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ORIGINAL ARTICLE

Health and Well-Being Among Young People From Canadian Farms: Associations With a Culture of Risk-Taking

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Abstract

Purpose: To determine whether patterns of adolescent risk behavior in rural populations, and especially farm populations, are associated with negative indicators of adolescent health and well-being, beyond an established association between risk-taking and injury.

Methods: The study base was Cycle 7 (2014) of the Canadian Health Behaviour in School-Aged Children study. Children aged 11-16 years (n = 2,565; 2,533 weighted) who reported living or working on farms were matched within schools in a 1:1 ratio with other rural children. We related a scale describing engagement in multiple risk behavior to a series of indicators of adolescent health and well-being.

Findings: Farm children, particularly male farm children, showed the highest levels of risk behavior. Multiple risk behavior was strongly and consistently associated with negative indicators of general health, mental health (life satisfaction, psychosomatic symptoms), and academic performance in all subpopulations.

Conclusions: Adolescent risk behavior in rural populations, and especially farm populations, is common and associated with a variety of negative indicators of adolescent health and well-being. We speculate that the origins of this risk-taking lifestyle surround cultural definitions of self and identity, which have both protective and negative effects.

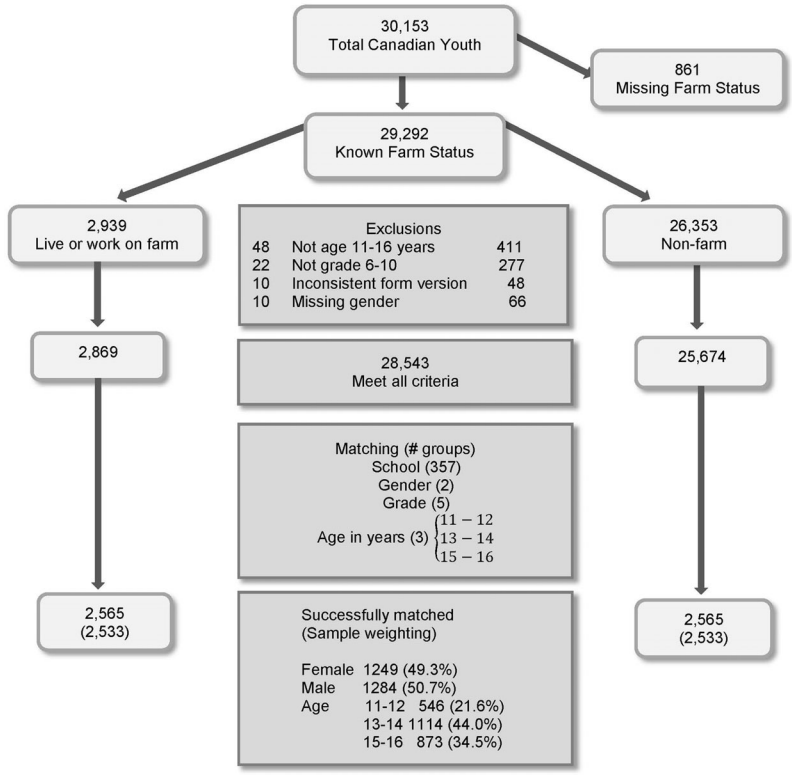
Key words adolescent behavior, farm, health, risk-taking, rural population.

Experiences that occur during adolescence, both positive and negative, lay a foundation for adult health conditions. Some of these experiences include engagement in risk behaviors by young people.[1] Behaviors such as substance misuse, violence, and failure to take safety precautions, while normative in many adolescent populations, are also associated with acute risks to the physical health of developing children.[2] Even if they do not have immediate health consequences, if left unmitigated they can be early markers for a problem behavior lifestyle that can eventually lead to negative health trajectories.[3,4]

Engagement in a syndrome of multiple risk behavior, as distinct from an isolated risk behavior, is a phenomenon that emerges during adolescence.[5] Clustered risk behavior has social and environmental origins and is strongly influenced by peer group interactions.[6-8] Multiple risk behavior is also associated with many acute health effects, the most established of which is excess risk for the occurrence of injury.[7-9]

