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Submitted by CIHR
Déposé par les IRSC

*J Adolesc Health*. Author manuscript; available in PMC 2018 April 01.

Published in final edited form as:

*J Adolesc Health*. 2017 April ; 60(4): 380–387. doi:10.1016/j.jadohealth.2016.09.019.

# Victimization, Suicidal Ideation, and Alcohol Use From Age 13 to 15 Years: Support for the Self-Medication Model

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## Abstract

**Purpose—**Recent years have seen increased coverage of adolescent victimization and suicide. Both adolescent peer victimization and substance use have been associated with suicidal ideation, with evidence suggesting that all three factors are interrelated. There are at least four models which can explain the associations between these factors (i.e., self-medication, secondary mental disorder, bidirectional, and common factor). However, none of them is being empirically supported as the dominant model because few longitudinal studies have explored the association between these factors.

**Methods—**The present study compared longitudinal paths of all four models simultaneously using a cross-lagged model. This was done using self-reported measures of peer victimization, suicidal ideation, and alcohol use at age 13, 14, and 15 years in a longitudinal sample of 238 adolescents.

**Results—**All three variables were moderately stable across time. Significant cross-lagged associations were found, showing that frequent peer victimization at age 13 years was associated with higher odds of having suicidal ideation at age 14 years (odds ratio, 1.82; $p < .05$). In turn,

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**Conflicts of Interest:** The authors have no conflicts of interest to disclose.

**Disclaimer:** The study sponsors have no role in the article.

Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jadohealth.2016.09.019.

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presence of suicidal ideation at age 14 years was significantly associated with higher alcohol use frequency at age 15 years (β = .13; $p < .05$).

**Conclusions—**Results support previous literature suggesting that peer victimization predates alcohol use and extends it by showing clear directionality between suicidal ideation and alcohol use over 1 year, supporting the self-medication model. Clarifying the empirical basis of these underlying models could allow for earlier prevention strategies, by targeting the risk factor that appears the earliest in the model.

**Keywords**

Adolescent; Alcohol use; Suicidal thoughts; Peer victimization; Self-medication model; Secondary mental health model

Recent years have seen increased media coverage of adolescent victimization and suicide and research identifying them as significant public health concerns [1]. For example, peer victimization and suicidal ideation or behaviors have each been shown to be longitudinally associated with later substance use [2–5]. Although available studies have mostly documented the associations between pairs of the following factors: peer victimization and suicide ideation or behavior, peer victimization and substance use, or suicide ideation or behavior and substance use, the literature suggests that all three factors (i.e., peer victimization, suicide ideation or behavior, and substance use) are inter-related. Indeed, one cross-sectional study of U.S. adolescents aged 12–18 years has shown that this is the case [6]. However, the developmental direction of associations between pairs of factors, let alone between the three factors, has not been examined systematically. Clarifying that direction and developmental sequence is important to guide prevention efforts.

There are at least four theoretical models that may explain the longitudinal associations between these factors and help organize our literature review: (1) the secondary substance use disorder model (the self-medication model), (2) the secondary mental disorder model, (3) the bidirectional model, and (4) the common factor model. In the context of our study, the self-medication model states that victimization could lead to suicidal ideation, which in turn would lead to alcohol use as a way to help cope with, or self-medicate, negative feelings [7]. The secondary mental disorder model states that victimization would lead to alcohol use which would result in greater risk of suicide ideation through an increase in maladaptive coping strategies and psychological distress [8]. The bidirectional model implies that all three factors (i.e., alcohol use, peer victimization, and suicide ideation) have reciprocal effects on one another contributing to an increase in overall problematic behavior and symptomology over time [9]. Finally, the common factor model states that there are one or more factors (e.g., peer victimization) which are responsible for increased risk of developing multiple disorders (e.g., alcohol use and suicide ideation) [9]. For a graphical representation of the four models, see Figure 1. The following three sections summarize the developmental literature on pairs of these three behaviors. Although our analyses focus on suicidal ideation, this review will also include studies on suicidal behaviors because both are strongly associated and the literature on this subject in adolescence is sparse.

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## Peer victimization and suicidal ideation and behavior

Most studies that have examined the link between peer victimization and suicide ideation or behavior are cross sectional and found greater association of suicide ideation and attempts in adolescents who reported being bullied or victimized. For a comprehensive review on the subject, see the study by Kim and Leventhal [10].

