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Original Research Article

The Relationship Between Pain Severity and Alcohol Use Among School-Aged Children and Adolescents: The Moderating Role of Drinking Motives

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Abstract

Objective. Evidence from adult samples suggests a co-occurrence between pain and alcohol abuse. However, studies in adolescents are scarce and results are inconsistent, with some studies observing heightened and others observing reduced alcohol consumption in adolescents suffering from pain. We hypothesized that in adolescents the association between pain and alcohol use will be moderated by drinking motives.

Methods. Data from a large representative sample of Flemish school children and adolescents (N = 10,650, 50.8% boys, age range = 10–21 years, M_{age} = 14.33 years) were collected as part of the World Health Organization collaborative Health Behaviour in School-Aged Children (HBSC) survey. Pain severity was graded based on a pediatric pain classification system that accounts for both pain intensity and disability. Alcohol consumption was operationalized using two variables: frequency of drinking and drunkenness. The Drinking Motives Questionnaire–Revised was used to capture drinking motives; it assesses four motive categories (enhancement, coping, social, and conformity).

Results. Findings indicated that higher pain severity was associated with greater frequency of alcohol use and drunkenness. However, drinking motives moderated this association. The positive association between pain severity and drinking frequency was stronger in case of high conformity motives. Likewise, the association between pain severity and drunkenness frequency was stronger at high levels of conformity motives and reached significance only at high levels of coping motives.

Conclusions. Our findings suggest that specific drinking motives are linked to problematic alcohol use in adolescents with pain. Future studies using a longitudinal design are needed to draw conclusions about direction of effects.

Key Words. Pediatric Pain; Chronic Pain; Drinking Motives; Alcohol; Adolescents

Introduction

Pain is a common experience in children and adolescents [1,2] that may lead to significant limitations in daily activities [3–5]. In addition, adolescence is a key period for the initiation of regular alcohol use [6] and the development of alcohol use disorders [7]. Critically, substance abuse may contribute to deleterious outcomes in the context of pain [8–10]. Accumulating evidence indicates a co-occurrence of pain and problematic alcohol

consumption in adults [11–13] and recently in adolescents [8,14]. These findings are alarming as alcohol abuse in adolescence may likewise contribute to impairments in brain development, neurocognitive functioning, and educational outcomes [15–17].

To date, evidence linking pain problems with alcohol use in adolescence is preliminary and findings remain mixed, with one investigation actually reporting lower alcohol consumption among treatment-seeking adolescents with pain [18]. As a potential explanation for such mixed findings, we propose that the association between pain and alcohol use might be moderated by drinking motives, which are the most proximal predictors of drinking behavior [19,20]. Drinking motives are categorized along two dimensions, depending on 1) whether individuals aim to obtain positive or avoid negative outcomes and 2) whether internal vs external rewards are pursued [21]. This results in four motive categories: enhancement (positive internal; e.g., drinking to get "high"), social (positive external; e.g., drinking to enjoy a party), coping (negative internal; e.g., drinking to forget problems), and conformity (negative external; e.g., drinking to avoid social exclusion) motives [22].

Coping motives may be particularly relevant for children and adolescents who must deal with pain and associated disability and distress. Specifically, alcohol consumption may be used as a (maladaptive) coping strategy, as alcohol has pain-dampening [23] and mood-enhancing [24] effects. In line with this, previous research has identified self-medication of pain symptoms with alcohol among individuals with pain problems [25]. Accordingly, pain may be associated with greater alcohol use particularly among youth who drink to cope with problems, whereas this association may be less pronounced for youth who drink for other reasons, for example, to enjoy social events.

The current study examined the relationship between pain severity, drinking motives, and alcohol consumption in a large representative sample of Flemish-speaking school-aged children and adolescents. The investigation of nonclinical samples might be of particular relevance in this context in order to allow for early identification of risk populations and targeted intervention before pain and associated problems become more difficult to manage. Specifically, we evaluated whether drinking motives moderated the association between pain severity and frequency of alcohol use and drunkenness. We hypothesized that greater pain severity would be associated with more frequent alcohol consumption and drunkenness, particularly among youth who endorsed a higher level of coping motives. Moderation by other drinking motives was also explored.

