 9.0%)	Digestive (1484, 5.4%)	Respiratory (20 050, 10.3%)
4	Nervous system (21, 10.3%)	Nervous system (38, 4.6%)	Homicide (75, 5.9%)	Circulatory (176, 6.3%)	Circulatory (625, 13.3%)	Suicide (928, 6.9%)	Respiratory (1420, 5.2%)	Mental disorders (14 259, 7%)
5	Congenital anomalies (16, 7.9%)	Homicide (26, 3.2%)	Nervous system (62, 4.8%)	Homicide (118, 4.2%)	Digestive (214, 4.6%)	Digestive (800, 5.9%)	Endocrinal, nutritional and metabolic diseases (1121, 4.1%)	Nervous system (10 836, 5.6%)
6	Endocrinal, nutritional and metabolic diseases (7, 3.4%)	Congenital anomalies (21, 2.6%)	Circulatory (38, 3.0%)	Nervous system (88, 3.2%)	Endocrinal, nutritional and metabolic diseases (168, 3.6%)	Endocrinal, nutritional and metabolic diseases (482, 3.6%)	Unintentional injuries (1103, 4.0%)	Endocrinal, nutritional and metabolic diseases (7682, 4%)
7	Circulatory (7, 3.4%)	Circulatory (20, 2.4%)	Congenital anomalies (31, 2.4%)	Endocrinal, nutritional and metabolic diseases (66, 2.3%)	Nervous system (146, 3.1%)	Respiratory (452, 3.3%)	Nervous system (818, 3%)	Digestive (7264, 3.7%)
8	Respiratory (5, 2.5%)	Infectious (9, 21.1%)	Endocrinal, nutritional and metabolic diseases (19, 1.5%)	Digestive (59, 2.1%)	Infectious (125, 2.7%)	Nervous system (387, 2.9%)	Suicide (705, 3.0%)	Unintentional injuries (6231, 3.2%)
9	Infectious (5, 2.5%)	Blood diseases (6, 0.7%)	Infectious (15, 1.2%)	Congenital anomalies (50, 1.8%)	Respiratory (101, 2.1%)	Infectious (374, 2.8%)	Infectious (626, 2.3%)	Genitourinary (4686, 2.3%)
10	Homicide (5, 2.5%)	Respiratory (6, 0.7%)	Respiratory (10, 0.8%)	Respiratory (50, 1.8%)	Homicide (83, 1.8%)	Mental disorders (222, 1.6%)	Mental disorders (379, 1.4%)	Infectious (4538, 2.3%)
All causes[a] (244 370)	203	818	1266	2786	4702	13 494	27 364	193 737
								Suicide (531, 0.3%)
	Total suicide (3926, 1.6%)							

Source: Statistics Canada, CANSIM Tables 102-0521–102-0534, 102-0540–102-0561.

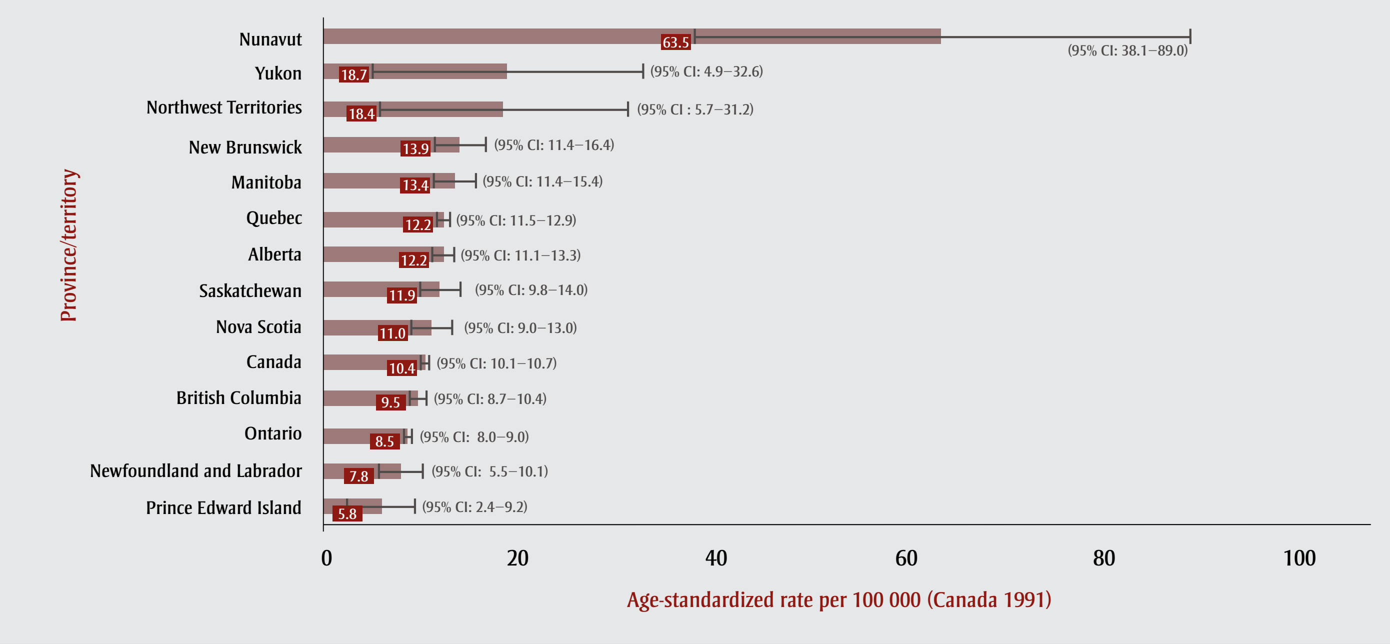
[a] Total number of deaths for persons aged 10 years and older, from all causes. Not all causes are shown here.

self-inflicted injury by means of cutting/piercing, suffocation and falls rank second to fourth in frequency, respectively, following poisonings. We observed no difference between males and females with regard to the ranking of methods.

Discussion

The aim of this study was to describe the trends and patterns of self-inflicted injuries, with both fatal and non-fatal outcomes from 1979 to 2014/15, based on Canadian administrative data. The overall standardized suicide rates have been found to be decreasing over the past 33 years; however, suicide still remains a significant and extremely complex public health problem requiring ongoing surveillance to improve

FIGURE 3
Age-standardized (Canada 1991) suicide mortality rate/100 000, by province/territory, Canada, 2012



Source: Statistics Canada, Canadian Vital Statistics: Death Database (2012).

Note: The age-standardized rates were calculated to the 1991 Canadian Census population using the direct method.

understanding and guide prevention.[6] Further examinations by sex found that male suicide rates have been declining over time, while female rates have shown no improvement during the last 10 years of the study timeframe: a trend that bears further investigation. Consistent with other studies, males generally displayed higher suicide rates than females, with the exception of earlier adolescence (10–14 years); however, females are more frequently admitted to hospital for self-inflicted injuries (the “gender paradox” of suicidal behaviour).[28] Over the life course, male suicide rates were observed to steadily increase beginning in adolescence, peaking first during middle adulthood and again among seniors 80 years and older; the same pattern was also observed among females, albeit of a lesser magnitude.

Young Canadians (10–24 years) do not display the highest suicide rates overall, yet there is a noticeable peak among those aged 20 to 24 years, due primarily to suicides among males within that age group.[29] In contrast, when we look at the self-injury hospitalizations, there is an earlier peak, in the 15-to-19 age group, due to females. A focus on prevention specific to youth is paramount, as suicide attempts are an

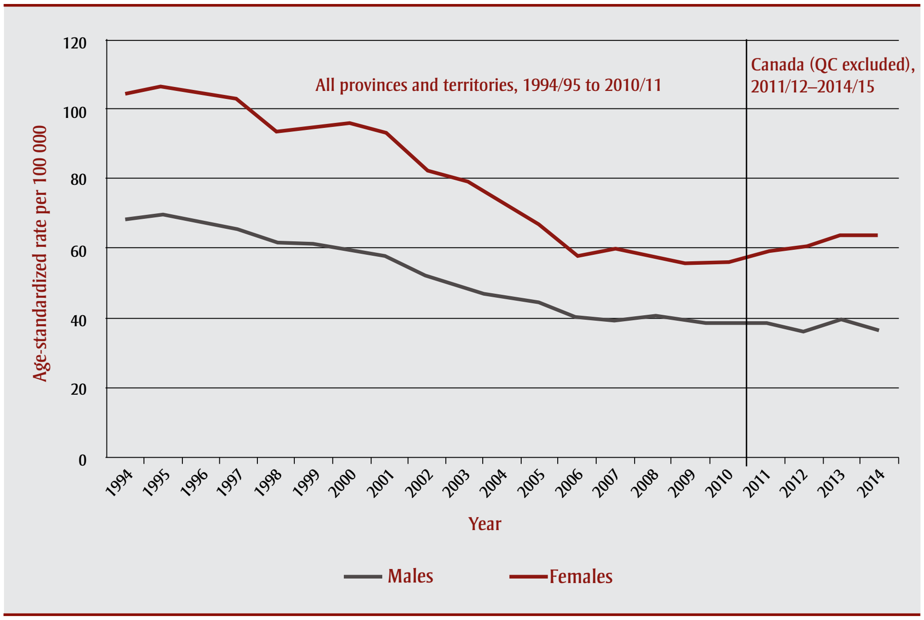
TABLE 2
Suicide in Canada by method and sex, all ages, 2012

Method	Both sexes			Males			Females		
	Cases	%	Rate/100 000[a]	Cases	%	Rate/100 000[a]	Cases	%	Rate/100 000[a]
All methods	3926	100.0	11.3	2972	100.0	17.3	954	100.0	5.4
Suffocation	1843	46.9	5.3	1427	48.0	8.3	416	43.6	2.4
Poisoning	915	23.3	2.6	534	18.0	3.1	381	39.9	2.2
Firearm	544	13.9	1.6	528	17.8	3.1	16	1.7	0.1
Fall	305	7.8	0.9	229	7.7	1.3	76	8.0	0.4
Drowning	100	2.5	0.3	65	2.2	0.4	35	3.7	0.2
Cut/pierce	111	2.8	0.3	96	3.2	0.6	15	1.6	0.1
Transport	40	1.0	0.1	37	1.2	0.2	3	0.3	0.0
Fire/flame	24	0.6	0.1	18	0.6	0.1	6	0.6	0.0
Other/unspecified	44	1.1	0.1	38	1.3	0.2	6	0.6	0.0

Source: Statistics Canada, Canadian Vital Statistics: Death Database (2012).

[a] Crude rate/100 000 persons.

FIGURE 4
Age-standardized hospitalization rates associated with self-inflicted injuries by year and sex, Canada 1994/95 to 2010/11 and Canada excluding Quebec 2011/12 to 2014/15

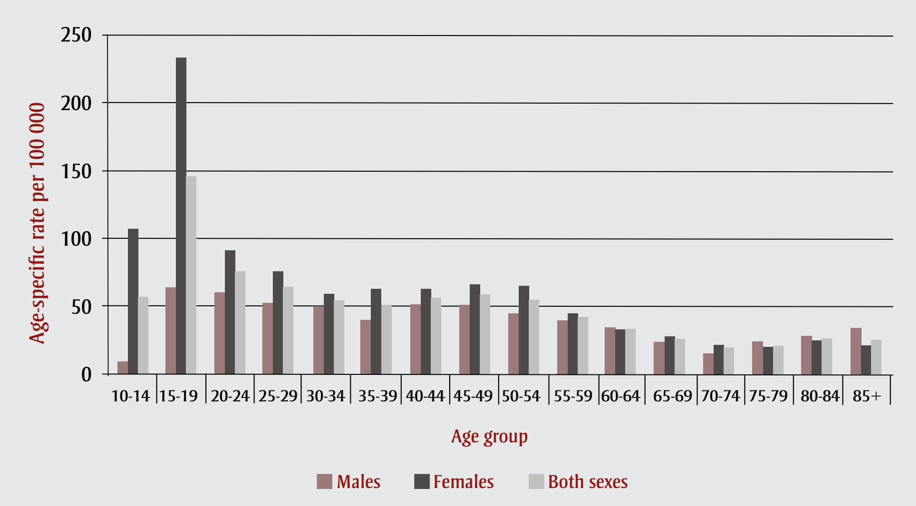


Source: Hospital Morbidity Database (2010/11), and Discharge Abstract Database (2014/15), Canadian Institute for Health Information.

important predictor of suicide,[3-5,30-32] and youth suicides represent an early loss to society, as estimated by the PYLL. Accounting for risk-taking behaviour as a part of adolescent exploration, suicide behaviour can be the result of complex individual, family and social circumstances. For example, social disadvantage and isolation, family social difficulties, exposure to stressful events and mental health and substance abuse problems are among some of the most difficult challenges.[30-32]

Attempted suicides are much less common among seniors when compared with younger age groups. This may be due to the fact that attempts more often result in death among seniors, possibly due to social isolation, reduced general health, physical frailty, loneliness and depression.[33-35] Risk for suicide among older adults is associated with suicidal ideation or behaviour, mental illness, personality vulnerability, medical illness, losses and poor social support, functional impairment and low resiliency. Among seniors, there is particular concern regarding recognition of intentional harm by self-poisoning.[33]

FIGURE 5
Age-specific hospitalization rates associated with self-inflicted injuries by sex and age group, age-specific rates/100 000, Canada excluding Quebec, 2014/15



Source: Discharge Abstract Database (2014/15), Canadian Institute for Health Information.