Most prospective studies have tested a link that presumes a direction going from peer earlier victimization to later suicidal behaviors or thoughts. For instance, in one study, adolescents who reported peer victimization at age 15 years were 3.8 times more likely to report suicide ideation at age 17 years. However, authors did not control for prior suicide ideation and did not examine bidirectional associations, which limits the heuristic value of these findings [11]. In a second study examining seventh- and eighth-grade Korean adolescents over a 10-month period, authors found that girls reporting being victimized at baseline later reported higher suicidality, even after controlling for baseline suicidality [12]. As for boys who reported being victimized at baseline, they also showed increased risk for suicidal behaviors and ideation at follow-up, while controlling for bidirectionality. There are other noteworthy prospective studies that have examined the link between victimization and suicidal behaviors across wider age ranges. For instance, a cohort study on Finnish children found that girls and boys reporting being victimized and bullied at age 8 years were more likely to have attempted suicide or completed suicide over a 17-year period after initial assessment. The results remained significant only for girls even after controlling for conduct problems and depression at age 8 years [13]. More recently, a Canadian prospective cohort study showed that adolescents reporting being victimized at age 13 years were a little over twice more likely to report suicidal ideations and three times more likely to report having attempted suicide at age 15 years, even after controlling for baseline suicidality [14]. The greatest limitation to the current literature on the association between peer victimization and suicide ideation remains the lack of bidirectional testing. With the available literature suggesting that peer victimization comes before suicide ideation, all four models could be theoretically supported. Nevertheless, present studies lend most support to the self-medication and the secondary mental disorder models.

## Peer victimization and substance use

Cross-sectional studies of peer victimization and substance use have found that adolescents who report higher peer victimization also tend to report higher substance use [15]. Longitudinal studies find varying results. For instance, one study found that between ages 13 and 17 years, adolescents who initially reported using substances were more likely to report being cyberbullied 6 months later, whereas those who initially reported higher cyberbullying did not report greater substance use later on [3]. Conversely, another study found that being bullied between ages 11 and 14 years predicted higher substance use 1 school year later, even after controlling for prior substance use [4]. A similar study showed that prior peer victimization was associated with drinking problems 1 year later among adolescents aged 13–15 years [5]. Finally, a study of 9- to 15-year-olds showed that those who reported either direct or indirect victimization were more likely to report substance use 2.5 years later [16]. Henceforth, there seems to be more studies suggesting a directional flow of associations

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from peer victimization to greater substance use in adolescence. However, this provides only limited support for the self-medication model because bidirectional effects were not tested in any of these studies. Thus, directionality needs to be further tested, as to better test the bidirectional model because there is at least one prospective study showing support for it [3].

## Suicidal ideation and behavior and substance use

The association between substance use and suicide ideation and behavior has been examined extensively in the literature. However, most of these studies are also limited by their cross-sectional design, thus preventing any interpretation of directionality [17,18]. To compensate for this limitation, some researchers have added retrospective information to their cross-sectional designs [19]. Most commonly, studies included retrospective reports of early alcohol use or early alcohol initiation (i.e., before the age of 13 years) as a predictor of future suicide ideation. Although such studies found earlier alcohol initiation to be associated with later suicide ideation [19,20], they remain subject to retrospective bias.

Most of the studies that examined the longitudinal association between substance use and suicidal outcomes have found that alcohol and substance use were associated with future suicide ideation and attempts, supporting the secondary mental disorder model [2,21–25]. For example, a study by Duncan et al. [22] found that higher alcohol use throughout adolescence was associated with suicide ideation in early adulthood. Pedersen [25] found that the link between cannabis use and suicide ideation and attempts 1 year later was only significant in young adults but not in adolescents. More recently, Rasic and Weerasinghe [26] found that 15-year-olds who used illicit drugs had more than twice the odds of reporting suicide ideations 2 years later. Although slightly inconsistent, these results suggest that suicidal thoughts and attempts could be amplified by alcohol and drug use, possibly because of a disinhibition effect or a blunting effect on participants' problem-solving abilities. However, at least two longitudinal studies have demonstrated that suicide ideation and behavior was prospectively associated with substance use problems later in life, mostly supporting the self-medication model [27,28]. Finally, it is also possible that uncontrolled third variables such as peer victimization may be the source of the apparent link between substance use and suicide ideation attempts (i.e., common factor model).