Methods

Participants

Data for the present study were derived from the Belgian-Flemish version of the 2009–2010 survey of Health Behaviour among School-aged Children (HBSC), which is a four-year cross-sectional research study conducted in collaboration with the World Health Organization (WHO) Regional Office for Europe; the study addresses young people's health and well-being, health behavior, and social context [26–28]. The HBSC study used the cluster sampling (school or classes) method; samples were stratified to ensure representativeness by age, sex, and school type. In addition to core HBSC questions related to pain, the 2009–2010 survey for the Flemish speaking region of Belgium included items assessing pain-related characteristics (see the *Measures* section). Portions of pain-related data collected in this sample (e.g., frequency and location of pain, health care utilization) have previously been published in a paper regarding association between pain and school-related variables [29]. More details on study procedure can be found in the standardized international research protocol (see http://www.hbsc.org/publications/international/) [26]. The survey was approved by the ethics committee of the University Hospital of Ghent, project 2009/662.

One hundred and forty primary Flemish schools representing grades 5 and 6 and 270 secondary Flemish schools representing grades 7 through 12 were invited to participate. Fifty-six primary schools (40%) and 66 secondary schools (24%) agreed to participate, and 11,726 children and adolescents were approached. Of these, 291 (2.5%) children/adolescents did not participate because of school absence due to illness when questionnaires were administered, 177 (1.5%) did not participate because parents refused child participation, and 143 (1.2%) did not participate for another reason (e.g., doing an internship, being suspended). Further, 295 (2.5%) of the questionnaires were returned uncompleted owing to lack of time to fill out the questionnaires during school hours and 170 (1.4%) were considered invalid (i.e., due to missing basic sociodemographic information, inconsistent responding, or leaving the majority of the items blank), resulting in a final sample of 10,650 children and adolescents who provided valid data (91% of those invited).

Measures

Sociodemographic Measures

Information about age, sex, school grade, family situation, and socioeconomic status was collected at the time of questionnaire administration. Family situation was coded as "two-parent family," "one-parent family," "parent and stepparent," or "other." Family affluence was assessed with the Family Affluence Scale (FAS) as an indicator for individual socioeconomic status (SES) [27,30]. The FAS is a composite indicator of self-reported SES comprising four items that address family assets or conditions that indicate wealth: "Does your family own a car, van or truck?" (0 = none, 1 = one, 2 = two or more); "Do you have your own bedroom for

yourself?" (0 = no, 1 = yes); "During the past 12 months, how many times did you travel away on holiday with your family?" (0 = not at all, 1 = once, 2 = twice, 3 = more than twice); "How many computers does your family own?" (0 = none, 1 = one, 2 = two, 3 = more than two). Responses are summed on a 1 to 10 scale, with higher scores indicating greater affluence. The score (0–9) was divided into tertiles (low, medium, high FAS score).

Pain Severity (Pain Grades)

Pain severity was classified into one of five levels (pain grades 0–IV) assessed with a five-item version of the seven-item Graded Chronic Pain Scale (GCPS) developed by Von Korff et al. [31]. Two items were discarded due to not being suitable for children or adolescents (see below). Compared with other pain scales, the GCPS has the advantage of taking into account not only pain intensity but also pain-associated disability, with high disability corresponding to higher pain severity (grade II and IV) regardless of pain intensity. The validity of the original GCPS in the general population and chronic pain samples has previously been demonstrated [32–35]. Most importantly, higher pain grades are associated with more deleterious outcomes in other measures of pain severity (e.g., frequency of pain, health care utilization) and also with emotional distress and poorer overall functioning [29,31,33,36–38]. Further, the applicability of the GCPS to pediatric samples has been supported by two studies using slightly modified versions of the original scale [37,38].