Young people who live or work on farms comprise one group that is especially vulnerable to this phenomenon.[10] Excesses in multiple risk behavior, adolescent injury, and plausible connections between the 2 have been demonstrated in rural children, but they are especially evident in adolescents from farms.[11] This may have social and anthropological explanations. Farmers are often rewarded

Figure 1 Health Behaviour in School-Aged Children 2013/2014 Canadian Study, Matched Farm Cohort.



in very practical terms for a willingness to engage in risk-taking.[12] Production of livestock, crops, and other agricultural products is an occupation that is often fraught with uncertainty, time pressures, and physical hazards, and it is only by embracing the risks associated with such factors that farmers are able to survive and indeed often thrive. Hence, in addition to being a cause of injury, engagement in risk behaviors may actually serve a protective function, and it is logical that such behaviors may be fostered and accepted in the next generation. What is not established, however, is whether this pattern of adolescent risk behavior on farms is associated with other indicators of adolescent health and well-being and how this pattern may differ in nonfarm settings. In addition to its hypothetical protections, negative possibilities include impacts on general health, mental health, and academic performance.

We had a unique opportunity to explore these ideas using a subset of youth who lived or worked on farms, identified from a national sample of young people in Canada.[13] Through this analysis, our hopes were to investigate whether a lifestyle that includes multiple risk behavior could potentially result in negative indications for population health that extend beyond the occurrence of injury. More specifically, study findings may provide baseline evidence that documents the extent and influence of a culture of risk-taking that appears to be pervasive among adolescents from farms, thereby informing health promotion strategies that focus on this vulnerable population.

Methods

The 2014 Health Behaviour in School-Aged Children Study

Our study base was Cycle 7 (2016 updated data set) of the Canadian Health Behaviour in School-Aged Children study, or HBSC.[13] HBSC is a school-based, international health promotion survey affiliated with the World Health Organization and conducted in Canada by Queen's University.[14] It involves a multistage sampling approach, with individual students aged 11-16 years nested within schools, school boards, then provinces/territories. Participation is voluntary, with consent (explicit or implicit depending on local protocol) received from school administrators, parents, and participating students. Exclusions (<7% of eligible students)[15] are those from private schools, home schools, schools on First Nation or Inuit reserves, street youth not in school, and incarcerated youth. Response rates in Cycle 7 were 100% at

the provincial/territorial level and 77% at the individual student level. Ethics approval was sought and granted from: (1) the Queen's University General Research Ethics Board and (2) Health Canada/the Public Health Agency of Canada.

The Matched Sample

HBSC survey participants consisted of 30,153 students from 369 schools, and of these 29,292 reported whether they lived or worked on a farm (Figure 1). Those who affirmed that they lived or worked on a farm formed our group of primary interest ("farm children"), while other students were eligible for the comparison group ("nonfarm children"). Further inclusions were as follows: (1) participated in the HBSC survey and provided complete information on all key study variables and (2) aged 11-16 years, in grades 6 to 10, inclusive.

Strong differences were observed between farm and nonfarm children demographically. For example, 37% of farm children in the full sample survey were from 2 Prairie Provinces (Manitoba, Saskatchewan) as compared with 16% of nonfarm children. Furthermore, only 5% of the children who lived or worked on farms were from metropolitan areas, as compared with 14% of nonfarm children. Farm children were more often male (53% vs 49%), and this was particularly true for the oldest students (62% vs 49% for those 16 years old). To ensure that our comparisons reflected effects of the farm environment with minimal confounding by geographic differences and other factors, records for 2,565 (2,533 weighted) farm children were, therefore, matched to records in a 1:1 ratio from nonfarm children from the same school, by grade (6 to 10), age (11-12, 13-15, 15-16 years), and sex (boy or girl).

Core Measures

Overview

The primary exposure under study was a multiple risk behavior scale. The primary outcomes were indicators of general health status, mental health status, and school performance.