## Section summary

We briefly reviewed three lines of adolescent developmental research that examines mostly pairwise associations between three factors: peer victimization, suicide ideation or behavior, and substance use. We note that most studies do not test for bidirectionality over time. However, such a test is necessary to better understand which of four developmental models best accounts for observed associations. Furthermore, as supported by one cross-sectional study [6], it is likely that the three factors reviewed are also linked longitudinally. Figure 1 shows the four models with developmental links between all three factors. To better understand which model is better supported in early adolescence, the present study examined how peer victimization, suicide ideation, and alcohol use are associated longitudinally across 13, 14, and 15 years of age using a cross-lagged model. This allowed us to test simultaneously all paths suggested by these models.

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## Method

### Participants

The adolescents come from a longitudinal study for which participants were randomly selected at birth in 1996 from the Québec birth registry. Five hundred and seventy-two of 1,000 families contacted participated in the first wave of the study (see Table 1 for more sociodemographic information concerning these 572 families). The Louis-Hippolyte Lafontaine Hospital and the Centre Hospitalier Universitaire Sainte-Justine Research Center ethics committees approved this project. Children were first assessed at 5 months of age and then annually. Informed consent was obtained from parents (and assent from children as they reached age of understanding) each year. Parents completed the questionnaires until participants reached 11 years of age at which point they began self-reporting on their behavior. Participants were assured confidentiality in adolescence, which increases the validity of responses to sensitive questions [29]. All participants were from urban areas but came from diverse socioeconomic backgrounds.

To be included in the analyses, participants needed to have available data for at least one of the three variables of interest at any time point across adolescence (i.e., 13, 14, or 15 years). Attrition over the 13-year period occurred for various reasons (e.g., moving away, loss to follow-up, declined to participate any further) and resulted in the 238 participants (54% girls) available for the present study. Of the 238 valid participants, 60% had complete data at all three time points, 22% at two time points, and 17% at only one time point. Missing data in this sample was associated with low levels of parental education ($p = .05$) but with no other demographic variable or temperament and anxiety in childhood. Thus, data were considered to be missing at random. This sample did not differ significantly from the remainder of the original cohort on sex, mother's education, family income, conduct problems, emotional problems, or victimization at ages 3.5, 5, and 6 years.

### Measures

All measures were assessed annually. Participants were instructed to answer items while thinking back on the past 12 months.

*Peer victimization* was a sum of seven self-assessed items, each scored on a seven-point Likert scale. Items included questions on physical, verbal, and cyber peer victimization. All items come from the Social Experiences Questionnaire [30]. Internal consistency for the scale was considered good at 13 ($\alpha = .79$), 14 ($\alpha = .77$), and 15 ($\alpha = .77$) years of age.

*Suicidal ideation* was assessed with one question that asked whether adolescents had suicidal ideation in the past 12 months (four-point Likert scale: never to often). The item was dichotomized (0–1, absence or presence of suicidal ideation) because of high skewness, even after transformations.

*Alcohol use* was self-assessed through a single-item question asking participants to report on the frequency of their alcohol use over the past 12 months (seven-point Likert scale: never to everyday [31]). The item comes from the Dubé et al. national study on alcohol consumption in Québec. Originally other substances were to be included in the analyses (i.e., drug use),

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but frequency of use was very low at the selected age groups (13 years = 7%; 14 years = 13%, and 15 years = 28%). Accordingly, the variance of the resulting variables (substance use) was almost entirely attributable to the alcohol use item. Therefore, it was decided to only include the alcohol use variable.

*Sex* and *mother's level of education* (seven-point Likert scale: grade school to university) were included as control variables in analysis because they are known to be associated with alcohol use outcomes [32].

### Analyses

Structural equation modelling was used to conduct an integrated cross-lagged model examining the associations between the three variables of interest across three time points using Mplus version 6 [33] and a maximum likelihood with robust standard errors estimator. This type of analysis allows examining bidirectional (cross-lag) effects between variables, while controlling for their stability (autoregressed effects). The different theoretical models (Figure 1) are nested within the cross-lagged model allowing us to test them simultaneously. Several indices were used to evaluate model fit: root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR; for both values < .08 indicate acceptable fit) and comparative fit index (CFI; value > .90 indicating acceptable fit). Full information maximum likelihood was used to handle missing data.