The first three items yielded mean pain intensity calculated as the average of current pain intensity and worst and average pain intensity during the past six months, each rated on a 0 to 10 scale with the end points of "no pain" (0) and "a lot of pain" (10; Cronbach's $\alpha = 0.83$). Mean pain intensity was categorized into low (<5) vs high (≥ 5) pain according to the original GCPS. The number of disability days was indexed by one item assessing the number of days in the last six months that the child/adolescent had been kept from doing his/her usual activities. The number of disability days (0–180) was classified in disability points according to Von Korff et al. (i.e., 0–6 days = 0 points, 7–14 days = 1 point, 15–30 days = 2 points, >31 days = 3 points) [31]. Finally, pain interference was assessed with one instead of the three original items. In the original GCPS, the three questions refer to pain interfering with daily/usual activities, recreational/social and family activities, and work (including housework). As the majority of children/adolescents are not employed and the remaining two items substantially overlap, only the item assessing interference with daily/usual activities was used. Thus, children/adolescents were asked to rate the degree to which pain interfered with their daily/usual activities in the past six months using a 0 to 10 scale ranging from "no interference" (0) to "unable to carry on any activities" (10). The degree of interference was classified into disability points according to the original procedure (i.e., scores $<3 = 0$ points, scores ≥ 3 and $<5 = 1$ point, scores ≥ 5 and $<7 = 2$ points, and scores $\geq 7 = 3$ points). Based on the mean pain intensity and total disability points (i.e., calculated based on disability days and interference), pain severity was classified according to five grades:

Grade 0: no pain problem in the prior six months

Grade I: low pain intensity (intensity index <5/10) and low disability (<3 disability points)

Grade II: high pain intensity (intensity index $\geq$5/10) and low disability (<3 disability points)

Grade III: moderate disability (3–4 disability points), regardless of pain intensity

Grade IV: high disability (5–6 disability points), regardless of pain intensity

Alcohol Consumption

Alcohol consumption was operationalized using two variables: drinking frequency and drunkenness frequency. These variables were assessed by two standard items referring to consumption in the last 30 days that have been employed in numerous national and international drug use surveys [39–41].

The association between age and drinking was analyzed by using an additional item referring to the general frequency of alcohol consumption.

Drinking Frequency
Drinking frequency was assessed using the following item: "On how many occasions (like going out, at a party...) during the last 30 days did you drink alcohol?" Responses were made on a seven-point scale ranging from "never" (1) to "40 times or more" (7).

Drunkenness Frequency
Children and adolescents were asked "On how many occasions (like going out, at a party...) during the last 30 days were you drunk?" Answers were made on the same seven-point scale as for drinking frequency, ranging from "never" (1) to "40 times or more" (7).

General Drinking Frequency
Children and adolescents were asked "How often do you drink alcohol, e.g., wine, liquor, beer, ...? Also take into account the times you drank only a little bit." Answers were made on a five-point scale ranging from "never" to "daily" separately for the following types of drinks: "beer," "wine," "liquor," "alcopops," "aperitif," and "other drinks containing alcohol." General drinking frequency was determined referring to the most frequently consumed type of drink.

Drinking Motives

For children and adolescents who reported any alcohol consumption in the past 12 months, drinking motives were assessed using the Drinking Motive Questionnaire Revised–Short Form (DMQR-SF) [42]. This 12-item questionnaire has been developed as a shorter version of the original 20-item DMQ-R [22]. The DMQR-SF has acceptable internal consistency (Cronbach's $\alpha = 0.70$–0.83) and good concurrent validity with the DMQ-R [42]. It assesses the four categories of drinking motives described above: enhancement (positive internal; e.g., "to get high"), social (positive external; e.g., "because it helps you enjoy a party"), coping (negative internal; e.g., "to forget about your problems"), and conformity (negative external; e.g., "so you won't feel left out"). The three items reflecting each motive category are rated on a five-point scale ranging from "(almost) never" (1) to "(almost) always" (5) and averaged. Cronbach's α for the four scales ranged from 0.75 to 0.88 in this study.

Statistical Analysis

Data were analyzed using SPSS (version 20.0). Significance levels were set at a P value of less than 0.05. First, descriptive statistics and bivariate associations were examined. Normality of dependent variables was checked by visual inspection of histograms and Q-Q plots of the residuals. Then, the association between pain and alcohol use was evaluated first generally with a contingency table analyzing the association between pain grades and alcohol use vs no use and then more specifically with univariate analyses of variance (ANOVAs) using pain grades as the independent variable and drinking and drunkenness frequency as dependent variables. Post hoc pairwise comparisons with a Bonferroni correction were used to examine differences among the five pain grades. To enhance interpretability of results, effect sizes (partial eta squared [η^2_p]) for significant group comparisons are reported (0.01 = small, 0.06 = medium, and 0.14 = large effect) [43].