Self-inflicted injury-related hospitalization rates, used in this study as a proxy for suicide attempts, have been declining in the last 21 years among both sexes, but remain higher among females. According to other Canadian indicators for the burden of suicide, particularly the Canadian Community Health Survey – Mental Health 2012, there were around 145 000 suicide attempts (0.5%†) by Canadians (15 years and older) in 2012, and over 900 000 Canadians (3.3%) reported experiencing "serious thoughts of committing suicide" in the past year.[36] This is noteworthy because suicide ideation and attempts are known to be among the greatest predictors of suicide.[3-5]

Consistent with other studies in Australia, England and the United States,[20,21,37] our study found that poisoning was the most common method associated with self-inflicted injuries admitted to hospital, for both males and females. Alternately, suffocation was found to be the primary mechanism among suicides for both sexes, followed by poisoning for females, and both poisoning and firearms for males. This is comparable to earlier analysis of methods of suicide using Canadian data from 1980 to 2008, in which an increase in suffocations and a decrease in other methods (such as poisoning and firearms) was found among youth.[38] Monitoring of methods involved in self-injury is important in prevention of suicide by limiting access to means and as part of intervention evaluation.

Strengths and limitations

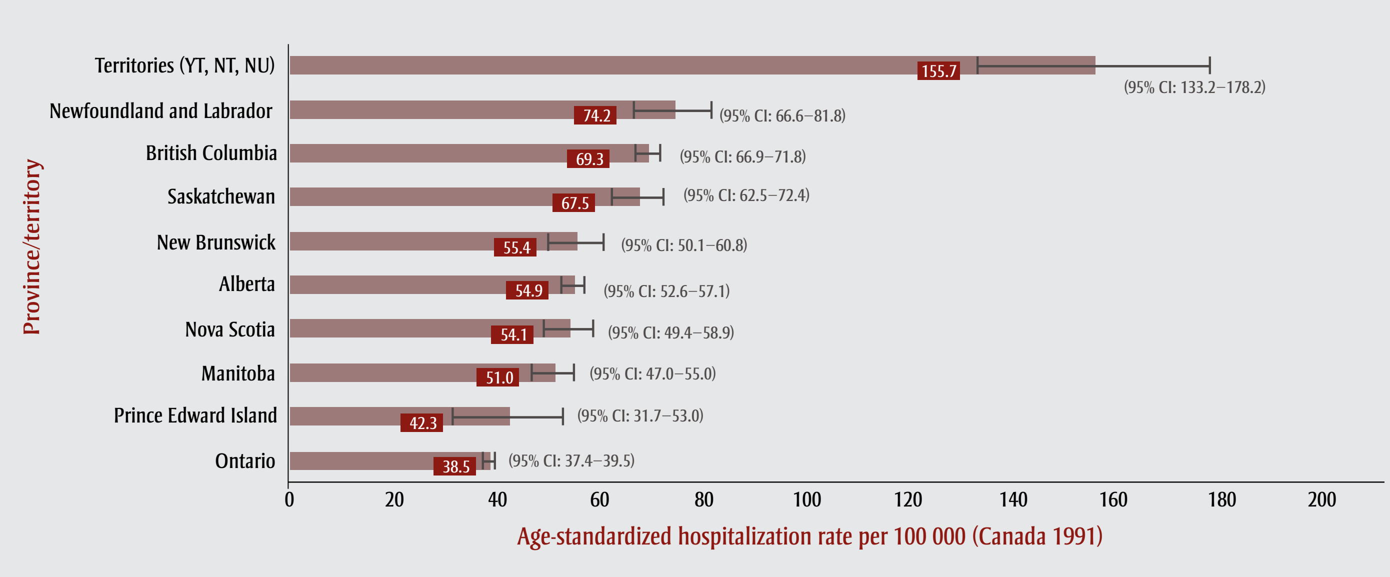
This is a retrospective observational study, which provides a comprehensive overview of trends in suicides and self-inflicted injuries resulting in hospitalizations over

---

† Use with caution (these data have a coefficient of variation between 16.6% and 33.3%).

FIGURE 6

Age-standardized hospitalization rates associated with self-inflicted injuries by province/territory, Canada (excluding Quebec), 2014/15



Source: Discharge Abstract Database (2014/15), Canadian Institute for Health Information.

Abbreviations: NT, Northwest Territories; NU, Nunavut; YT, Yukon.

time. The use of administrative data restricts the number of variables for analysis and necessitates different time periods for mortality and morbidity data. The underreporting of suicides is a recognized issue in the literature,[39] due in part to the failure to recognize intent during the death investigation, especially in case of poisoning, which can lead to misclassification.[14,40,41] Due to these factors, studies have estimated suicide rates are underreported by a minimum of 10%.[42,43] This study uses hospital separations associated with treatment of self-inflicted injuries as a proxy for suicide attempts due to the absence of any other nationally representative indicator. Hospital morbidity statistics reflect the number of hospitalizations to acute care facilities, which may be greater than the number of individuals hospitalized, since individuals with multiple

TABLE 3

Hospitalizations associated with self-inflicted injuries by sex and method, Canada excluding Quebec, 2014/15

Method	Both sexes			Males			Females		
	Cases	%	Rate/100 000[a]	Cases	%	Rate/100 000[a]	Cases	%	Rate/100 000[a]
All methods	13 438[b]	100.0	49.2	4987	100.0	36.9	8448	100.0	61.3
Poisoning	11 564	86.1	42.3	3926	78.7	29.0	7635	90.4	55.4
Cut/pierce	1 112	8.3	4.1	588	11.8	4.3	524	6.2	3.8
Suffocation	329	2.5	1.2	204	4.1	1.5	125	1.5	0.9
Fall	161	1.2	0.6	97	2.0	0.7	64	0.8	0.5
Firearm	56	0.4	0.2	–	–	–	–	–	–
Fire/hot object/substance	42	0.3	0.2	21	0.4	0.2	21	0.2	0.2
Transport	31	0.2	0.1	22	0.4	0.2	9	0.1	0.1
Struck by/against	19	0.1	0.1	10	0.2	0.1	9	0.1	0.1
Drowning	14	0.1	0.1	9	0.2	0.1	5	0.1	0.0
Other	110	0.8	0.4	58	1.2	0.4	52	0.6	0.4

Source: Discharge Abstract Database (2014/15), Canadian Institute for Health Information.

Note: May not sum due to rounding.

– Suppressed due to cell sizes of 0 or less than 5.

[a] Crude rate/100 000 persons.

[b] 3 cases where sex was missing.

admissions during a single year would be counted more than once in the totals. Conversely, many individuals who attempt suicide do not necessarily receive medical treatment; therefore, many attempts may be underreported within administrative data. Furthermore, if they do present to an emergency department, they may not be admitted to hospital for care.[44] These factors together, which are also influenced by changing hospital practices, contribute to the underreporting of attempts within administrative data by as much as 50%.[45]

Conclusion

Although there have been some improvements in the rates of both deaths and hospitalizations associated with self-inflicted injury, the results of the current study highlight that a serious—but preventable—public health problem remains. Ongoing surveillance of self-inflicted injury mortality and morbidity of Canadians, which involves a complex set of variables dependant on gender and stage of life, is critical to understanding the magnitude of the issue, assessing risk and protective factors and developing and evaluating effective interventions.

References

1. Spiwak R, Elias B, Bolton JM, Martens PJ, Saree J. Suicide policy in Canada: lessons from history. Can J Public Health. 2012:103(5).
2. World Health Organization. Preventing suicide: a global imperative [Internet]. WHO: 2014. Available from: http://www.who.int/mental_health/suicide-prevention/world_report_2014/en/
3. Cooper J, Kapur N, Webb R, Lawlor M, Guthrie E, Mackway-Jones K, Appleby L. Suicide after deliberate self-harm: a 4-year cohort study. Am J Psychiatry. 2005 Feb;162(2):297-303.
4. Skegg K. Self-harm. Lancet. 2005; 376(9495):1471-1483.
5. Vijayakumar L, Phillips MR, Silverman MM, Gunnell D, Carli V. Suicide. In: Patel V, Chisholm D, Dua T, Laxminarayan R, Medina-Mora ME, editors. Mental, Neurological, and Substance Use Disorders: Disease Control Priorities. 3rd ed. (Vol. 4). Washington (DC): The International Bank for Reconstruction and Development/The World Bank; 2016 Mar:163-181.
6. Data and Surveillance Task Force of the National Action Alliance for Suicide Prevention. Improving national data systems for surveillance of suicide-related events. Am J Prev Med. 2014 Sep;47(3 Suppl 2):S122-9.
7. Office for National Statistics. Suicides in the United Kingdom: 2014 registrations [Internet]. Newport, South Wales. Available from: http://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/suicidesintheunitedkingdom/2014registrations
8. Australian Bureau of Statistics. Causes of Death, Australia, 2014 [Internet]. Available from: http://abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/3303.0~2014~Main%20Features~Intentional%20self-harm%20by%20Age~10051
9. Curtin SC, Warner M, Hedegaard H. Increase in suicide in the United States, 1999–2014. NCHS data brief, no 241. Hyattsville (MD): National Center for Health Statistics. 2016.
10. Statistics Canada. Table 102-0561. Leading causes of death, total population, by age group and sex, Canada, annual, CANSIM (database) [Internet]. Ottawa (ON): Statistics Canada [modified 2014 Jan 27; cited 2015 Jul 23]. Available from: http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=1020561
11. Skinner R, McFaull S, Rhodes AE, Bowes M, Rocket IRH. Suicide in Canada: is poisoning misclassification an issue? Can J Psychiatry. 2016 Jul;61:405-412.
12. Rockett IRH. Counting suicides and making suicide count as a public health problem. Crisis. 2010;31(5): 227-230.
13. Tøllefsen IM, Hem E, Ekeberg O. The reliability of suicide statistics: a systematic review. BMC Psychiatry. 2012; 12(9):9-19.
14. Campbell LA, Jackson L, Bassett R, Bowes MJ, Donahue M, Cartwright J, et al. Can we use medical examiners' records for suicide surveillance and prevention research in Nova Scotia? Chronic Dis Inj Can. 2011;31(4):165-171.
15. Rockett IRH, Kapusta D, Bhandari R. Suicide misclassification in an international context: revisitation and update. Suicidol Online. 2011;2:48-61.
16. Donaldson AE, Larsen GY, Fullerton-Gleason L, Olson LM. Classifying undetermined poisoning deaths. Inj Prev. 2006;12:338-343.
17. Canadian Institute for Health Information (CIHI). National Trauma Registry Analytic Bulletin: hospitalizations due to suicide attempts and self-inflicted injury in Canada, 2001-2002. Toronto (ON): CIHI; 2004.
18. Owens C. Interventions for self-harm: are we measuring outcomes in the most appropriate way? Br J of Psychiatry. 2010 Nov;197(6):502-503.
19. Hawton, K. Deliberate self-harm: systematic review of efficacy of psychosocial and pharmacological treatments in preventing repetition. BMJ. 1998;317.
20. Tovell A, McKenna K, Bradley C, Pointer S. Hospital separations due to injury and poisoning, Australia 2009–10. Injury research and statistics series no. 69. Canberra: AIHW; 2012 [Catalogue No.: NJCAT 145].
21. Geulayov G, Kapur N, Turnbull P, Clements C, Waters K, Ness J, et al. Epidemiology and trends in non-fatal self-harm in three centres in England, 2002-2012: findings from the multicentre study of self-harm in England. BMJ Open. 2016;6(4).
22. Shepard DS, Gurewich D, Lwin AK, Reed GA, Silverman MM. Suicide and suicidal attempts in the United States: costs and policy implications. Suicide and Life-Threat Behav. 2016;46(3): 352-362.
23. Parachute. The Cost of Injury in Canada. Parachute: Toronto (ON): 2015.
24. Anderson RN, Miniño AM, Hoyert DL, Rosenberg HM. Comparability of cause of death between ICD-9 and ICD-10: preliminary estimates. Natl Vital Stat Rep. 2001;49:1-32.
25. Geran L, Tully P, Wood P, et al. Comparability of ICD-10 and ICD-9 for mortality statistics in Canada. Ottawa (ON): Statistics Canada; 2005 [cited 2011 Oct 31]. Available from: http://www.statcan.gc.ca/pub/84-548-x/2005001/4078904-eng.htm

26. Alberta Health. Performance measure definition. Potential years of life lost (PYLL) [Internet]. Government of Alberta [modified 2014 Feb 19; cited 2015 Jul 23]. Available from: http://www.health.alberta.ca/documents/PMD-Potential-Years-Life-Lost.pdf

27. Statistics Canada. Table 102-0311. Potential years of life lost, by selected causes of death and sex, population aged 0 to 74, three-year average, Canada, provinces, territories, health regions and peer groups, occasional, CANSIM (database) [Internet]. Ottawa (ON): Statistics Canada [modified 2005 Jan 31; cited 2015 Jul 23]. Available from: http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=1020311

28. Rhodes AE, Boyle MH, Bridge JA, Sinyor M, Links PS, Tonmyr L, et al. Antecedents and sex/gender differences in youth suicidal behaviour. World J Psychiatr. 2014;4(4):120-132.