The Multiple Risk Behavior Scale

Based on precedent,[8] we combined 6 individual risk behaviors into a composite scale (Cronbach's $\alpha = 0.77$). Risk behaviors included: (1) lifetime smoking history; (2) use of alternative smoking products; (3) frequency of alcohol consumption; (4) lifetime drunkenness history; (5) bicycle helmet nonuse; and (6) energy drink consumption. These behaviors were among those identified in previous work,[16] which applied exploratory and confirmatory factor analysis to HBSC questions that spanned the categories of priority health-risk behaviors among youth identified by the Centers for Disease Control and Prevention.[17] Such behaviors are known to cluster together within adolescent populations as expressions of multiple risk behavior.[8]

The multiple risk behavior scale was created by first applying the following coding structure to the relevant HBSC questions: 0 = "no engagement"; 1 = "moderate levels of engagement"; and 2 = "high levels of engagement." The results were then scaled by taking the mean response over the 6 behaviors, thereby maintaining the original range of 0 (no engagement in any of the behaviors) to 2 (high engagement in all behaviors).

General Health Status

Self-perceived general health status was considered as an outcome using the internationally validated item, "Would you say your health is . . . ," with 4 possible responses ("poor," "fair," "good," or "excellent").[18]

Mental Health Status

We considered validated indicators of life satisfaction and psychosomatic symptoms as study outcomes. First, life satisfaction was measured using a version of the Cantril Ladder adapted from adult research, whereby young people rated their life on a scale from 0 ("worst possible life") to 10 ("best possible life").[19] Second, youth reported the frequency (5-point Likert-like scale: "rarely or never," "about every month," "about every week," "more than once a week," "about every day") of the following psychosomatic symptoms: "headache," "stomachache," "backache," "feeling low (depressed)," "irritability or bad temper," "feeling nervous," "difficulties in getting to sleep," and "feeling dizzy." These 8 symptom reports were combined into a composite scale with strong psychometric properties (Cronbach's $\alpha = 0.85$).[20] The scale was created by taking the mean over the 8 symptoms, thereby maintaining the original range of 1 ("rarely or never" on all symptoms) to 5 ("about every day" for all symptoms).

School Performance

Class marks during the past year were considered a study outcome. Youth reported whether they had "mostly A's," mostly A's and B's," "mostly B's and C's," "mostly C's," or "mostly letter grades below C."

Table 1 Individual Outcome Measures for Full Matched Cohort

Health	N		%
Excellent	1,308		30.7
Good	2,206		51.8
Fair	661		15.5
Poor	86		2.0
Life Satisfaction	**N**		**%**
Best 10-9	1,190		28.3
8-7	1,901		45.2
6-5	750		17.8
Worst 4-0	362		8.6
Psychosomatic Index (8 items)		95% Limits	
	Mean	Lower	Upper
	2.11	2.06	2.16
Class Marks	**N**		**%**
Mostly A's	1,124		26.6
A's & B's	2,156		51.1
B's & C's	736		17.4
Mostly C's	164		3.9
Mostly <C's	38		0.9

Table 2 Individual Risk Behaviors for Full Matched Cohort

Smoking Lifetime	N	%
Never	3,731	86.4
1-29 days	424	9.8
30+ days	164	3.8
Alternative tobacco		
Never	3,535	81.9
One	398	9.2
More than one	385	8.9
Alcohol consumption		
Never	2,144	49.6
Rarely	1,278	29.6
At least monthly	897	20.8
Drunkenness lifetime		
Never	3,280	76.0
Once	396	9.2
More than once	643	14.9
Bicycle helmet use		
Always	1,613	37.3
Some/most times	1,159	26.8
Never	1,547	32.8
Energy drink consumption		
Never	3,294	76.3
<Once per week	806	18.7
2+ times per week	219	5.1

Statistical Analysis

Data analyses were conducted with SAS 9.4 (SAS Institute Inc., Cary, North Carolina). Descriptive analyses were used to characterize the final samples of farm and nonfarm children by age, sex, and grade.