To investigate the moderating influence of drinking motives, the above univariate ANOVAs were repeated with the addition of the four drinking motives (coping, enhancement, social, and conformity) as main effects, as well as their interactions with pain grades. Age, sex, and SES were controlled in these analyses due to observed associations between these demographic variables and alcohol use. Significant interactions were probed at high and low levels of a given motive (using 1 SD above and below the means, respectively) using procedures outlined by Holmbeck [44]. Because drinking motives were only assessed for youth who reported any alcohol use, these analyses utilized a smaller sample than the ANOVAs evaluating the relationships between pain grades and drinking behavior. Cases with missing data were excluded from analyses.

Results

Descriptive Statistics

Demographic Variables

The sample consisted of an equal distribution of boys (50.8%) and girls (49.2%). Mean age was 14.33 years (SD = 2.44 years). Approximately 15% of children and adolescents were recruited from the fifth grade, 11% from the sixth grade, 15% from the seventh grade, 13% from the eighth grade, 12% from the ninth grade, 13% from the 10th grade, 13% from the 11th grade, and 9% from the 12th grade. The majority of children and adolescents surveyed (66%) grew up in a two-parent family. About half of the children and adolescents (51%) reported medium family affluence, 21% reported low affluence, and 27% reported high affluence.

Alcohol-Related Variables

Visual inspection of histograms and Q-Q plots of the residuals confirmed that both drinking and drunkenness frequency were normally distributed.

Overall, 62.9% of the sample reported alcohol consumption in the past 12 months. Associations between age group (10–12 years, 13–15 years, 16–18 years, 19–21 years) and general frequency of alcohol use as well as pain grade are displayed in Table 1. Mean scores, standard deviations, and intercorrelations for the alcohol-related variables (drinking and drunkenness frequency in the last 30 days and drinking motives) are shown in Table 2.

Pearson correlation analyses indicated that drinking frequency and drunkenness frequency were positively correlated with each other ($r = 0.63$, $P < 0.001$) and with all four drinking motives ($r = 0.25$ to 0.53, all $P < 0.001$). All four drinking motives were also positively correlated with one another ($r = 0.45$ to 0.77, all $P < 0.001$). Further, child/adolescent age was positively associated with endorsement of all four drinking motives ($r = 0.13$ to 0.42, all $P < 0.001$) and with more frequent alcohol use and drunkenness ($r = 0.31$, both $P < 0.001$). Finally, boys reported more frequent alcohol use and drunkenness than girls, as well as stronger endorsement of all drinking motives (all $t \geq 8.99$, $P < 0.001$), except for coping motives ($t = 1.11$, ns).

Pain Grades

In terms of pain severity, 95% of children/adolescents (all but 485 who had missing values) were classified into one of the five GCPS pain grades: grade 0: pain free (N = 1,848, 18.2%); grade I: low pain intensity–low disability (N = 4,987, 49.1%); grade II: high pain intensity–low disability (N = 1,941, 19.1%); grade III: moderate

Table 1 Pain grade and general frequency of alcohol use in relation to age group

	Age 10–12 y No. (%)	Age 13–15 y No. (%)	Age 16–18 y No. (%)	Age 19–21 No. (%)	Chi-square (df)	Effect size (Cramer's V)
Pain grade†					67.69* [12]	0.05
Grade 0	699 (37.9)	651 (35.3)	467 (25.3)	29 (1.6)		
Grade I	1,638 (32.9)	1,762 (35.4)	1,512 (30.3)	70 (1.4)		
Grade II	663 (34.2)	714 (36.8)	536 (27.6)	26 (1.3)		
Grade III	382 (35.0)	358 (32.8)	330 (30.2)	21 (1.9)		
Grade IV	75 (25.5)	84 (28.6)	123 (41.8)	12 (4.1)		
Frequency of alcohol use‡					3,504.93*[12]	0.33
Never	2,294 (58.7)	1,174 (30.0)	404 (10.3)	39 (1.0)		
Rarely	1,104 (34.3)	1,440 (44.7)	640 (19.9)	35 (1.1)		
Every month	116 (7.8)	589 (39.7)	747 (50.4)	30 (2.0)		
Every week	55 (3.2)	452 (26.2)	1168 (67.7)	51 (3.0)		
Every day	21 (10.3)	52 (25.5)	113 (55.4)	18 (8.8)		

*$P < 0.0005$.
†For N = 498 missing information.
‡For N = 108 missing information.