29. Conner KR, Goldston DB. Rates of suicide among males increase steadily from age 11 to 21: developmental framework and outline for prevention. Aggress Violent Behav. 2007;12:193-207. doi:10.1016/j.avb.2006.07.002.

30. Beautrais AL. Risk factors for suicide and attempted suicide among young people. Aust N Z J Psychiatry. 2000;34:420-436. doi: 10.1046/j.1440-1614.2000.00691.x.

31. Brent DA, Baugher M, Bridge J, Chen T, Chiapaetta L. Age- and sex-related risk factors for adolescent suicide. J Am Acad Child Psychiatry. 1999;38(12):1497-1505.

32. Bridge JA, Goldstein TR, Brent DA. Adolescent Suicide and Suicidal Behavior. J Child Psychol Psychiatry. 2006;47(3-4):372-3394.

33. Heisel MJ. Suicide and its prevention among older adults. Can J Psychiatry. 2006;51:143-154.

34. Chan J, Draper B, Banerjee S. Deliberate self-harm in older adults: a review of the literature of 1995 to 2004. Int J Geriatr Psychiatry. 2007;22(8):720-732.

35. Choi GN, DiNitto MD, Marti NC, Choi. Nonsuicidal self-injury and suicide attempts among ED patients older than 50 years: comparison of risk factors and ED visit outcomes. Am J Emerg Med. 2016 Jun;34(6):1016-1021.

36. Public Health Agency of Canada. Analysis of data from the 2012 Canadian Community Health Survey–Mental Health Share file (CCHS–MH). Ottawa (ON): PHAC; 2016 Sept.

37. CDC. National estimates of nonfatal injuries treated in hospital emergency departments: United States 2000. MMWR. 2001;50:340-346.

38. Skinner R, McFaull S. Suicide among children and adolescents in Canada: trends and sex differences, 1980-2008. CMAJ. 2012;184(9):1029-1034.

39. Tollefsen IM, Hem E, Ekeberg O. The reliability of suicide statistics: a systematic review. BMC Psychiatry. 2012;12(9):9-19.

40. Holding TA, Barraclough BM. Undetermined deaths-suicide or accident? Br J Psychiatry. 1978;133:542-549.

41. Shepherd G, Klein-Schwarts W. Accidental and suicidal adolescent poisoning deaths in the United States, 1979-1994. Arch Pediatr Adolesc Med. 1998;152:1181-1185.

42. Ohberg A, Lonnqvist J. Suicides hidden among undetermined deaths. Acta Psychiatr Scand. 1998 Sep;98(3):214-8.

43. Donaldson AE, Larsen GY, Fullerton-Gleason L, Olson LM. Classifying undetermined poisoning deaths. Inj Prev. 2006;12:338-343.

44. Langlois S, Morrison P. Suicide deaths and suicide attempts. Health Rep. 2002;13(2):9-22.

45. Canadian Institute for Health Information (CIHI). Health Indicators 2011 [Internet]. Ottawa (ON): CIHI; 2011. Available from: https://secure.cihi.ca/free_products/health_indicators_2011_en.pdf

Is child sexual abuse declining in Canada? Results from nationally representative retrospective surveys

M. Shields; L. Tonmyr, PhD; W. Hovdestad, PhD

This article has been peer reviewed.

Tweet this article

Abstract

Introduction: Numerous data sources suggest a decline in child sexual abuse (CSA) in the United States since the early 1990s. Some evidence also indicates that an earlier period of higher CSA incidence began following World War II. This study examines prevalence estimates of sexual abuse reported retrospectively as having occurred in childhood (ChSA) in two nationally representative surveys of the Canadian population.

Methods: Data are from 13 931 respondents aged 18 to 76 years from the 2004/2005 Canadian Gender, Alcohol, and Culture: An International Study (GENACIS), and from 22 169 household residents aged 18 years or older who participated in the 2012 Canadian Community Health Survey–Mental Health (CCHS-MH). We present inter- and intrasurvey comparisons of ChSA prevalence specific to sex and age groups.

Results: Findings from both surveys suggest a decline in CSA since 1993, consistent with declines observed in the United States. Results also suggest that 1946 to 1992 was a period of higher risk of CSA, relative to the period before 1946. The evidence was more robust for women.

Conclusion: Evidence of a decline in CSA in Canada since the early 1990s is encouraging, given the long-term debilitating effects with which it is associated. Continued monitoring is critical. The long-term negative effects associated with CSA underscore the importance of continuing to move from lower risk to zero risk.

Keywords: *child abuse, child maltreatment, childhood sexual abuse, prevalence, childhood person year, change over time, cohort*

Highlights

- Data from two nationally representative surveys of the Canadian population suggest a decline in child sexual abuse (CSA) since 1993, consistent with declines observed in the United States.
- Results also suggest that 1946 to 1992 was a period of higher risk of CSA, relative to the period before 1946.
- Evidence was more robust for women than men.
- Although retrospective, population-based, methodologically consistent surveys can provide evidence of trends in CSA, a more comprehensive picture could be gleaned from contemporaneous information collected in surveys of children.
- The long-term negative effects associated with CSA highlight the importance of continuing to progress to the elimination of CSA; ongoing surveillance is required and complacency is not an option.

Introduction

The impact of child sexual abuse (CSA)—associated with impairment throughout the lifespan—is unequivocal.[1,2] Less clear are the magnitude of this problem and how the prevalence may have changed over time. Much of the information available about the incidence of CSA comes from data collected by child protection professionals. In the United States, data from child welfare agencies and professionals serving children in schools, hospitals and daycares reflect rising rates of CSA incidence from the mid-1970s to the early 1990s.[3-5] It has been suggested that the increases observed over the 1970s and 1980s in data compiled by agencies reflected increased public awareness and changes in identifying and reporting CSA, rather than a true rise in incidence.[3] Data from the United States' National Child Abuse and Neglect Data System indicate that over the years from 1992 to 2013, CSA declined by 64%, similar to the decline in forcible rape apparent in FBI statistics.[6] This decline is better supported by the evidence than the increase, as it does not stem from changes in administrative procedures.[7] The decline is also consistent with improvements in other areas of child well-being in the United States during this period, including decreases in teen pregnancy, teen suicide and the prevalence of child poverty.[8-10]

A major obstacle to studying trends in the true incidence of CSA using data from child welfare and law enforcement agencies is that estimates from these sources capture only the tip of the iceberg. Sexual abuse is often not reported to such agencies.[11,12] In the absence of direct surveys of children and adolescents, retrospective population surveys, in which adults and adolescents are asked about experiences that occurred during childhood, provide an alternative source of information for

Author reference:

Public Health Agency of Canada, Ottawa, Ontario, Canada

Correspondence: Lil Tonmyr, Public Health Agency of Canada, 785 Carling Avenue, AL 6807B, Ottawa, ON K1A 0K9; Tel: 613-240-6334; Fax: 613-960-0944; Email: Lil.Tonmyr@phac-aspc.gc.ca

deriving more accurate estimates of CSA.[3] In this paper we use the term "childhood sexual abuse" (ChSA) to refer to sexual abuse during childhood reported in such surveys.

Data from numerous American victimization surveys provide evidence of declining rates of sexual abuse of children since the early 1990s that parallel trends observed from child welfare agency data.[13] Other survey data suggest an increase following World War II.[3,14-16] Some researchers,[17,18] however, have concluded that legislation, social climate and differences in response rates and definitions of ChSA account for the apparent increase.

Two recent Canadian surveys representative of the general adult population included questions on ChSA: the 2012 Canadian Community Health Survey–Mental Health (CCHS-MH)[19] and the 2004/2005 Canadian Gender, Alcohol, and Culture: An International Study (GENACIS).[20,21] Our analysis compares prevalence estimates of ChSA (by age group) between and within these two surveys. We assessed the consistency of Canadian data with the declines in CSA reported by Finkelhor et al.,[6] and with reported increases post–World War II. More specifically, we examined Canadian survey data for any correspondence with the previous findings that ChSA prevalence was relatively lower before the end of World War II, relatively higher from after World War II to the early 1990s and then relatively lower after the early 1990s.

Methods

Data sources

We used data from the Canadian GENACIS to provide ChSA estimates for 2004/2005. The Canadian GENACIS is part of a large, international, multidisciplinary collaboration covering a range of topics related to gender, culture and alcohol-use problems. For the Canadian arm of GENACIS, a sample was selected using random-digit dialling to be representative of the Canadian household population aged 18 to 76 years living in the 10 provinces in 2004/2005.[20] Interviews were conducted by telephone using computer-assisted telephone interviewing. The survey excluded households without a residential phone line, persons who did not speak English or French and the institutionalized population.[21] The response rate was 52.8% (number of completions divided by estimated total number of eligible households),[20] with a responding sample of 14 063 (6009 men and 8054 women). This study excluded respondents who did not answer the ChSA questions (51 men and 81 women), reducing the sample size to 13 931 (5958 men and 7973 women).

We used data from the CCHS-MH to provide ChSA prevalence estimates for 2012. Statistics Canada conducted the CCHS-MH using a multistage, stratified, clustered sampling design.[19] The target population for the CCHS-MH was household residents aged 15 years or older living in the 10 Canadian provinces. Most of the interviews were conducted in person (87%). The survey excluded people living on reserves and other Aboriginal settlements; full-time members of the Canadian Forces; and the institutionalized population, together representing about 3% of the target population. The response rate was 68.9%,[19] yielding a sample of 25 113 individuals aged 15 years or older. CCHS-MH respondents were asked for permission to share their survey data with Statistics Canada's partners, including the Public Health Agency of Canada; most (n = 23 709; 94%) consented. This article is based on data from the "share" file. The ChSA questions were asked only of respondents aged 18 or older (n = 22 486). Respondents who refused to answer (159 men and 158 women) were excluded from the study, resulting in a sample of 22 169 (9910 men and 12 259 women).

Measures

GENACIS respondents were classified as having experienced ChSA if they answered "yes" to either of the following questions:

- "Before you were 16 years old, did anyone in YOUR FAMILY try to make you do sexual things or watch sexual things when you did NOT want to?"
- "Before you were 16 years old, did anyone OTHER THAN A FAMILY MEMBER try to make you do sexual things or watch sexual things when you did NOT want to?"

CCHS-MH respondents were asked about "things that happened to you before you were 16 in your school, in your neighbourhood, or in your family":

- "How many times did an adult force you or attempt to force you into any unwanted sexual activity, by threatening you, holding you down or hurting you in some way?"
- "How many times did an adult touch you against your will in any sexual way? By this, I mean anything from unwanted touching or grabbing, to kissing or fondling."

CCHS-MH respondents were classified as having experienced ChSA if they answered "one or more times" to either question.

Analyses

We used two methods to examine changes in ChSA prevalence over time. First, we compared prevalence estimates of ChSA for groups in the same age range in GENACIS and CCHS-MH. Second, we compared ChSA prevalence for different age groups within the same survey. Comparison of prevalence estimates by age groups within retrospective surveys of adults is commonly used to examine generational differences in the extent of CSA.[3,22] This approach reduces the possibility of methodological differences resulting in apparent differences in prevalence.

We proposed that prevalence would be relatively higher in people who spent their childhood (ages 0–15 years) during the period 1946 to 1992, and relatively lower in those who were aged 0 to 15 years during the period before the end of World War II (before 1946) or after the early 1990s (1993 and after). We used a modified version of the conventional person-years approach to create a "childhood person year" unit of analysis. Childhood person years (CPYs) are the individual units of time when the people in the study population were, by virtue of being aged 0 to 15 years, potentially exposed to CSA. We calculated the percentage of their childhood years that those in each age group spent in the higher- and lower-risk periods. Table 1 indicates the number and percentage of CPYs (i.e. at ages 0–15 years) that those in each age group (at the time of the survey) spent in the three time periods. Figure 1 is a graphical depiction of how we calculated the percentages of the CPYs for what we proposed to be the higher-risk period.

Table 1 illustrates the CPY calculations. Consider the age group 18 to 24 years,

TABLE 1
Number and percentage of childhood person years (ages 0–15) spent in risk periods for child sex abuse (1993 or after, from 1946–1992, and 1945 or before) among respondents to GENACIS and CCHS-MH, by age group at the time surveyed

Age group in years	Total CPYs[a] (ages 0–15)	GENACIS 2004							CCHS-MH 2012						
		Year of birth	Number and % of CPYs (ages 0–15) spent						Year of birth	Number and % of CPYs (ages 0–15) spent					
			1993 or after		1946–1992		1945 or before			1993 or after		1946–1992		1945 or before	
			#	%	#	%	#	%		#	%	#	%	#	%
18–24	112	1980–1986	42	38	70	63	0	0	1988–1994	97	87	15	13	0	0
25–34	160	1970–1979	3	2	157	98	0	0	1978–1987	55	34	105	66	0	0
35–49	240	1955–1969	0	0	240	100	0	0	1963–1977	0	0	240	100	0	0
50–64	240	1940–1954	0	0	219	91	21	9	1948–1962	0	0	240	100	0	0
65–76	192	1928–1939	0	0	45	23	147	77	1936–1947	0	0	137	71	55	29
77 or older[b]	368								1935 or earlier	0	0	15	4	353	96

Abbreviations: CPYs, childhood person years; GENACIS, Gender, Alcohol, and Culture: An International Study; CCHS-MH, Canadian Community Health Survey–Mental Health.