## Results

### Descriptive statistics

Of the 238 participants, 10% (14 girls, 6 boys) reported suicidal ideation at 13 years, 13% (13 girls, 8 boys) at 14 years, and 15% (21 girls, 3 boys) at 15 years. Mean scores for peer victimization remained relatively constant from 13 years (M = 9.6, SD = 2.7), to 14 years (M = 9.2, SD = 2.4), to 15 years (M = 9.2, SD = 2.3), whereas mean frequency of alcohol use increased significantly between ages 13 and 15 years ($t = 5.11$, $p<.001$): from 1.5 (SD = 1.0) at 13 years, to 2.2 (SD = 1.4) at 14 years, to 2.3 (SD = 1.9) at 15 years. Table 2 presents the bivariate correlation matrix for all variables included in the models.

### Cross-lag model

A cross-lagged model on peer victimization, suicide ideation, and alcohol use frequency at 13, 14, and 15 years (Figure 2) resulted in an acceptable model fit: $\chi^2/df = 2.17$, RMSEA = .069, CFI = .92, SRMR = .05. As expected, the three variables were moderately stable across time, with $\beta \geq .45$ (peer victimization and alcohol use frequency) and odds ratios of ≥ 15.27 (suicide ideation). More interestingly, two significant cross-lagged regression paths were found: frequent peer victimization at age 13 years was significantly associated with higher odds of having suicide ideation at 14 years (odds ratio, 1.82; $p < .05$); in turn, suicide ideation at 14 years was significantly associated with higher alcohol use frequency at 15 years ($\beta = .13$, $p < .01$). No other significant cross-lagged or cross-sectional (within age) associations were found. To test whether the indirect effect from peer victimization at 13 years to alcohol use at 15 years through suicide ideation at 14 years was significant, we used

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the product of coefficients method recommended by Mackinnon et al. [34] and found that it was significant (ab = .25; 95% confidence interval, .001–.059).

To further test the robustness of the observed results, we ran a simplified model (Figure 3) where all nonsignificant paths were constrained to zero. Model fit of this trimmed model was good $\chi^2$/df = 1.92, RMSEA = .06, CFI = .91, SRMR = .06 and comparable to that of the full cross-lag model. (No significant difference was found between model fit of both models using the Santorra-Bentler chi-square difference test; $\Delta\chi^2$ (10) = 13.03. $p$ = .22.) All associations remained significant and of the same size as in the base model.

## Discussion

The main objective for this study was to examine the longitudinal associations between peer victimization, suicide ideation, and alcohol use in adolescence, to clarify which developmental models (i.e., self-medication, secondary mental disorder, bidirectional, or the common factor) were best supported empirically. A general cross-lagged approach was used, which allowed us to test simultaneously all the paths proposed by the four models. Results revealed a significant developmental sequence where higher peer victimization at 13 years was associated with the presence of suicide ideation at 14 years, which in turn was associated with higher alcohol use frequency at age 15 years. Thus, the adolescents who report greater peer victimization in early adolescence were more likely to report not only suicide ideation 1 year later but also higher alcohol consumption at 15 years, indirectly through their increased likelihood of suicide ideation. These results support previous findings showing that peer victimization predicted alcohol use, supporting the self-medication model, and add to these by clarifying the directionality between suicide ideation and alcohol use over 1 year across this developmental period.