Table 2 Means, standard deviations, and Pearson correlations

	M (SD)	N	2	3	4	5	6
1. Alcohol frequency	1.98 (1.36)	10,491	0.63*	0.35*	0.25*	0.53*	0.53*
2. Drunkenness frequency	1.27 (.76)	10,478	—	0.42*	0.30*	0.51*	0.46*
3. Coping motives	1.33 (.72)	6,579		—	0.48*	0.54*	0.45*
4. Conformity motives	1.26 (.62)	6,544			—	0.48*	0.46*
5. Enhancement motives	1.80 (.94)	6,568				—	0.77*
6. Social motives	2.06 (1.16)	6,569					—

*$P < 0.0001$.

disability, regardless of pain intensity (N = 1,095; 10.8%); grade IV: high disability regardless of pain intensity (N = 294, 2.9%).

Pain Severity and Its Relationship to Alcohol Use and Drinking Motives

There was an association between alcohol use (vs no use) and pain grade (χ^2 (4) = 131.43, $P < 0.0001$), with the percentage of children and adolescents reporting alcohol use increasing with pain grades (grade 0: 52.6%; grade I: 63.9%; grade II: 66.1%; grade III: 68.7%; grade IV: 76.8%). As shown in Table 3, results from ANOVAs indicated that higher pain grades were associated with greater frequency of alcohol use and drunkenness. Specifically, contrasts revealed that alcohol frequency was significantly higher with each elevation in pain grade. Similar but less pronounced findings were observed for drunkenness. Specifically, children/adolescents classified as pain grade IV reported significantly more frequent drunkenness than those classified as grade III, who, in turn, reported more drunkenness than those classified as grades 0 and I, but not those in grade II. Children/adolescents in grade I and II also did not differ from those classified as grade 0.

Further, examination of the relationship between pain grade and drinking motives revealed that increasing pain grade was generally associated with higher levels of all four drinking motives, although the pattern of differences varied slightly between motive categories. Specifically, conformity motives in children/adolescents classified as pain grade IV were higher compared with those classified as pain grades III, II, I, and 0, who all reported similar levels of conformity motives, except for those in pain grade I, who reported slightly lower conformity motives than those in pain grade 0. Coping motives significantly increased with each elevation in pain grade, except between pain grades II and III, which did not differ from each other. Enhancement motives were significantly higher for children/adolescents in grade IV than for those in grades III, II, I, and 0, who reported comparable levels, except for those in grade II, who reported higher levels than those in grade I. Finally, social motives in grade IV were significantly higher compared

Table 3 Alcohol consumption and drinking motives in relationship to pain grade

	Grade 0 M (SD)	Grade I M (SD)	Grade II M (SD)	Grade III M (SD)	Grade IV M (SD)	*F* test	Effect size (Partial eta squared)
Alcohol frequency	1.81 (1.36)[a]	1.96 (1.30)[b]	2.03 (1.37)[c]	2.13 (1.40)[d]	2.63 (1.78)[e]	28.84*	0.01
N	1,770	4,953	1,926	1,084	291		
Drunkenness frequency	1.26 (0.81)[a]	1.23 (0.62)[a]	1.29 (0.75)[a, b]	1.34 (0.88)[b]	1.67 (1.42)[c]	28.65*	0.01
N	1,772	4,940	1,926	1,082	288		
Conformity motives	1.30 (0.72) [a]	1.21 (0.53)[b]	1.26 (0.62)[a]	1.26 (0.66)[a]	1.43 (0.89)[c]	9.70*	0.01
N	946	3,075	1,252	744	225		
Coping motives	1.31 (0.73)[a]	1.25 (0.58)[b]	1.42 (0.81)[c]	1.40 (0.80)[c]	1.64 (1.08)[d]	27.70*	0.02
N	942	3,094	1,261	751	226		
Enhancement motives	1.78 (0.99)[a]	1.76 (0.89)[a]	1.85 (0.95)[b]	1.79 (0.98)[a]	2.12 (1.15)[c]	8.57*	0.01
N	943	3,092	1,257	748	225		
Social motives	2.06 (1.24)[a]	2.05 (1.14)[a]	2.06 (1.15)[a]	2.06 (1.17)[a]	2.38 (1.24)[a]	4.24**	0.003
N	947	3,088	1,257	746	225		