Note: 2004 is used as the year for GENACIS since the majority of respondents (93%) were interviewed in 2004.

[a] Total CPYs = (# of birth years in cohort) × 16.

[b] Assumes the age cohort extends to age 99.

shown in the first line of Table 1. These respondents had a total of 112 CPYs (the 16 years represented in the 0–15 years of childhood × the 7 possible ages included in the 18–24 age group, assuming that the 7 ages are equally represented). For GENACIS respondents in this age group, 70 CPYs were spent in the years 1946 to 1992, the higher-risk period. Those aged 18 years (born in 1986) spent 7 years (1986–1992); those aged 19, 8 years; those aged 20, 9 years; and so on until the final group, those aged 24, who spent 13 years in the higher-risk period; for a combined total of 70 childhood person years (7 + 8 + 9 + 10 + 11 + 12 + 13).

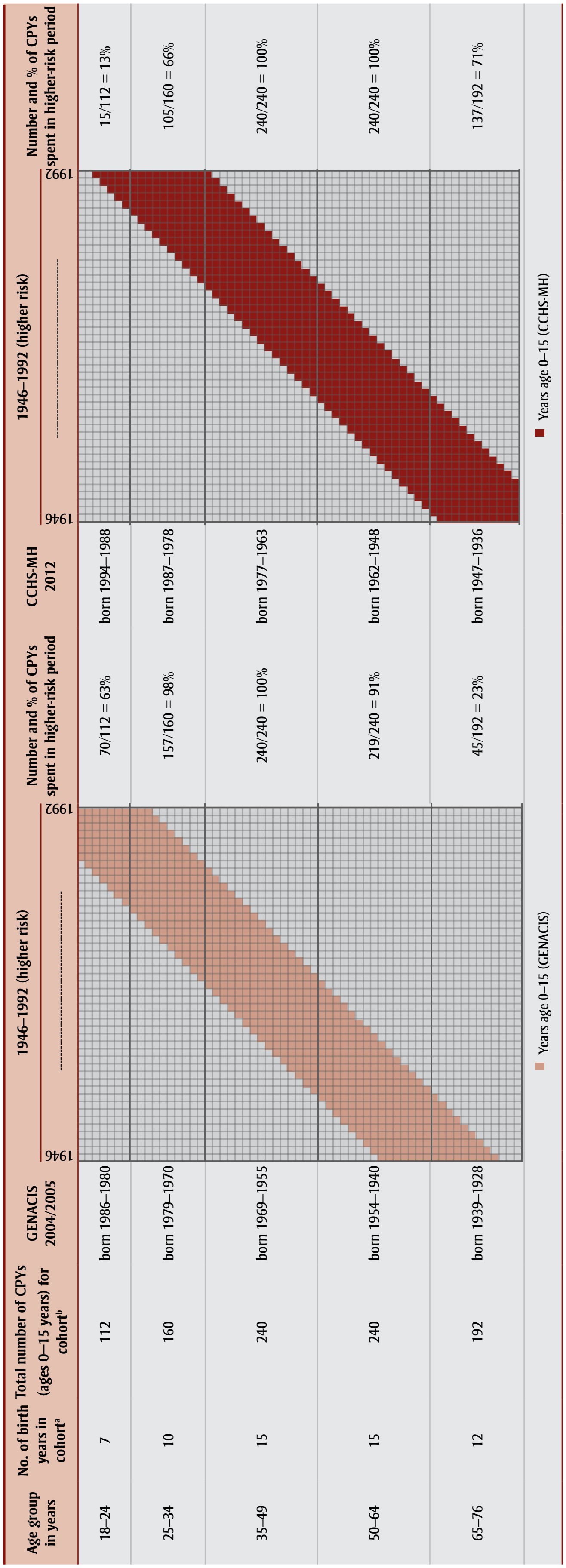
Therefore, the members of the youngest GENACIS age group spent 70 out of their 112 CPYs (63%) in the time period we hypothesized to be higher-risk and the remainder (38%) in the time period (1993 or after) we hypothesized to be lower-risk. In Figure 1, each shaded box represents a CPY spent in the higher-risk period. For GENACIS respondents aged 18 to 24, there are a total of 70 shaded boxes (higher-risk) out of a total of 112 CPYs. The remaining 42 boxes that would fall to the right in the lower-risk period (1993 or after) are not shown in the figure. Those aged 35 to 49 years spent *all* 240 of their CPYs in the higher-risk period from 1946 to 1992 and respondents aged 25 to 34 and 50 to 64 years spent nearly all of their CPYs in this period (98% and 91%, respectively). Members of the oldest GENACIS age group (65–76 years) lived the majority of their CPYs before the end of World War II (147/192 = 77%), a period we hypothesized to be lower-risk. Note that in Figure 1, only 45 shaded boxes appear in the higher-risk period for this age group; the remaining 147 CPYs for this group would fall to the left in the lower-risk period before 1946. These CPYs were included in the analyses (in the lower-risk period) but are not shown in the figure.

Because CCHS-MH respondents were surveyed eight years later than GENACIS respondents, people who were then in the age groups used to classify GENACIS respondents would have spent different proportions of their childhood years in times of higher or lower risk. The four intermediate CCHS-MH age groups (25–34, 35–49, 50–65, and 65–76 years) spent the majority of their CPYs in what we term the higher-risk period. Those aged 35 to 49 and 50 to 64 years spent *all* of their CPYs in this time period. Among those in the youngest (18–24 years) and oldest (77 years or older) age groups, the majority of CPYs were spent in what we have been calling the lower-risk periods (those in the youngest group spent 87% of their CPYs in the period 1993 or after, and those in the oldest group, 96% in the period before the end of World War II).

When comparing ChSA prevalence estimates between GENACIS and CCHS-MH, we assumed that the ChSA construct is the same in both surveys. Estimates may vary due to methodological differences between the surveys and/or changes over time in participants' willingness to disclose ChSA. To assess the potential for differences in methodology affecting the estimates, we compared estimates by matching cohorts with the same year-of-birth groupings in the two surveys. Since there was an eight-year time lag between the two surveys, we would expect, for example, that prevalence of ChSA would be statistically similar between GENACIS respondents aged 18 to 24 and CCHS-MH respondents aged 26 to 32 (all born from 1980–1986), barring differences due to these other factors.

We conducted our analyses using SAS Enterprise Guide 5.1 (SAS Institute Inc; Cary, North Carolina, USA). All estimates are based on weighted data. Tests for significant differences between estimates from GENACIS and CCHS-MH were based on pooled *t* tests. For CCHS-MH estimates, variance and 95% confidence intervals (CIs) were calculated using the bootstrap technique to account for the complex survey design of the CCHS–MH.[19] For GENACIS estimates, variance and 95% CIs were calculated assuming simple random sampling.

FIGURE 1
Number and percentage of childhood person years (ages 0–15 years) lived during higher-risk period for child sexual abuse (1946–1992) among respondents to GENACIS and CCHS-MH, by age cohort



Age group in years	No. of birth years in cohort[a]	Total number of CPYs (ages 0–15 years) for cohort[b]	GENACIS 2004/2005	Number and % of CPYs spent in higher-risk period	CCHS-MH 2012	Number and % of CPYs spent in higher-risk period
18–24	7	112	born 1986–1980	70/112 = 63%	born 1994–1988	15/112 = 13%
25–34	10	160	born 1979–1970	157/160 = 98%	born 1987–1978	105/160 = 66%
35–49	15	240	born 1969–1955	240/240 = 100%	born 1977–1963	240/240 = 100%
50–64	15	240	born 1954–1940	219/240 = 91%	born 1962–1948	240/240 = 100%
65–76	12	192	born 1939–1928	45/192 = 23%	born 1947–1936	137/192 = 71%

Abbreviations: CCHS-MH, Canadian Community Health Survey–Mental Health; CPYs, childhood person years; GENACIS, Gender, Alcohol, and Culture: An International Study.

Note: Each shaded box in the figure represents a childhood person year.

[a] The number of birth years for each cohort is the number of distinct years of age within the age range, e.g. for age group 18–24 there are 7 distinct years of birth, one corresponding to each distinct age within the range (18, 19, 20, 21, 22, 23, and 24).

[b] Total CPYs = (# of birth years in cohort) × 16.

Results

ChSA prevalence estimates from GENACIS and CCHS-MH were similar for the population aged 18 to 76 years; i.e. 9.8% based on 2004/2005 GENACIS data, and 10.5% based on 2012 CCHS-MH data (Table 2). However, differences by sex and age group emerged between the two time periods.

Among women in the youngest age group (18–24 years), prevalence declined from 10.0% in 2004/2005 to 6.4% in 2012. Among women aged 25 to 34 years, prevalence was 15.0% in 2004/2005 and 12.1% in 2012, but the decline only approached statistical significance ($p = .08$). Women in these two age groups at the time of the CCHS-MH would have spent a greater percentage of their childhood years in the period 1993 or after (lower-risk), compared with women in these age groups at the time of GENACIS.

Conversely, among women in the two oldest groups, prevalence increased between the two time periods; from 14.2% to 19.8% among those aged 50 to 64 years, and from 6.2% to 13.2% among those aged 65 to 76. Women in these age groups at the time of the CCHS-MH spent a greater percentage of childhood in the years 1946 to 1992 (higher-risk) compared with women in these age groups at the time of GENACIS.

Among women, a U-shaped association was observed between age and ChSA. In 2004/2005, prevalence of ChSA was highest for those aged 35 to 49 years (who spent *all* childhood years in the higher-risk period 1946–1992). In 2012, it was highest for those aged 35 to 49 and 50 to 64 years (who also spent *all* childhood years in this higher-risk period). In both time periods, the lowest prevalence estimates were observed for those in the youngest and oldest age groups. Women in the youngest group spent a greater proportion of childhood years in the period 1993 or after, while those in the oldest age group spent more childhood years in the period before the end of World War II (both periods of lower risk).

Among men, the only significant difference observed between the surveys was for those aged 65 to 76 years, for whom prevalence increased from 6.3% in 2004/2005 to 10.0% in 2012. Men aged 65 to 76 in 2012 spent 71% of their childhood

TABLE 2
Prevalence of childhood sexual abuse by sex and age group at time surveyed, household population aged 18 or older, Canada, 2004/2005 and 2012

	2004/2005 (GENACIS)				2012 (CCHS-MH)				2012 vs. 2004/2005
	Year of birth	%	(95% CI)		Year of birth	%	(95% CI)		
Total (ages 18–76)	1928–1986	9.8	(9.2–10.3)		1936–1994	10.5	(9.9–11.2)		
Sex (ages 18–76)									
Male (ref)	1928–1986	5.4	(4.8–6.0)		1936–1994	5.9	(5.2–6.7)		
Female	1928–1986	14.0	(13.2–14.9)	[a]	1936–1994	15.0	(14.0–16.1)	[a]	
Age group (in years)									
18–24	1980–1986	6.0	(4.6–7.4)	[a]	1988–1994	4.3	(3.3–5.4)	[a]	
25–34	1970–1979	9.5	(8.3–10.8)	[a]	1978–1987	7.6	(6.2–9.1)	[a]	
35–49 (ref)	1955–1969	12.0	(11.0–13.0)		1963–1977	11.5	(10.1–12.9)		
50–64	1940–1954	10.4	(9.3–11.4)	[a]	1948–1962	13.5	(12.1–14.8)	[a]	[b]
65–76	1928–1939	6.2	(4.9–7.6)	[a]	1936–1947	11.7	(10.1–13.3)		[b]
77 or older					1935 or earlier	6.2	(4.8–7.7)	[a]	
Males age group (in years)									
18–24	1980–1986	2.2	(1.0–3.5)	[a]	1988–1994	2.3	(1.1–3.4)	[a]	
25–34	1970–1979	4.3	(2.9–5.6)	[a]	1978–1987	3.4	(2.1–4.7)	[a]	
35–49 (ref)	1955–1969	6.4	(5.2–7.5)		1963–1977	6.0	(4.5–7.5)		
50–64	1940–1954	6.4	(5.1–7.8)		1948–1962	7.3	(5.6–9.0)		
65–76	1928–1939	6.3	(4.2–8.4)		1936–1947	10.0	(7.5–12.6)	[a]	[b]
77 or older					1935 or earlier	4.7	(2.7–6.7)		
Females age group (in years)									
18–24	1980–1986	10.0	(7.6–12.5)	[a]	1988–1994	6.4	(4.8–8.1)	[a]	[b]
25–34	1970–1979	15.0	(12.9–17.0)		1978–1987	12.1	(9.6–14.6)	[a]	
35–49 (ref)	1955–1969	17.6	(16.0–19.1)		1963–1977	16.6	(14.2–18.9)		
50–64	1940–1954	14.2	(12.6–15.8)	[a]	1948–1962	19.8	(17.7–22.0)		[b]
65–76	1928–1939	6.2	(4.5–7.9)	[a]	1936–1947	13.2	(11.2–15.2)	[a]	[b]
77 or older					1935 or earlier	7.4	(5.2–9.5)	[a]	

Sources: GENACIS Canadian Survey 2004/2005; Statistics Canada, CCHS-MH, 2012 (share file).

Abbreviations: CCHS-MH, Canadian Community Health Survey–Mental Health; CI, confidence interval; GENACIS, Gender, Alcohol, and Culture: An International Study; ref, reference group.