The finding that suicide ideation preceded greater substance use is in disagreement with a number of prospective studies suggesting the opposite direction in association [21–23,25,26]. Discrepancies across studies could be attributed to the fact that these studies did not examine bidirectional effects or focused on different developmental periods. For example, several studies included participants who were all aged >15 years [21,25,26], whereas others combined the results of adolescents of different age groups [22,23] (i.e., 12- to 18-year-olds and 11- to 14-year-olds, respectively). It is possible that the direction of the effects changes from early to late adolescence to adulthood, becoming bidirectional over that time period. Hence, suicide ideation in early adolescence could be associated longitudinally with greater substance use in middle adolescence—a period where onset of alcohol use and its prevalence substantially increases—whereas greater substance use in middle adolescence—once a certain level (quantity/frequency) of alcohol use is reached that could potentially have neurotoxic effects on cognition and problem-solving abilities—could, in turn, be associated with higher odds of suicide ideation in late adolescence or early adulthood in accordance with a developmental cascade model [35]. This could also explain why results supporting the self-medication model seem to be age specific, with no significant associations found between suicide ideation at 13 years and alcohol use frequency at 14 years or between peer victimization at 14 years and suicide ideation at 15 years. Therefore, associations between these factors should be examined repeatedly across development in

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accordance with a transactional model (i.e., with all variables having reciprocal effects on one another over time).

## Strengths and limitations

It is important to note that our findings come from a community sample of adolescents. To our knowledge, this is the first study to show significant associations between these three factors, and it does so using a conservative analytical approach, which controlled for bidirectional and autoregression effects. Nonetheless, future studies could be designed to circumvent the following limitations.

First, although significant cross-lagged effects were found, the strength of their contribution to each factor was low, suggesting that they only accounted for a small part of the variance in suicide ideation and in alcohol use. The greatest part of the variance was attributed to the autoregressed effects, which was to be expected. This suggests that a number of other developmental and environmental factors may be implicated in these behaviors (e.g., parental monitoring, temperament, and friendship [32,36,37]). Second, the suicide ideation variable was dichotomized (i.e., presence/absence) because of high skewness at this age, reducing variance and potentially contributing to the loss of information. Third, the use of self-report and single items to assess alcohol use and suicidal ideation could be another limitation. However, single-item self-report measures of substance use and suicide ideation are commonly used and have been shown to be a valid source for such sensitive questions [29,38,39], particularly when confidentiality is guaranteed, as was the case in the present study. For example, some studies have shown that by guaranteeing confidentiality prevalence of self-reported suicidal thoughts averages 8% but plummets to 1% when confidentiality is not guaranteed [29]. Fourth, self-report biases could have played an important role in the victimization variable which consists of a social interaction; therefore, multiple sources of information would have been preferable to get a more reliable image of the victimization occurring [40]. Fifth, a relatively small sample size constrained the structural equation modelling to be as parsimonious as possible, to be sufficiently powered to detect small–moderate effects, reducing the chance of type 2 errors (Supplementary Material). Finally, although these results clarify the directionality of effects, they do not prove causality. Experimental studies are therefore required to better understand factors affecting this sequence. Such questions could be addressed within the context of prevention studies.

Despite their limitations, results suggest that peer victimization is an important social experience that could lead to important internalized and externalized problems. Accordingly, it will be important that future studies examine the possible mediating role of negative self-perceptions and depressed mood in the pathway from peer victimization and suicide ideation [36,37]. The same could be said of a possible moderating mechanism, such as protective friendships [32]. Furthermore, although we have shown suicidal ideation to be associated with subsequent alcohol use, it would be important to examine if the same association would also be found with actual suicidal behaviors. Future studies are also needed to replicate results across different samples and longer developmental periods. If replicated, findings suggest the need for developing and implementing early prevention and intervention programs for victimized youth. This could be done by reducing victimization in

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preadolescence or by offering greater support to victimized youth in the first year after grade school.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

The authors are grateful to their partner, the Institut de la Statistique du Québec. They thank all the parents and children for their generous participation in the study.

The first draft was written by Shawn Marschall-Lévesque.

**Funding Sources**

This study was supported by an award to SML from the Fonds Monique Gaumond pour la recherche en maladies affectives and funded by the Canadian Institutes for Health Research via a fellowship and Grants MOP 44072 and MOP-97910; the Fonds de Recherche en Santé du Québec via fellowships and Grants 981055 and 991027; the Social Sciences and Humanities Research Council of Canada by Grants 839-2000-1008 and 410-99-1048; and the Fonds de recherche du Québec–Société et culture Grants 2002-RS-79238 and 2009-RG-124779.

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## IMPLICATIONS AND CONTRIBUTION

Studies show that adolescent peer victimization, suicidal ideation, and substance use are associated, at least cross-sectionally and prospectively. This study investigated their longitudinal associations across early adolescence to clarify the directionality, highlighting the underlying model (self-medication), and possible targets for prevention.