In our primary analyses, we used procedures for regression analysis of complex survey data (PROC SURVEYREG) to model the multiple risk behavior scale as a function of farm status and to assess associations with the selected health outcomes. All analyses were adjusted for the weighting and clustering of the complex HBSC sampling design. Analyses were stratified by gender, and age was additionally controlled (beyond the matching described above) with covariates in the regression models using a restricted cubic spline to allow for flexible age trends.

Simulations based on bootstrapping were used to investigate the large sample estimates of variability in our initial regression analyses. The results of some tests of association did not appear stable with respect to the statistical significance indicated by the original large sample results, primarily due to the relatively limited numbers of farm students in many schools (overall median of 357 schools = 3 farm students per school). To address this, bootstrap resampling was used to provide more robust estimates of the true variability. The full cohort was bootstrapped 1,000 times, rematched farm to nonfarm, and reanalyzed as above. The assessments of association reported here were based on bootstrap estimates over the 1,000 replications.

Results

As shown in Figure 1, the matched cohort was quite equally split by sex (50.7% male), and 44% were ages 13-14 (mean age 14.1 years). Overall, outcomes were generally favorable in the full matched cohort (Table 1). For example, about 82% of students reported good or excellent health, and about 77% reported receiving grades of mostly A's or A's and B's. The mean psychosomatic index was 2.1, which on the ordinal response scale corresponds to symptoms reported "about every month." The most commonly reported risk behaviors were failure to use bicycle helmets (33% never), alcohol consumption (21% at least monthly), and drunkenness (15% more than once, Table 2).

Next, we compared risk-taking between farm and matched nonfarm children by sex. Males, and particularly farm males, tended to report more engagement in risk behaviors (Figure 2). Accordingly, the estimated mean level of the multiple risk behavior scale was highest in males, most notably in male farm children ($P < .001$, Table 3).

Risk-taking was strongly and consistently associated with a variety of indicators of health and well-being including measures of school performance, general health,

Figure 2 Number of Risk Behaviors Reported with Moderate or High Engagement.