Note: The GENACIS estimates include 239 records with a missing value for age (excluded from estimates by age group).

[a] Significantly different from reference.

[b] Significantly different from 2004/2005.

years in the higher-risk period from 1946 to 1992, compared with 23% for men in this age group at the time of GENACIS.

Among men, the prevalence of ChSA in 2012 was highest (10.0%) among those aged 65 to 76 years and was lower for the two youngest age groups, who spent more of their childhood years in the lower-risk period of 1993 or after.

Comparisons based on matched year-of-birth cohorts between the two surveys (Table 3) revealed statistically similar estimates for most of the matched year-of-birth groupings (which would be expected, barring methodological differences between the two surveys). However, significant differences were observed for men born from 1940 to 1954 and women born 1940 to 1954 and 1928 to 1939: prevalence was higher among CCHS-MH respondents.

Discussion

This study of ChSA prevalence estimates from two large, representative surveys of the Canadian adult population supports our hypothesis that 1993 and after was a period of lower risk for CSA, 1946 to 1992 was a period of higher risk, and the time before 1946 was a period of lower risk. The evidence was substantial for women. The lower prevalence estimates for younger

TABLE 3
Prevalence of childhood sexual abuse by sex and matched date-of-birth cohorts, household population aged 18 to 76 years, Canada, 2004/2005 and 2012

Year of birth cohort	2004/2005 (GENACIS)			2012 (CCHS-MH)			2012 vs. 2004/2005
	Age group at time of GENACIS	% reporting ChSA	(95% CI)	Age group at time of CCHS	% reporting ChSA	(95% CI)	
	Males age group (in years)			**Males age group (in years)**			
1980–1986	18–24	2.2	(1.0–3.5)	26–32	2.5	(1.1–3.8)	
1970–1979	25–34	4.3	(2.9–5.6)	33–42	5.5	(3.8–7.1)	
1955–1969	35–49	6.4	(5.2–7.5)	43–57	6.9	(5.3–8.5)	
1940–1954	50–64	6.4	(5.1–7.8)	58–72	9.1	(7.0–11.1)	[a]
1928–1939	65–76	6.3	(4.2–8.4)	73–84	5.1	(3.4–6.9)	
	Females age group (in years)			**Females age group (in years)**			
1980–1986	18–24	10.0	(7.6–12.5)	26–32	11.3	(8.9–13.6)	
1970–1979	25–34	15.0	(12.9–17.0)	33–42	16.1	(13.0–19.2)	
1955–1969	35–49	17.6	(16.0–19.1)	43–57	18.5	(16.1–20.9)	
1940–1954	50–64	14.2	(12.6–15.8)	58–72	17.3	(15.4–19.1)	[a]
1928–1939	65–76	6.2	(4.5–7.9)	73–84	10.0	(7.5–12.4)	[a]

Sources: GENACIS, Canadian Survey 2004/2005; Statistics Canada, CCHS-MH, 2012 (share file).

Abbreviations: CCHS-MH, Canadian Community Health Survey—Mental Health; ChSA, childhood sexual abuse; CI, confidence interval; GENACIS, Gender, Alcohol, and Culture: An International Study.

[a] Significantly different from 2004/2005.

men in the CCHS-MH provide weak evidence of a possible slight decline since the early 1990s. However, further surveillance is required to substantiate a decline in CSA among Canadian males.

Evidence and reasons for the decline

Our findings regarding the decline (or lower risk) of CSA since the early 1990s are consistent with findings from Finkelhor et al., based on many American data sources,[6,13] and with findings from a study based on a nationally representative survey of Australians.[22] Studies of data collected from students also provide evidence of a decline during this time period. For example, in Aotearoa, New Zealand, reports of CSA declined between 2001 and 2007, with a greater decrease being reported for males.[23] In British Columbia, Canada, a decline was observed between 1992 and 2003.[24] Data from child welfare authorities captured in the Canadian Incidence Study of Reported Child Abuse and Neglect (CIS) also suggest that declines have occurred.[25,26] Although concerns have been raised about the national representativeness of estimates based on CIS weighted data,[27] estimates indicate a decline in the number of substantiated sexual abuse investigations per 1000 children aged 0 to 15, from 86 in 1998 to 43 in 2008.[25,26] Likewise, police-reported sexual offences in Canada peaked in 1993 and then declined throughout the late 1990s and into the 2000s.[12]

Finkelhor and Jones[9] reviewed numerous potential explanations for the decline in CSA observed in the United States and concluded that multiple factors likely contributed. They proposed that economic prosperity, increases in policing and other agents of social intervention such as social and child protection workers, and psychiatric pharmacotherapy were the most plausible explanations. They also suggested that the increasing availability of effective contraception in the years leading up to and during the period of the CSA declines resulted in fewer unplanned births, and a greater likelihood that children would be raised in environments with adequate social and economic resources to ensure their protection. Changing norms and practices may have also played a role; rising levels of education may have heightened awareness of CSA and the importance of providing safe environments for children.

Some of the explanations for CSA declines in the United States may not apply to the Canadian context. A study comparing reasons for the general drop in crime observed in the 1990s in Canada and the United States suggested somewhat different explanations for the two countries.[28] In Canada, in contrast to the United States, policing and incarceration rates changed little or not at all during the decline; rather, changes in demographics, employment rates and collective values were more likely explanations.[28] Canadian data sources support other possible explanations proposed by Finkelhor and Jones,[9] including declines in teen pregnancy,[29] increases in educational levels[30] and decreases in unemployment.[28] The use of antidepressants also increased in Canada from the early 1990s.[31] Parents with mental disorders who can obtain treatment may be better able to attend to and protect their children than parents who lack necessary treatment.[9]

Finally, CSA prevention programs within schools and campaigns to raise awareness of the issue may have had a positive effect.[32,33]

Evidence and reasons for increased risk

Evidence to substantiate an increase in CSA in the post–World War II period is less clear. The paucity of surveys conducted in these years and inconsistencies in methodologies of the surveys that were conducted reduce the usefulness of findings related to this time period. Methodological inconsistencies preclude direct comparisons of GENACIS and CCHS-MH with a 1983 Canadian survey.[34] However, results from this survey support our hypothesis of a higher risk of CSA in the post–World War II period. Although this survey provides limited information specific to age groups, one report states that prevalence of ChSA among those under 25 years was twice that in those aged 44 or older.[14] Those under 25 would have spent *all* of their childhood years in the period we term "higher-risk" (1946–1992) while those 44 or older would have spent the majority of their childhood years in the "lower-risk" period prior to 1946. Results from other surveys also suggest an increase of CSA during the post–World War II era.[3,15,16]

Changes in family structure post–World War II may have contributed to the increase.[14,35] Before World War II, divorce in Canada was close to non-existent. After World War II, divorce became more common, and rates peaked in the late 1980s after amendments were made to the *Divorce Act*.[35] Since the early 1990s, divorce rates have been fairly stable. Several studies of CSA that occurred during the 1970s and 1980s suggest that children living with a single parent or a stepparent had a greater risk of CSA than those living with two biological parents,[36-38] possibly accounting for the increase in CSA in the post–World War II era. However, the characteristics of step- and single-parent families of the 1990s and later may differ from these earlier families. The other factors cited previously likely account for the decline in CSA during the period of stable divorce rates (i.e. since the early 1990s).

Strengths and limitations

Our study uses a novel approach (that of "childhood person years") to illustrate evidence of trends in CSA in Canada using two large representative surveys of the Canadian population. The epidemiology of CSA is difficult to measure. The childhood-person-years approach may assist future work in providing evidence of CSA trends based on prevalence of ChSA among adults and adolescents from retrospective surveys.

Although the use of retrospective surveys to examine trends in CSA addresses some of the problems related to the underreporting of CSA inherent in agency data, survey data are subject to some limitations. While false positive reports of ChSA in retrospective surveys are rare,[39] the rate of false negatives is substantial—ranging from 40% to 50%.[40-42] There is evidence that underreporting is more common among males.[42,43] Although the specific items used to measure ChSA in the CCHS-MH and GENACIS have not been validated, similar items were used in the Canadian General Social Survey[12] and the items are behaviour-specific and thus likely to have higher validity and reliability than broad and subjectively defined questions.[39] Finally, both surveys exclude people residing in institutions and those without fixed addresses, populations in which CSA would likely be more prevalent.

Discrepancies in estimates from different survey sources may arise from methodological inconsistencies rather than true differences in prevalence. The items used to measure ChSA differed between GENACIS and the CCHS-MH, as did response rates and modes of administration. As well, CCHS-MH respondents were asked four items about other forms of childhood maltreatment before the two ChSA items; GENACIS respondents experienced no such priming. Despite these differences, comparisons by matched year-of-birth cohorts showed similar prevalence estimates for the three youngest age cohorts, suggesting that the two surveys were measuring a similar construct. However, the extent to which response rates, particularly the low response rate to GENACIS, affect prevalence estimates of ChSA is unknown.

While comparing prevalence by age group within surveys avoids some of the shortcomings associated with methodological inconsistencies between surveys, some limitations remain. The likelihood of reporting varies by age, in that people may not disclose their CSA experiences until many years have passed.[43] However, lower prevalence among older respondents may result partly from premature mortality among people who have experienced CSA.[44,45] As the length of time since the CSA occurred increases, so too will downward biases on prevalence estimates due to premature mortality; people who have died cannot be in the sample and report their ChSA. Therefore, evidence of an increase between the pre– and post–World War II periods is likely to be erroneously exaggerated, and evidence of a decline since 1993 may be somewhat understated.

Secular trends may also affect the likelihood of acknowledging ChSA. Comparisons of matched year-of-birth cohorts revealed higher prevalence in the CCHS-MH than in GENACIS for women born 1928 to 1954 and men born 1940 to 1954. These findings suggest an increased likelihood for these groups to disclose ChSA, perhaps as an effect of media coverage of high-profile cases[46] or other media attention to the issue of sexual violence. Note that frequent or intense media attention may also result in the public perception that CSA is increasing, independent of actual trends in its incidence. Although the likelihood of disclosing may increase with age, in general, the lower prevalence among older respondents may relate to a persistent reluctance to disclose among these individuals who were born in an era when having been sexually victimized may have been more stigmatizing.

Given these limitations, the novelty of our CPY method and the paucity of similar prior analyses using Canadian data, we encourage replication of our study in Canada and elsewhere to provide additional evidence for a real decline in CSA.

Conclusion

Evidence for a decline in CSA in Canada since the early 1990s, consistent with a decline in the United States during the same timeframe, is an encouraging finding. However, in 2012, among those aged 18 to 24, 6% of women and 2% of men reported ChSA—figures that most likely understate the true magnitude of occurrence. Continued monitoring of the prevalence of ChSA is critical. Retrospective population-based surveys, using items with sound psychometric properties and consistent methodologies are effective means of providing evidence of trends in CSA. A more complete picture, however, could be gleaned from contemporaneous data sources such as information collected in surveys of students. High quality data are essential for evaluating intervention programs aimed at eradicating sexual abuse of Canadian children. The long-term negative effects associated with CSA underscore the importance of continuing to move from lower risk to zero risk; complacency is not an option.

Acknowledgements

Data collected as part of the international project Gender, Alcohol and Culture: An International Study (GENACIS), were provided by the Institute for Social Research (ISR), York University. The survey was completed on behalf of the Centre for Addiction and Mental Health (CAMH). Funding for the Canadian arm of GENACIS was provided through an operations grant from the Canadian Institutes of Health Research (CIHR). Neither CAMH, ISR nor CIHR are responsible for the analyses and interpretations presented here.

The authors gratefully acknowledge Kathryn Wilkins' assistance with developing the clearest possible expression of the complex constructs used in these analyses.