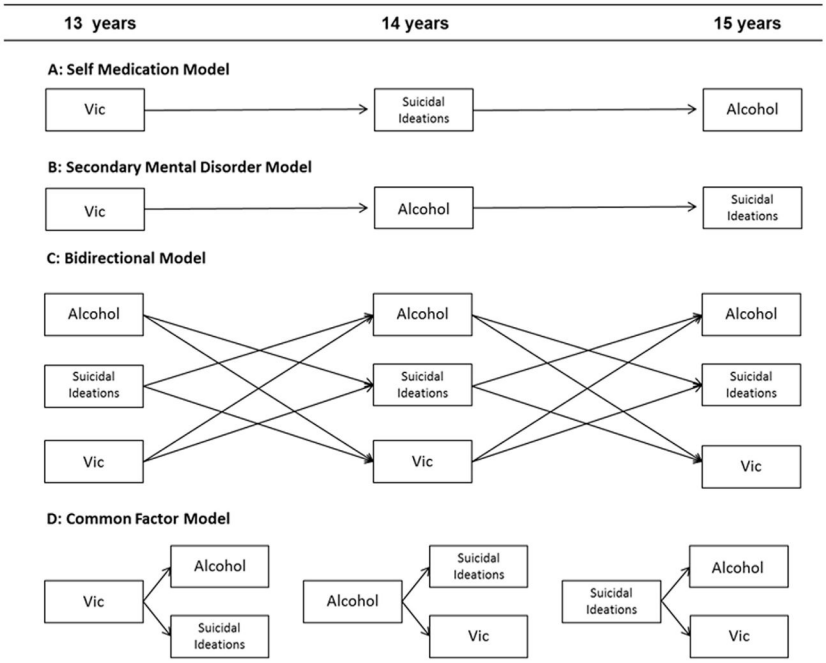


**Figure 1.**

Longitudinal models of the relations between peer victimization, alcohol use, and suicidal ideation.



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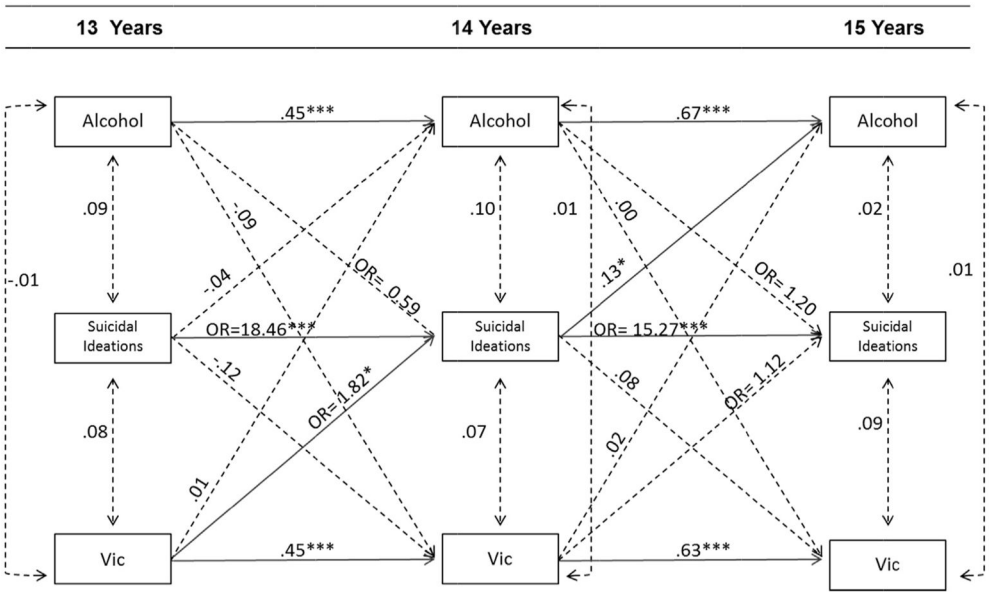


**Figure 2.**

Standardized results for the cross-lagged model. Model fit: $\chi^2$/df = 2.17, RMSEA = .069, CFI = .92, SRMR = .05. $^{*}p < .05$; $^{***}p < .001$. Only standardized outcomes are provided; unless otherwise indicated, all coefficients are standardized betas; dashed lines represent nonsignificant paths and solid lines represent significant paths. OR = odds ratio.