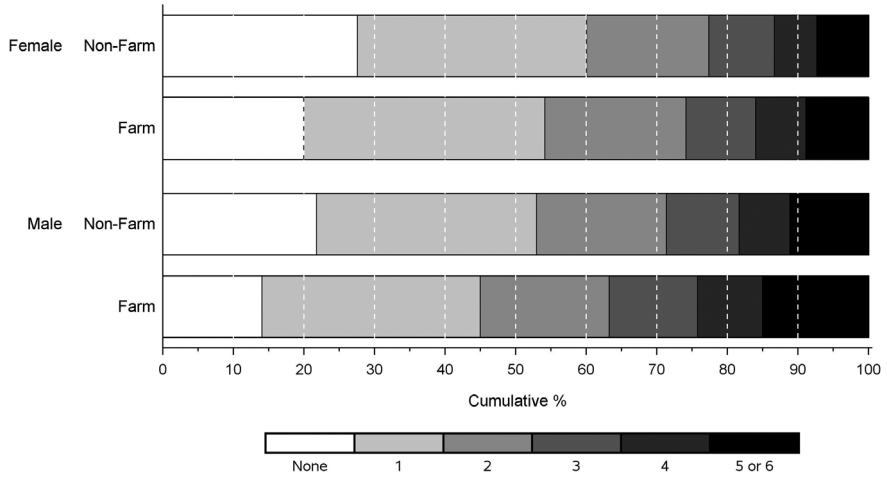
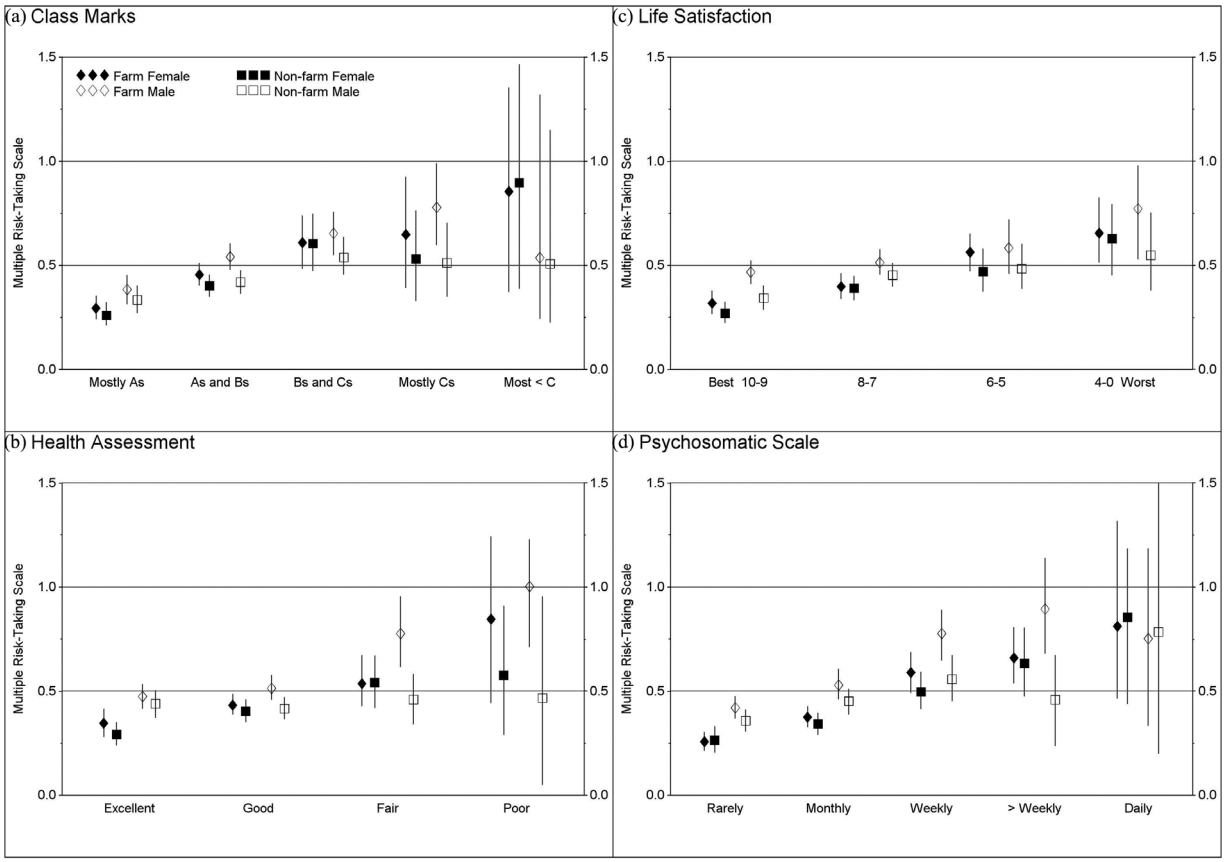


Figure 3 Relationships between a Risk Scale Summarizing Engagement in Multiple Risk Behavior and 4 Indicators of Health and Well-Being.
Note: Bootstrap medians and 95% empirical confidence limits based on 1,000 replications are presented separately for males and females from farm and nonfarm settings. Each example provides evidence of a negative association of risk-taking with the health and well-being of children.



and mental health. Even when stratified by gender and farm status, the associations were often statistically significant (Table 4), demonstrating higher levels of risk-taking with poorer indications of health and well-being. The consistency of these trends is more visually apparent in plots of these estimates (Figure 3). In general, the median level of multiple risk behavior among those showing the poorest outcomes (rightmost

groups in Figure 3a-d) was more than twice that among those showing the best outcomes (leftmost groups in Figure 3a-d).

Discussion

This study extends an emerging program of research into risk-taking and its influence on the health and well-being of children from farm and rural populations. Study findings affirm that multiple risk behavior is common in such settings, and beyond past findings for injury outcomes,[11] it is consistently associated with a variety of negative outcomes related to general health, mental health, and school performance. Farm children may be particularly susceptible to these potential effects, as multiple risk behavior appears to be a normative practice in the lives of many of these children.