References

1. Gilbert R, Widom CS, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. Lancet. 2009;373(9657):68-81. doi: 10.1016/S0140-6736(08)61706-7.
2. Maniglio R. The impact of child sexual abuse on health: a systematic review of reviews. Clin Psychol Rev. 2009;29(7):647-57. doi: 10.1016/j.cpr.2009.08.003.
3. Finkelhor D. Current information on the scope and nature of child sexual abuse. Future Child. 1994;4(2):31-53. doi: 10.2307/1602522.
4. Lindsey D. Mandated reporting and child abuse fatalities: requirements for a system to protect children. Soc Work Res. 1994;18(1):41-54.
5. Sedlack AJ, Broadhurst DD. Third National Incidence Study of Child Abuse and Neglect. Washington (DC): U.S. Department of Health and Human Services; 1996.
6. Finkelhor D, Saito K, Jones L. Updated trends in child maltreatment, 2013. Durham (NH): Crimes against Children Research Center; 2015.
7. Almeida J, Cohen AP, Subramanian SV, Molnar BE. Are increased worker caseloads in state child protective service agencies a potential explanation for the decline in child sexual abuse? A multilevel analysis. Child Abuse Negl. 2008;32(3):367-75. doi: 10.1016/j.chiabu.2007.08.003.
8. Finkelhor D, Jones LM. Explanations for the decline in child sexual abuse cases. Juvenile Justice Bulletin. Washington (DC): Office of Juvenile Justice and Delinquency Prevention; 2004.
9. Finkelhor D, Jones LM. Why have child maltreatment and child victimization declined? J Soc Issues. 2006; 62(4):685-716. doi: 10.1111/j.1540-4560.2006.00483.x.
10. Land KC, Lamb VL, Kahler Mustillo S. Child and youth well-being in the United States, 1975-1998: some findings from a new index. Soc Indic Res. 2001;56(3):241-320. doi: 10.1023/A:1012485315266.
11. Afifi TO, MacMillan HL, Taillieu T, et al. Relationship between child abuse exposure and reported contact with child protection organizations: results from the Canadian Community Health Survey. Child Abuse Negl. 2015;46: 198-206. doi: 10.1016/j.chiabu.2015.05.001.
12. Brennan S, Taylor-Butts A. Sexual assault in Canada 2004 and 2007. Canadian Centre for Justice Statistics Profile Series. Ottawa (ON): Statistics Canada; 2008. [Statistics Canada, Catalogue No.: 85F0033M].
13. Finkelhor D, Jones LM. Have sexual abuse and physical abuse declined since the 1990s? Durham (NH): Crimes against Children Research Center; 2012.
14. Bagley C. Child sexual abuse in Canada: further analysis of the 1983 national survey. Ottawa (ON): Health and Welfare Canada; 1988.
15. Leventhal JM. Have there been changes in the epidemiology of sexual abuse of children during the 20th century? Pediatrics. 1988;82(5): 766-73.
16. Wyatt GE, Loeb TB, Solis B, Carmona JV, Romero, G. The prevalence and circumstances of child sexual abuse: changes across a decade. Child Abuse Negl. 1999;23(1):45-60. doi: 10.1016/S0145-2134(98)00110-0.
17. Feldman W, Feldman E, Goodman JT, et al. Is childhood sexual abuse really increasing in prevalence? An analysis of the evidence. Pediatrics. 1991;88(1): 29-33. doi: 10.1016/s0890-8567(10)80016-4.
18. Gorey KM, Leslie DR. The prevalence of child sexual abuse: integrative review adjustment for potential response and measurement biases. Child Abuse Negl. 1997;21(4):391-8. doi: 10.1016/s0145-2134(96)00180-9.
19. Statistics Canada. Canadian Community Health Survey (CCHS) - Mental Health User Guide. Statistics Canada; 2013.
20. Graham K, Bernards S. Canada: alcohol and partner physical aggression in the 10 provinces. In: Graham K, Bernards S, Munné M, Wilsnack S, eds. Unhappy Hours: Alcohol and Physical Partner Aggression in the Americas. Washington (DC): Pan American Health Organization; 2008: 90-108.
21. Graham K, Massak A. Alcohol consumption and the use of antidepressants. CMAJ. 2007;176(5):633-7. doi: 10.1503/cmaj.060446.
22. Dunne MP, Purdie DM, Cook MD, Boyle FM, Najman JM. Is child sexual abuse declining? Evidence from a population-based survey of men and women in Australia. Child Abuse Negl. 2003;27(2):141-52. doi: 10.1016/s0145-2134(02)00539-2.
23. Denny SJ, Grant S, Utter J, et al. Health and well-being of young people who attend secondary school in Aotearoa, New Zealand: what has changed from 2001 to 2007? J Paediatr Child Health. 2011;47(4):191-7. doi: 10.1111/j.1440-1754.2010.01945.x.
24. Tonkin RS. British Columbia Youth Health Trends: A Retrospective, 1992-2003. Vancouver, BC: McCreary Centre Society; 2005.

25. Public Health Agency of Canada. Canadian Incidence Study of Reported Child Abuse and Neglect - 2008: major findings. Ottawa (ON): Public Health Agency of Canada; 2010.

26. Trocmé N, MacLaurin B, Fallon B, et al. Canadian Incidence Study of Reported Child Abuse and Neglect: Final Report. Ottawa (ON): Minister of Public Works and Government Services Canada; 2001.

27. Dumais J. Comparison and assessment of CIS 1998, 2003 and 2008 designs. Ottawa (ON): Statistics Canada; 2010. Unpublished report.

28. Ouimet M. Explaining the American and Canadian crime "drop" in the 1990s. Can J Criminol. 2002;44(1): 33-50.

29. McKay A. Trends in Canadian national and provincial/territorial teen pregnancy rates 2001-2010. Can J Hum Sex. 2013;21(3-4):161-75.

30. Statistics Canada, Council of Ministers of Education, Canada. Education indicators in Canada: an international perspective. Ottawa (ON); 2014. [Statistics Canada, Catalogue No.: 81-604-X].

31. Hemels ME, Koren G, Einarson TR. Increased use of antidepressants in Canada: 1981-2000. Ann Pharmacother. 2002;36(9):1375-9. doi: 10.1345/aph.1a331.

32. MacMillan HL, Wathen CN, Barlow J, Fergusson DM, Leventhal JM, Taussig HN. Interventions to prevent child maltreatment and associated impairment. Lancet. 2009;373(9659):250-66. doi: 10.1016/S0140-6736(08)61708-0.

33. Walsh K, Zwi K, Woolfenden S, Shlonsky A. School-based education programmes for the prevention of child sexual abuse. Cochrane Database Syst Rev. 2015;4:CD004380. doi: 10.1002/14651858.CD004380.pub3.

34. Badgley RF, Allard HA, McCormick N, et al. Sexual offenses against children. Ottawa (ON): Department of Supply and Services; 1984.

35. Milan A. Marital status: overview, 2011. Report on the demographic situation in Canada. Ottawa (ON): Statistics Canada; 2013 [Statistics Canada, Catalogue No.: 91-209-X].

36. Daly M, Wilson M. Child abuse and other risks of not living with both parents. Ethol Sociobiol. 1985;6(4): 197-210.

37. Fleming J, Mullen P, Bammer G. A study of potential risk factors for sexual abuse in childhood. Child Abuse Negl. 1997;21(1):49-58. doi: 10.1016/s0145-2134(96)00126-3.

38. Giles-Sims, J. Current knowledge about child abuse in stepfamilies. Marriage Fam Rev. 1997;26:215-230.

39. Hardt J, Rutter M. Validity of adult retrospective reports of adverse childhood experiences: review of the evidence. J Child Psychol Psychiatry. 2004;45(2):260-73. doi: 10.1111/j.1469-7610.2004.00218.x.

40. Fergusson DM, Horwood LJ, Woodward LJ. The stability of child abuse reports: a longitudinal study of the reporting behaviour of young adults. Psychol Med. 2000;30(3):529-44. doi: 10.1017/s0033291799002111.

41. Scott KM, Smith DR, Ellis PM. Prospectively ascertained child maltreatment and its association with DSM-IV mental disorders in young adults. Arch Gen Psychiatry. 2010;67(7): 712-9.

42. Widom CS, Morris S. Accuracy of adult recollections of childhood victimization: Part 2. Childhood sexual abuse. Psychol Assess. 1997;9(1):34-46. doi: 10.1037/1040-3590.9.1.34.

43. Hébert M, Tourigny M, Cyr M, McDuff P, Joly J. Prevalence of childhood sexual abuse and timing of disclosure in a representative sample of adults from Quebec. Can J Psychiatry. 2009;54(9):631-6. doi: 10.1177/070674370905400908.

44. Brown DW, Anda RF, Tiemeier H, et al. Adverse childhood experiences and the risk of premature mortality. Am J Prev Med. 2009;37(5):389-96. doi: 10.1016/j.amepre.2009.06.021.

45. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. Am J Prev Med. 1998; 14(4):245-58. doi: 10.1016/s0749-3797(98)00017-8.

46. Weatherred JL. Child sexual abuse and the media: a literature review. J Child Sex Abus. 2015;24(1):16-34. doi: 10.1080/10538712.2015.976302.

Status report

Public Health 2016: time for a cultural shift in the field of public health

E. R. M. Mallach, MSc (1); T. Ferrao, MSc (1); R. MacLean, MPH (1); S. F. L. Kirk, PhD (2)

Tweet this article

Public Health 2016, the Canadian Public Health Association's annual conference, was held from June 13 to 16, 2016, in Toronto, Canada, and showcased a wide variety of public health issues that fostered considerable discussion at the conference and on social media.[1,2] The four plenary sessions, while on seemingly disparate topics including technology, violence prevention, racism and harm reduction, all revealed the need for a cultural shift in the field of public health that acknowledges *and* addresses the broader inequities that influence the health and well-being of populations. They also highlighted some of the key challenges that society faces in achieving the UN Sustainable Development Goals released in 2015.[3]

The impact of the social determinants of health is widely acknowledged in the field of public health, yet much work remains to effectively address these social, economic and environmental factors through policy change and program intervention. Further, while the dominant public health discourse acknowledges the role of income, employment and education, it often skirts around broader social inequities such as racism and structural violence, thereby perpetuating the very same health disparities the field is trying to lessen.

The opening ceremony at *Public Health 2016* featured introductory remarks by Dr. Camara Jones, the president of the American Public Health Association, who spoke persuasively on the impact of racial disparities, privilege and power as they relate to health inequities. Dr. Jones used the powerful allegory of a two-sided sign displayed in a restaurant window shortly following closing: those within the restaurant enjoying their meal see the "Open" side, while hungry individuals passing by the restaurant see the "Closed" side. This allegory very effectively illustrates how social inequities such as racism create a dual reality whereby individuals on opposite sides of the "Open-Closed" sign receive differential access to opportunities, ultimately maintaining population health inequities.

Dr. David Buckeridge gave the opening plenary on technology and public health. He organized his presentation around three points: big data, going mobile and take-home thoughts. Dr. Buckeridge discussed the opportunity to harness technology and monitor health at a population level given the large amounts of available data. He used several examples to demonstrate the potential of mobile technology to promote health and underlined the advantages of technology, including its broad reach at a low cost, a reduced need for direct contact and its efficiency for communicating health information. The interventions Dr. Buckeridge discussed were focussed on individual behaviour change rather than the social determinants of health. Despite promising signs at the individual level, there is little evidence to suggest that technology can improve health equity at the population level. This represents an important gap in the literature, and an area worth exploring within public health.

The second plenary session was a panel on violence prevention, including an international, regional and Indigenous peoples' perspective. Given its high prevalence in Canada, the speakers made a clear and compelling case for the public health sector to address violence and its devastating consequences, which are clearly linked to the social determinants of health.

The speakers acknowledged that violence is a systemic problem that disproportionately affects certain subpopulations. Alessandra Guedes, Pan American Health Organization, stated that one in three women will experience partner violence or sexual violence by a non-partner in their lifetime.[4] Looking even deeper, Sylvia Maracle, Ontario Federation of Indigenous Friendship Centres, noted an Indigenous woman in Canada has a seven or eight in 10 chance of being a victim of some form of violence. Beyond the immediate impacts of these violent acts, including an increased likelihood of injury and death, women are more likely to endure mental as well as sexual and reproductive health consequences.

Given the pervasive problem of violence in society, action is needed to increase access to safe and supportive services for those individuals who have experienced violence, and to prevent interpersonal as well as structural violence altogether. As a very first step in addressing violence, the public health field needs to take a lead role in acknowledging violence as a public health issue necessitating immediate action. Etienne Krug, World Health Organization, noted that the public health community has important contributions to make, as violence is largely preventable through appropriate interventions. Further, by addressing issues such as early childhood development, alcohol misuse, drug abuse and ensuring appropriate legislation on firearms, the public health community can contribute to violence prevention in Canada. When violence does occur, appropriate services must be available to

---

Author references:

1. Canadian Public Health Association, Ottawa, Ontario, Canada
2. Healthy Populations Institute, Dalhousie University, Halifax, Nova Scotia, Canada

Correspondence: Emma R. M. Mallach, Canadian Public Health Association, 404-1525 Carling Ave., Ottawa, ON K1Z 8R9; Tel: 613-725-3769 ext. 160; Fax: 613-725-9826; Email: emallach@cpha.ca

those in need: the plenary speakers highlighted that although women who have experienced violence often use health services more frequently, they do not always disclose their experience of violence to their service provider. Increasing training of health and social service providers is a requisite to ensure that service providers are prepared to respond to individuals' needs in such a way that does not further contribute to trauma, an area where the public health field has shown considerable leadership.

The third plenary session focussed on health equity, social justice and the racialization of Canadian society. Building on many of the ideas presented during the violence prevention plenary, a diverse panel of experts discussed how racism is structurally embedded and propagated through Canadian practices, programs and policies. The speakers described racialization as a social construct whereby individuals receive differential opportunities based on their perceived membership in a racial community. Take the case of Canada's *Indian Act*, which was enshrined by the federal government in 1876 to govern relations with First Nations peoples but, in doing so, created the conditions to exert enduring control over First Nations populations and uphold inequities.[5] The panellists made a clear link between racism and health. Desmond Cole, a freelance journalist, described racism as a legitimate stressor with resultant health implications and related this to his experience of targeted violence based on the colour of his skin. Dr. Ingrid Waldron, Dalhousie University, highlighted that race shapes how individuals are diagnosed and treated, emphasizing the disproportionate number of black men diagnosed with schizophrenia as an example.