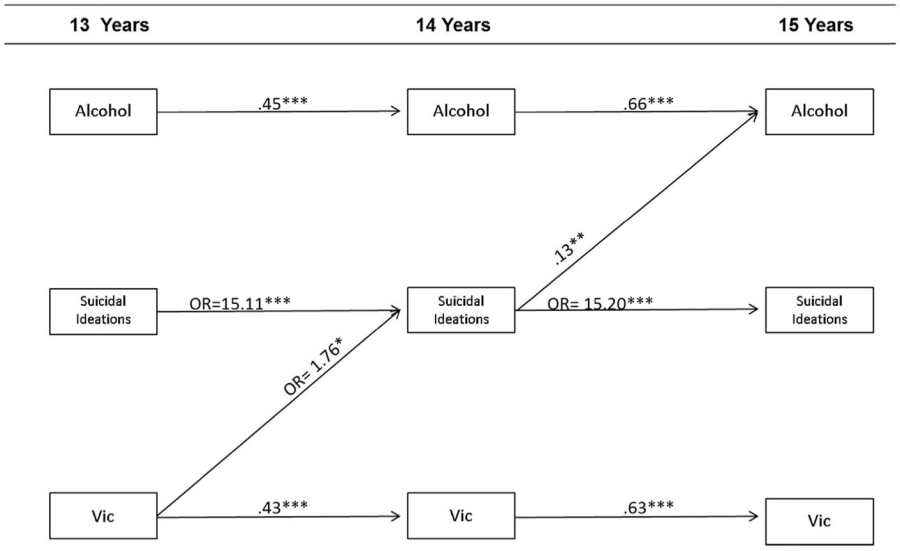


**Figure 3.**

Simplified model with nonsignificant paths trimmed or constrained to zero. Model fit: $\chi^2$/df = 1.92, RMSEA = .06, CFI = .91, SRMR = .06. $^{*}p < .05$; $^{**}p \leq .01$; $^{***}p < .001$. Only standardized outcomes are provided; unless otherwise indicated, all coefficients are standardized betas.



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## Table 1

Sociodemographic characteristics of the original 572 families

| Sociodemographic characteristic | Percentage of sample |
|---|---|
| Ethnic origin | |
| European | 72.6 |
| First nations | 3.8 |
| Other background (Asian and African) | 23.6 |
| Family annual income | |
| <30,000$ | 29.0 |
| 30,000$–59,999$ | 41.7 |
| ≥60,000$ | 29.3 |

Twenty-seven percent of our sample was living in a low-income family according to the Canadian revenue agency.

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**Table 2**

Bivariate correlation matrix for all model variables

| | Suic 13 | Suic 14 | Suic 15 | Vic 13 | Vic 14 | Vic 15 | Alc 13 | Alc 14 | Alc 15 | Mother's education |
|---|---|---|---|---|---|---|---|---|---|---|
| Suic 13 | 1 | | | | | | | | | |
| Suic 14 | .46** | 1 | | | | | | | | |
| Suic 15 | .40** | .46** | 1 | | | | | | | |
| Vic 13 | .07 | .22** | .10* | 1 | | | | | | |
| Vic 14 | −.10 | .11 | .08 | .44** | 1 | | | | | |
| Vic 15 | −.06 | .15* | .14* | .55** | .64** | 1 | | | | |
| Alc 13 | .10 | −.10 | .08 | −.01 | −.11 | .02 | 1 | | | |
| Alc 14 | .01 | .01 | .05 | .02 | −.04 | −.03 | .44** | 1 | | |
| Alc 15 | .10 | .15* | .11 | −.01 | .02 | .02 | .35** | .66** | 1 | |
| Mother's education | .18* | .11 | .05 | .05 | −.05 | −.03 | .01 | −.01 | .03 | 1 |
| Sex | .10 | .08 | .21* | .08 | .07 | .11 | .08 | .11 | .03 | .13 |

Boys were coded as 0, and girls were coded as 1.

* $p < .05$;

** $p < .01$.

Alc = alcohol frequency; Suic = suicidal ideation; Vic = victimization.