Engagement in adolescent risk-taking in these settings is not without negative effects. Findings of an excess in risk-taking among rural children is consistent with past evidence that focuses on patterns of illicit substance use,[21] trauma due to motor vehicle crashes,[22] and engagement in health risk behaviors including violence.[23] If one considers the associations identified here to be causal, engagement in such risk-taking is not innocuous and provides a potential explanation for eventual negative health trajectories that can emerge in rural settings. Yet in truth, there is little established evidence about the culture of adolescent risk-taking observed in these populations. On farms, this trend may have anthropological origins associated with the need to engage in risks as a means for survival and productivity.[12] Indeed, farm populations may create a unique "sense-of-self" or identity involving risk-taking as "a way of adjusting and adapting to their environment."[12] This tendency is protective in some manners, and hence, is passed between generations. However, these same beliefs that assist farm populations in coping with challenging environments also "can be maladaptive when it is applied to safety decisions and hazard exposures."[12]

Analogously, engagement in risk-taking may provide a similar expression of self-identity among young people on farms. In the past, we have argued that these patterns of risk-taking on farms may have arisen by choice due to social norms, or by necessity due to the inherent level of risk typical of farm environments.[11] However, based on the types of behaviors involved (eg, substance misuse, failure to take safety precautions) and this theory surrounding cultural "identity,"[12] adolescent multiple risk behavior may also represent a process of self-identity that has social importance within rural populations. This form of expression of identity would emerge earlier in the life course than observed among adult farmers, and its possible effects include a range of direct and indirect influences on the health and well-being of farm children.

Strengths of this study include its novelty to the rural health literature. Our major finding confirms that multiple risk behavior is a normative phenomenon among adolescents growing up on farms, but more importantly, it is not innocuous in terms of its likely negative impacts on health and well-being. Second, our analysis was supported by a strong theoretical base in terms of cultural thinking surrounding farm populations and their behavioral identity,[12] as well as problem behavior theory that examines the profound implications of clustered risk behavior during adolescence on health and well-being.[5-8] Our findings provide a foundational base for pediatric health promotion efforts on farms and in other rural contexts, including the need to focus on groups that are especially vulnerable. The latter include young people of all ages who engage in multiple risk behavior, especially boys.

Limitations

Limitations of this study warrant comment. First, HBSC is based upon self-report and, hence, our findings are subject to misclassification. The likely effect of such errors, if nondifferential, is to diminish the observed strength of relationships. If errors in outcome assessment(s) were correlated with risk-taking tendencies, there is the possibility that our observed effects are inflated. Second, we consider our analyses to be descriptive and exploratory, and the outcomes under assessment (general health, mental health, school performance) each have many possible determinants. Hence, there is the possibility of uncontrolled or residual confounding. Third, while our sample was large overall, we did suffer from a lack of precision for some associations due to small cell sizes, and we used robust bootstrapping methods of analysis. Finally, the sample of farm children includes young people who self-identified as either living or working on a farm. This is an important distinction, and because we cannot subdivide the groups, we could not determine if the observed effects are more pronounced in young people who actually grew up on farms.

Implications

Our study findings have implications for further research. From a sociological perspective, this idea of the emergence of a farm cultural identity, as expressed through adolescent risk-taking, requires confirmation through mixed quantitative and qualitative study. Although beyond the scope of this study, exploration of factors

Table 3 Multiple Risk Behavior Scale[a] by Gender and Farm Status

Female Only						
	Farm (N = 1,135)			Nonfarm (N = 1,145)		
Mean	95% Lower	95% Upper	Mean	95% Lower	95% Upper	*P* Value
0.44	0.39	0.48	0.40	0.36	0.44	.177
Male Only						
	Farm (N = 1,101)			Nonfarm (N = 1,084)		
Mean	95% Lower	95% Upper	Mean	95% Lower	95% Upper	*P* Value
0.55	0.50	0.59	0.42	0.39	0.46	<.001

[a]Adjusted means and 95% confidence limits by group. Multiple risk behavior scale is the mean over 6 behaviors, and ranges from 0 (no engagement in any of the behaviors) to 2 (high engagement in all behaviors).