The panellists offered some suggestions for moving forward, including an indelible cultural shift within society that acknowledges and addresses racism as a social determinant of health. Doing so will provide an opportunity for public health to demonstrate leadership in Canada's much needed response to racism. Dr. David McKeown, Toronto Public Health, acknowledged that the privilege afforded to non-racialized groups in Canada and globally is often not evident to those who have it, but that the public health community has an important role to play in shedding light on the structures that uphold privilege and power for non-racialized groups. Dr. Waldron suggested that the public health community should collaborate with those outside of the health system in an effort to bring different views to the discussion. As stated by Dr. Charlotte Loppie, Centre for Indigenous Research and Community-Led Engagement at the University of Victoria, although there is still much progress to be made, we have come a long way from where we were just three to five years ago, when racism was not part of the dominant public health discourse in Canada.

Canada's Chief Public Health Officer, Dr. Gregory Taylor, delivered the final plenary on harm reduction, risk perception and alcohol. Harm reduction recognizes that while risks cannot be completely eliminated, negative outcomes associated with risky behaviours can be significantly reduced. Dr. Taylor acknowledged that public health is founded in a philosophy of harm reduction. While harm reduction has at times inappropriately been labelled as controversial, particularly with respect to substance use, there is no question it saves lives. There are important links between harm reduction and other areas of public health, including violence prevention, seatbelt laws, travel advice and physical activity guidelines. In 2012, there were over 3.3 million alcohol-related deaths worldwide,[6] confirming that public health has an important role to play in this area. Dr. Taylor went on to stress that if public health is to maintain its relevance and credibility, it needs to carefully consider how its messaging and outreach tactics affect risk perception and risk tolerance from a public perspective. Confusing, contradictory and paternalistic public health advice will erode public trust in the long term, cause the public to "tune-out" public health messaging and, ultimately, make it more difficult to achieve harm-reduction goals.

The plenaries at *Public Health 2016* revealed the need for a cultural shift in the field of public health that acknowledges the broader social inequities that underpin health, including racism and violence, and that addresses the practices, programs and policies embedded within Canadian society that uphold power and privilege and, in turn, promote health inequities. By acknowledging that racism and violence need to be addressed by the public health community, we are taking a clear position. We are recognizing that we are all part of a society that perpetuates health inequities, but we can also work towards lasting solutions. The discussions held at *Public Health 2016* were a steppingstone, but refined action is now needed. Public health must build bridges in an effort to increase collaboration with other sectors and ultimately contribute to health equity. Public health has a role to play in facilitating the change we so desperately need and seek and, 30 years after the release of the *Ottawa Charter for Health Promotion*, public health in Canada can lead the way.

Acknowledgements

We would like to thank Ian Culbert for reviewing the draft paper.

References

1. Canadian Public Health Association. Public Health 2016 – highlights [Internet]. Ottawa (ON): Canadian Public Health Association; 2016 [cited 2016 Jun 24]. Available from: https://storify.com/CPHA/public-health-2016-the-annual-conference-of-the-ca
2. Ndumbe-Eyoh S. Public Health 2016 plenary: health equity, social justice and the racialization of Canadian society [Internet]. Toronto (ON); 2016 [cited 2016 Jun 27]. Available from: https://storify.com/sumeeyoh/plenary
3. United Nations. Sustainable development goals [Internet]. New York (NY): United Nations; 2015 [cited 2016 Jul 25]. Available from: https://sustainabledevelopment.un.org/?menu=1300
4. World Health Organization. Violence against women: intimate partner and sexual violence against women. Fact sheet No. 239 [Internet]. Geneva, Switzerland: WHO; 2016 Jan [cited 2016 Jul 18]. Available from: http://www.who.int/mediacentre/factsheets/fs239/en/
5. Loppie S, Reading C, de Leeuw S. Aboriginal experiences with racism and its impacts [Internet]. Prince George (BC): National Collaborating Centre for Aboriginal Health; 2014 [cited 2016 Jul 18]. Available from: http://www.nccah-ccnsa.ca/Publications/Lists/Publications/Attachments/131/2014_07_09_FS_2426_RacismPart2_ExperiencesImpacts_EN_Web.pdf
6. World Health Organization. Global status report on alcohol and health – 2014 edition. Geneva, Switzerland: WHO Press; 2014.

CSEB Student Conference 2016 abstract contest winners

Preface

Health Promotion and Chronic Disease Prevention in Canada was pleased to manage, once again, the student abstract contest for the Canadian Society for Epidemiology and Biostatistics (CSEB) National Student Conference, which was held at the University of Manitoba in June 2016. An editorial panel from the Public Health Agency of Canada judged 17 abstract submissions and selected the top 7 to be published in this issue of the journal.

The editorial panel consisted of the following members:

- Robert Geneau, PhD, Editor-in-Chief
- Heather Orpana, PhD, Associate Scientific Editor
- Michelle Tracy, MA, Managing Editor

The selected abstracts were judged on their originality, clarity, scientific and technical excellence and potential impact.

Since 2009, our journal has collaborated with CSEB to foster publishing opportunities for students. We are proud to collaborate with CSEB again this year and to encourage students in their publishing efforts. On behalf of the journal's editorial team, I would like to thank all students who submitted their abstracts and to congratulate the winners. Having one's abstract published in a peer-reviewed journal is a good place to start in science publishing. We look forward to seeing future submissions of full research articles.

Michelle Tracy, MA
Managing Editor, *Health Promotion and Chronic Disease Prevention in Canada*

Music therapy for Alzheimer's patients

J. Asselstine, BSc (1); V. L. Kristman, PhD (1)

Introduction: Music therapy (MT) is an attractive, non-pharmacological treatment for many individuals suffering from dementia. It is well established that MT is responsible for many mood-boosting effects in Alzheimer's disease (AD) patients; however it is unclear whether these benefits extend to cognitive outcomes such as enhanced communicative abilities, improved retention and longer attention span. Prior studies focussed on the efficacy of MT for treatment of AD are limited by problematic and inconsistent methodologies, non-specific measurements of outcome and a failure to control for varying levels of dementia and type of MT between study participants. While experts in the field suggest that an active MT model (which involves the participants actively creating music with the music therapist) may be superior to that of a passive MT model (which involves the participants listening to an external source of music), evidence to support this hypothesis is limited.

Objective: The central purpose of this study is to assess MT treatments in a randomized fashion and compare any changes in cognitive functioning that occur between passive, active and no (control) MT groups. The methodology will be modified to make the study feasible at a master's level.

Methods: This study will utilize a three armed randomized control trial (RCT) design. Three long-term care facilities will be selected and randomized to a treatment type: active MT, passive MT, or a control. Participants within each home will be selected based on AD severity determined by the Global Deterioration Scale, as defined by the Alzheimer's Society of Canada. The MT sessions will be conducted by an accredited music therapist twice a week at each location, over a period of six weeks. Three cognitive outcome measures will be collected at each session. Measurements will include the mini-state mental examination (MMSE), the new Music in Dementia Assessment Scale (MiDAS) as proposed by McDermott et al. (2015), and the Alzheimer's disease Assessment Scale (ADAS), with the latter serving as a highly sensitive measurement for cognitive change over time. Following collection, data will be analyzed to explore relationships between treatment type and cognitive outcomes. Each of the three outcomes of interest will be analyzed using multivariate linear regression, with relevant confounding factors included in each model. A 10% change in the regression coefficient will indicate important confounding effects.

As research at the master's level is constricted by both funding and time, modifications to the proposed methodology are needed. For example, a graduate student rather than an accredited music therapist could conduct the MT sessions.

Results: Results are expected to be collected by August 2017.

Conclusion: The methodological framework utilized in this study will be of interest to other researchers involved with studying MT. Additionally, the results from this study may serve as a reference from which clinicians can make recommendations regarding MT to their patients.

Keywords: music therapy, Alzheimer's, dementia

Author reference:

1. Department of Health Sciences, Lakehead University, Thunder Bay, Ontario, Canada

Correspondence: Jennifer Asselstine; Email: jasselst@lakeheadu.ca

The association between work-related exposures and occupational injuries in the aging United States workforce

N. K. Baidwan, MPH (2); S. Gerberich, PhD (2); H. Kim, ScD (2); A. Ryan, MS (2)

Introduction: United States workers aged 55 years and older experience a fatal occupational injury rate that is four times higher than their younger counterparts. Although the rate of nonfatal injuries among older workers is lower than that among younger workers, the subsequent consequences are more severe. Limited research has identified exposures that may be associated with occupational injuries among aging workers.

Objectives: Using a longitudinal study design, we aimed to identify specific work-related exposures associated with occupational injuries in the aging workforce and thus inform injury-prevention strategies.

Methods: Data were obtained from the Health and Retirement Study (HRS), a nationally representative, biennial survey of adults aged 50 years and older and their spouses (regardless of age) in the United States. Of the 20 129 people who responded to the HRS in 2004, we selected a study cohort of 7212 respondents who were aged 50 years and above and were working for pay in the year 2004. This cohort was followed until 2012. We used generalized estimating equations (GEE) with negative binomial-type 2 distribution and Cox regression models to examine relations between work-related exposures (specifically, work-requirements for physical effort, lifting heavy loads, stooping/kneeling/crouching that were measured on a Likert scale) and occupational injuries, while controlling for potential confounders, which were identified based on directed acyclic graphs.

Results: Over the study period, 3.6 occupational injury events per 100 full-time-equivalent workers (FTEs) occurred. The rate of injury events per 100 FTEs was highest among those in the age group 50 to 60 years (4.2) and lowest for those 70 years and older (2.9). Additional univariate models identified high rates of injury among Hispanics, those with low education levels and those employed in occupations like farming/forestry/fishing, construction/extraction and protection services. Multivariable GEE and Cox regression models identified that (controlling for age, gender, race, job type, previous history of occupational injury and job tenure) the risk of experiencing occupational injuries increases significantly with requirements for increasing physical effort, lifting heavy loads, and stooping/kneeling/crouching. The risk of occupational injury nearly tripled for workers whose jobs had these work-requirements all/almost all of the time as compared to those who had them none/almost none of the time.

Conclusion: Priority injury-prevention interventions should target aging workers who are employed in occupations involving these higher work-requirements.

Keywords: injury, occupational health, epidemiology, risk factors

---

Author reference:

2. Division of Environmental Health Sciences, School of Public Health, University of Minnesota, Minneapolis, MN, US

Correspondence: Navneet Kaur Baidwan; Email: baidw002@umn.edu

Chronic pain and self-rated health among middle-aged and older Canadians: an analysis of the Canadian Community Health Survey–Healthy Aging

B. Chireh, MPH (3); C. Waldner, DVM (3,4); C. D'Arcy, PhD (3,5)

Introduction: Chronic pain is an important health problem adversely affecting functionality and quality of life. Though self-rated health (SRH) is a major predictor of mortality, its relationship with pain is not well understood. Early detection and treatment of pain can enhance well-being and SRH in seniors.

Objective: In this analysis, we explore 1) how pain and age interact to influence SRH; and 2) provincial variations in SRH across Canada.

Methods: We analyzed cross-sectional data from Statistics Canada's Canadian Community Health Survey–Healthy Aging (n = 30 685), which targeted those 45 years and older and was conducted from 2008-12-01 to 2009-11-30. The response rate was 74.4%. The topics covered included sociodemographics, well-being and chronic diseases. We performed bivariate analyses between each predictor and SRH; unadjusted odds ratios and 95% confidence intervals are reported. In the second phase of analysis, multivariate model building was used to examine the interaction between predictor variables. We used a two-level logistic regression mixed model consisting of provincial differences (first level) and individual differences (second level). An interclass correlation coefficient was computed to determine the degree of variability regarding seniors' SRH at the provincial level. All statistical analyses were completed in Stata 13 (StataCorp LP, College Station, TX, US) at a 5% level of significance.

Results: Slightly more than half of respondents (52.3%) were female. In the bivariate analysis, those experiencing daily chronic pain were 4.34 times more likely to rate their health as poor ($p < .001$). In the multivariate analysis, being female was protective ($p < .001$). Those who reported being depressed, lonely, less educated and/or having a lower income were more likely to rate their health as poor ($p < .001$). Respondents in Atlantic Canada were more likely to report poorer health. Analgesic users were also 1.56 times more likely to report poorer health ($p < .001$). The association between pain and SRH was stronger among younger age groups (45–54 years) compared to older age groups (≥ 85 years, with an odds ratio of 4.33 [$p < .001$] versus 2.47 [$p < .001$]).

Conclusion: Chronic pain, among other determinants, is associated with SRH. Individuals in rating their health may consider a variety of factors, some of which may not be apparent to health providers. We found the influence of pain on SRH was more pronounced among males and those who reported being depressed, lonely, less educated, and/or having a lower income. Also significant was the impact of pain on SRH among middle-aged Canadians in comparison to other age groups. A traditional east to west gradient in SRH in Canada was also observed in this study.

Keywords: aging, pain, self-rated health, epidemiology

Author references:

3. School of Public Health, University of Saskatchewan, Saskatoon, Saskatchewan, Canada
4. Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada
5. Department of Psychiatry, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

Correspondence: Batholomew Chireh; Email: bac563@mail.usask.ca

The effect of the Roots of Empathy program on the use of psychotropic medications among youth in Manitoba

L. Dahl, MSc (6); M. Chartier, PhD (6,7); R. Fransoo, PhD (6,7); B. Tefft, PhD (8)

Introduction: The Roots of Empathy (ROE) program was piloted in Manitoba schools during 2001 and has been implemented every year since to interested public, band-operated and private school divisions and communities. The aim of the program is to strengthen essential social skills through empathy development in children from kindergarten to Grade 8. Research has demonstrated the program's ability to effectively achieve these objectives; however, more distal and unintended outcomes of the program have not been studied. The program may improve mental health and has the potential, therefore, to decrease the use of psychotropic medications in youth.

Objectives: The objective of this study is to determine if the Manitoba Roots of Empathy program is reducing the risk of youth being dispensed psychotropic medication if they participated in the program as children.

Methods: This study uses administrative health, education and social service records for youth in Manitoba to estimate the effect of the ROE program on future psychotropic medication use. Children who participated in ROE between the 2002/03 and 2012/13 school years were matched to children who did not receive ROE through a combination of hard matching on key variables and propensity score matching approaches. Only children who were not dispensed a psychotropic medication in the year prior to the start of follow-up were eligible for study. Incomplete 10:1 matching without replacement resulted in 16 815 children in the control group and 5563 children in the ROE group. Youth from both groups will be followed from the conclusion of their ROE program for the first occurrence of being dispensed a medication from five subclasses of psychotropic medications: (1) antidepressants, (2) anxiolytics, (3) psychostimulants, (4) antipsychotics, and (5) hypnotics and sedatives. Kaplan-Meier survivor curves and Cox proportional regression models will be used to compare and describe the survival experience between the two groups. Analyses will be conducted on a composite outcome for being dispensed any psychotropic medication, as well as separate analyses for each of the subclasses of psychotropic medications.

Results: The study is expected to be completed by December 2016.

Conclusion: This study may provide novel insights regarding an unanticipated outcome of the ROE program that extends beyond the proximal outcomes that have established the program's success. Measuring the future use of psychotropic medications in youth may demonstrate a lasting effect of the program and its effectiveness to promote mental health among youth.

Keywords: program effectiveness evaluation, psychotropic medication, youth

---

Author references:

6. Department of Community Health Sciences, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada
7. Manitoba Centre for Health Policy, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada
8. Department of Psychology, Faculty of Arts, University of Manitoba, Winnipeg, Manitoba, Canada

Correspondence: Lindsey Dahl; Email: umdahllt@myumanitoba.ca

Specialized care and recurrent traumatic brain injury: a retrospective cohort study

O. Lasry, MDCM (9,10); J. Marcoux, MD (10); D. Buckeridge, MD (9)

Introduction: Many traumatic brain injury (TBI) patients suffer a recurrent TBI (rTBI). These patients are at a higher risk of poor cognitive and functional outcomes compared to patients with a single injury. However, interventions that may mitigate the risk of rTBI are currently unknown.

Objective: This study aimed to determine whether the care provided for an index mild TBI (mTBI) in neurotrauma centre emergency departments (specialized care) is associated with a lower risk of rTBI at one-year follow-up when compared to the care provided in non-neurotrauma centre emergency departments (non-specialized care).

Methods: A retrospective cohort study of all patients incurring mTBI and being treated in an emergency department from 1998 to 2014 was completed. Each patient had a follow-up period of up to one year. Administrative data for a 25% random sample of the Greater Montréal area were used to ascertain cases, outcomes and covariates. A time-to-event analysis was conducted using a Cox proportional hazards model, taking into account the time-dependent effects of the type of care received. Important confounders were included in the model to adjust for confounding. A sensitivity analysis using an instrumental variable (differential distance between a patient's closest neurotrauma and non-neurotrauma centre) was used to assess for residual confounding.

Results: During the study period there were 24 292 (19 516 non-specialized care and 4776 specialized care) mTBI patients that presented to an emergency department. A total of 1384 rTBI (5.7%) cases occurred during a one-year follow-up of each patient. After adjusting for confounders and the time-dependent effect of the type of care received, patients treated in neurotrauma centre emergency departments had a 36% reduction in the hazard of rTBI with a hazard ratio (HR) of 0.64 (95% CI: 0.51–0.80) in the first week after the index injury compared to patients treated in non-specialized emergency departments. This protective effect persisted for the first six weeks after the index injury. Over the one-year follow-up period, the overall reduction in the hazard of rTBI was 21% (HR = 0.79, 95% CI: 0.68–0.91) for patients treated in the specialized care setting. The instrumental variable sensitivity analysis supported these findings.

Conclusion: The treatment of mTBI patients in the emergency department of neurotrauma centres is associated with an important decrease in the occurrence of rTBI. Further research that identifies the mediators of this association is warranted so that specific interventions that lower the risk of rTBI can be implemented.

Keywords: traumatic brain injury, recurrence, specialized care

Author references:

9. Department of Epidemiology, Biostatistics and Occupational Health, McGill University, Montréal, Quebec, Canada
10. Department of Neurology and Neurosurgery, McGill University Health Centre, McGill University, Montréal, Quebec, Canada

Correspondence: Oliver Lasry; Email: oliver.lasry@mail.mcgill.ca

Influence of a pay-for-performance program on the care of diabetic patients by family physicians in New Brunswick

E. LeBlanc, BSc (11,12); M. Bélanger, PhD (11,12,13); V. Thibault, BSc (11,12); L. Babin, MD (11,12,13); B. Greene, MN (14); S. Halpine, PhD (14); M. Mancuso, MBA (15)

Introduction: With increasing costs associated with diabetes management, many jurisdictions are using pay-for-performance programs to entice family physicians to follow practice guidelines when caring for their diabetic patients. The impact of such programs on the health of patients is unknown.

Objective: The objective of this study was to determine whether hemoglobin A1C (A1C) of diabetic patients was improved following the introduction of an incentive program in New Brunswick in 2010. Two outcomes were considered: the probability of having had at least two A1C tests per year and the mean A1C of patients.

Methods: Administrative data from all diabetic patients (n = 83 580) with A1C tests were acquired from the New Brunswick Department of Health and patients' respective fee-for-service family physicians (n = 583). Both repeat-cross-sectional and cohort-based (2005–2014) analyses were conducted. Patients were divided in two groups depending on whether their family physician had claimed the incentive or not. Multivariate analyses were conducted to compare pre- and post-incentive period for probability of having had two tests per year (logistic) and mean A1C (linear). The same outcomes were compared between patients for whom an incentive was claimed and those for whom it was not claimed after 2010.

Results: Family physicians who were already prescribing at least two A1C tests per year before the implementation of the incentive program had 51% greater odds than other physicians to continue to do so after the implementation (99% CI: 1.44–1.57). Patients followed by a family physician claiming the incentive had 33% greater odds of receiving at least two A1C tests per year (99% CI: 1.24–1.43). However, there were no differences in annual A1C means between sub-groups studied.

Conclusion: This analysis suggests that implementation of an incentive program led physicians to provide better follow-up care to patients with diabetes. However, the incentive program has not been associated with differences in glycemic control. These results suggest that although incentive programs may help physicians provide better care to their patients with diabetes, these programs may not be sufficient to result in optimal glycemic control. Further analyses are needed to confirm these results, to estimate the combined effects of incentive programs with other interventions and to assess the cost-benefit of such interventions.

Keywords: diabetes, incentive, family physician

Author references:

11. Faculty of Medicine and Health Sciences, Université de Sherbrooke, Sherbrooke, Quebec, Canada
12. Centre de formation médicale du Nouveau-Brunswick, Université de Moncton, Moncton, New Brunswick, Canada
13. Vitalité Health Network, Moncton, New Brunswick, Canada
14. New Brunswick Department of Health, Fredericton, New Brunswick, Canada
15. New Brunswick Health Council, Moncton, New Brunswick, Canada

Correspondence: Emilie LeBlanc; Email: Emilie.R.Leblanc@USherbrooke.ca

Children with autism spectrum disorder in Manitoba: prevalence, population characteristics and psychotropic medication use

L. Vehling, MSc (6); M. Brownell, PhD (6,7); J. Kaufert, PhD (6); N. C. Nickel, PhD (6,7); S. Alessi-Severini, PhD (16)

Introduction: Autism spectrum disorder (ASD) is a neurodevelopmental disability diagnosed in an increasing number of children. Psychotropic medication use has also increased among Canadian children and may be more common among children with intellectual disabilities. However, psychotropic medications are not strongly recommended for use among children and have been associated with significant adverse events. ASD has few effective treatment options, yet psychotropic medications are used to manage challenging behaviours in some children with ASD.

Objectives: This study describes ASD prevalence and use of psychotropic medications in the pediatric population of Manitoba. Populations of children with and without ASD are described and compared to determine difference in psychotropic medication use and population characteristics.

Methods: Administrative data from the Repository at the Manitoba Centre for Health Policy were used to create a cohort of children born in Manitoba. Diagnoses of ASD were based on medical claim records, hospital abstracts or special education funding data.

Results: Between 2010 and 2014, 3079 Manitoba children aged 0 to 14 years had an ASD diagnosis (1% prevalence). Among children with ASD aged 0 to 18 years, 80% are boys, almost 60% were diagnosed before age 5, with 85% diagnosed before age 10, and almost 50% received special education funding. Close to 50% of all children with ASD received a psychotropic prescription before age 18, compared to only 12% in the population of children in Manitoba without ASD or an intellectual disability. Children with ASD are more likely than those in the general population of children to live in Winnipeg, be involved with child welfare services and receive psychotropic medications.

Conclusion: In Manitoba, ASD is diagnosed in preschool or early school years, when treatment and services can have the greatest impact on functioning. Children with ASD are more likely to use psychotropic medications and have different population characteristics when compared to children in the general population. This epidemiological information is important to understand risk factors, assess current treatment strategies and direct future intervention planning.

Keywords: autism, psychotropic medications, population health

---

Author references:

6. Department of Community Health Sciences, Max Rady College of Medicine, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada
7. Manitoba Centre for Health Policy, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada
16. College of Pharmacy, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba, Canada

Correspondence: Lorena Vehling; Email: plastinl@myumanitoba.ca

Extended!

Call for papers: The food environment in Canada

Tweet this Call for Papers

Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice

Special issue on: The Food Environment in Canada

Editors: **Robert Geneau** (Editor-in-Chief, Public Health Agency of Canada) and **Lana Vanderlee** (guest editor; Department of Nutritional Sciences, University of Toronto)

Diet is a fundamental component of health, and dietary habits are closely linked with the development of chronic disease and obesity. The ***food environment*** in which people make their food choices plays a major role in establishing eating habits and overall diet quality. Broadly defined as the physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence food choices and nutrition status, the food environment can promote or impede healthy diets.

The current food environment in Canada does not consistently support healthy food choices, which is reflected in the overall poor dietary habits of Canadians. Nationally and internationally, greater attention is being paid to how the food environment can be shifted towards one that is conducive to healthier food patterns.

Health Promotion and Chronic Disease Prevention in Canada: Research, Policy and Practice is seeking articles that examine the food environment in Canada. All article types are invited for submission. We are seeking research relating to all aspects of food environment, which may include, but are not limited to, food composition, labelling, promotion and marketing, provision and procurement, retail, prices and trade and investment. In particular, we are seeking articles that

- characterize the current Canadian food environment;
- examine the impact of food environment policies and interventions in the Canadian context; and
- synthesize evidence regarding the state of the food environment in Canada.

Kindly submit articles to Journal_HPCDP-Revue_PSPMC@phac-aspc.gc.ca by November 30, 2016. Submissions should mention this Call for Papers.

For more information on submission guidelines and article types, visit http://www.phac-aspc.gc.ca/publicat/hpcdp-pspmc/authinfo-eng.php

Other PHAC publications

Researchers from the Public Health Agency of Canada also contribute to work published in other journals. Look for the following articles published in 2016:

Bentham J, Di Cesare M, Stevens GA, […] **Robitaille C**, […] **Wang MD**, et al. A century of trends in adult human height. eLife. 2016;5:e13410. doi: 10.7554/eLife.13410.

Burton CE, Doucette KE, Mabilangan CA, **Plitt SS**, Lee BE, Preiksaitis JK. Hepatitis B and C serologic profiles of Canadian organ donors and recipients: retrospective 10-year review at a single center. Transplant Infect Dis. 2016;18(4):520-8. doi: 10.1111/tid.12558.

Coulthart MB, Jansen GH, Cashman NR. Evidence for transmissibility of Alzheimer disease pathology: cause for concern? CMAJ. 2016;188(10):E210-2. doi: 10.1503/cmaj.151257.

Majer A, Blanchard AA, **Medina S**, **Booth SA**, Myal Y. Claudin 1 expression levels affect miRNA dynamics in human basal-like breast cancer cells. DNA Cell Biol. 2016;35(7):328-39. doi: 10.1089/dna.2015.3188.

Richards JL, Kramer MS, **Deb-Rinker P**, **Rouleau J**, et al. Temporal trends in late preterm and early term birthrates in 6 high-income countries in North America and Europe and association with clinician-initiated obstetric interventions. JAMA. 2016;316(4):410-9. doi: 10.1001/jama.2016.9635.

Skinner R, **McFaull S**, Rhodes AE, Bowes M, Rockett IRH. Suicide in Canada: is poisoning misclassification an issue? Can J Psychiatry. 2016;61(7):405-12. doi: 10.1177/0706743716654628.

Vanlaar W, Mainegra Hing M, Brown S, McAteer H, **Crain J, McFaull S**. Fatal and serious injuries related to vulnerable road users in Canada. J Saf Res. 2016;58:67-77. doi: 10.1016/j.jsr.2016.07.001.