Table 4 Multiple Risk Behavior by Gender, Farm Status, and Outcome Measure (Estimates and 95% Confidence Limits)

	Female Nonfarm	Female Farm	Male Nonfarm	Male Farm
Class marks				
Mostly A's	0.26 (0.21-0.32)	0.29 (0.24-0.35)	0.33 (0.27-0.40)	0.38 (0.31-0.45
A's & B's	0.40 (0.35-0.45)	0.45 (0.40-0.51)	0.42 (0.36-0.48)	0.54 (0.48-0.60)
B's & C's	0.61 (0.47-0.75)	0.61 (0.48-0.74)	0.54 (0.46-0.64)	0.65 (0.55-0.76)
Mostly C's	0.53 (0.33-0.76)	0.65 (0.39-0.92)	0.51 (0.35-0.70)	0.78 (0.60-0.99)
Mostly <C's	0.90 (0.39-1.46)	0.85 (0.37-1.35)	0.51 (0.23-1.15)	0.54 (0.24-1.32)
P value	.028	.120	.163	.082
Health assessment				
Excellent	0.29 (0.24-0.35)	0.35 (0.28-0.41)	0.44 (0.37-0.50)	0.47 (0.42-0.53)
Good	0.40 (0.35-0.46)	0.43 (0.39-0.49)	0.42 (0.37-0.47)	0.51 (0.46-0.58)
Fair	0.54 (0.42-0.67)	0.54 (0.43-0.67)	0.46 (0.34-0.58)	0.78 (0.62-0.96)
Poor	0.58 (0.29-0.91)	0.85 (0.44-1.24)	0.47 (0.05-0.95	1.00 (0.71-1.23)
P value	.018	.114	.567	.065
Life satisfaction				
Best 10-9	0.27 (0.22-0.32)	0.32 (0.27-0.38)	0.34 (0.29-0.40)	0.47 (0.41-0.52)
8-7	0.39 (0.33-0.45)	0.40 (0.34-0.46)	0.45 (0.40-0.51)	0.51 (0.46-0.58)
6-5	0.47 (0.37-0.58)	0.56 (0.47-0.65)	0.48 (0.39-0.60)	0.58 (0.46-0.72)
Worst 4-0	0.63 (0.45-0.79	0.65 (0.52-0.82)	0.55 (0.38-0.75)	0.77 (0.53-0.98)
P value	.003	.029	.094	.303
Psychosomatic scale				
Rarely	0.27 (0.21-0.33)	0.26 (0.21-0.30)	0.36 (0.31-0.41)	0.42 (0.37-0.47)
Once/month	0.34 (0.29-0.40)	0.37 (0.33-0.43)	0.45 (0.39-0.51)	0.53 (0.46-0.61)
Once/week	0.50 (0.41-0.59)	0.59 (0.49-0.69)	0.56 (0.45-0.67)	0.78 (0.65-0.89)
>Weekly	0.63 (0.48-0.80)	0.66 (0.54-0.81)	0.46 (0.24-0.67)	0.89 (0.68-1.14)
Daily	0.86 (0.44-1.18)	0.81 (0.47-1.32)	0.78 (0.20-1.56)	0.75 (0.33-1.18)
P value	.013	.008	.120	.065

potentially mediating and moderating the associations reported here may be informative. Second, the long-term effects of engagement in multiple risk behavior, and whether it continues or abates with early adulthood, require confirmation via longitudinal study. Finally, this field requires knowledgeable rural health practitioners to design and implement targeted interventions that focus on adolescent risk-taking, as well as formal evaluation of such interventions via randomized trials and other controlled studies. This is a complex challenge, and

efficacious strategies are likely to involve the full public health model of education, environmental modification, and policy-oriented solutions, as well as provision of individual care for those most at risk.

Conclusion

In this novel Canadian analysis, we confirmed that adolescent risk behavior in rural populations, and especially by male farm youth, is associated with a variety of negative indicators of adolescent health and well-being. We speculate that the origins of this risk-taking lifestyle surround cultural definitions of self and identity, which have both protective and negative effects. Irrespective of their causes, the potential impacts are consequential, and innovative and targeted initiatives are required for the prevention of the negative aspects of these phenomena.

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