Different indices indicate significant differences between groups.
*$P < 0.0001$.
**$P < 0.005$.

with all other grades. In sum, alcohol consumption, drunkenness, and drinking motives were found to be generally greater among youth with higher pain severity, with those in pain grade IV consistently reporting the highest levels compared with youth in lower pain grades.

The Moderating Role of Drinking Motives in the Relationship Between Pain Severity and Alcohol Use

Drinking Frequency

Examination of drinking frequency revealed a significant interaction between pain grade and conformity motives ($F(4, 6{,}130) = 2.61$, $P < 0.05$), beyond the impact of participant age ($F(1, 6{,}130) = 589.82$, $P < 0.0001$) and gender ($F(1, 6{,}130) = 14.94$, $P < 0.0001$), indicating that the association between pain grade and drinking frequency varied with different levels (i.e., low vs high) of conformity motives to consume alcohol. No interactions with other motives (i.e., enhancement, social, and coping) were observed (all $F \leq 2.05$, ns).

Follow-up analyses indicated that the positive association between pain severity and frequency of alcohol use was stronger when conformity motives were high, with differences being most pronounced for children/adolescents classified as pain grade IV ($F(4, 6{,}176) = 12.19$, $P < 0.001$). Indeed, contrast analyses of means estimated at one SD above the mean on conformity motives indicated that frequency of alcohol use was significantly higher for children in pain grade IV compared with those in grades 0, I, II, or III, who reported comparable frequency of alcohol use ($M_{grade0} = 2.82 = M_{grade1} = 2.82 = M_{grade2} = 2.87 = M_{grade3} = 2.85 < M_{grade4} = 3.59$) (see Figure 1). At low levels of conformity motives (1 SD below the mean), the association between pain grade and alcohol use was still significant but less pronounced ($F(4, 6{,}176) = 4.00$, $P < -0.005$); contrast analyses indicated that alcohol use significantly increased from grade 0 to grade I and from grade II to grade III, but did not differ between grade III and grade IV ($M_{grade0} = 1.95 < M_{grade1} = 2.20 = M_{grade2} = 2.21 < M_{grade3} = 2.27 = M_{grade4} = 2.28$) (see Figure 1).

Drunkenness Frequency

Examination of drunkenness frequency revealed that pain grade likewise interacted with conformity motives ($F(4, 6{,}127) = 21.62$, $P < 0.001$) as well as coping motives ($F(4, 6{,}127) = 3.95$, $P < 0.005$), beyond the impact of participant age ($F(1, 6{,}127) = 58.86$, $P < 0.0001$) and gender ($F(1, 6{,}127) = 21.49$, $P < 0.0001$). No interaction with social or enhancement motives was observed (all $F \leq 2.21$, ns).

Follow-up analyses at high and low values of conformity motives suggested that the association between pain severity and drunkenness frequency was stronger at high levels of conformity motives ($F(4, 6{,}176) = 48.23$, $P < 0.001$) compared with low levels of conformity motives ($F(4, 6{,}176) = 4.85$, $P < 0.005$) (see Figure 2). Contrast analyses indicated that, at high levels of conformity motives, children in grade I reported less drunkenness frequency than children/adolescents in grade 0, yet drunkenness frequency increased from grade II to III and particularly from grade III to IV ($M_{grade0} = 1.79 > M_{grade1} = 1.52 = M_{grade2} = 1.62 < M_{grade3} = 1.77 < M_{grade4} = 2.45$) (see Figure 3). At low levels of conformity motives, frequency of drunkenness significantly increased from grade 0 to grade I and II, but did not differ between grades II and III and significantly decreased from grade III to IV ($M_{grade0} = 1.11 < M_{grade1} = 1.21 < M_{grade2} = 1.26 = M_{grade3} = 1.19 > M_{grade4} = 0.95$) (see Figure 2).

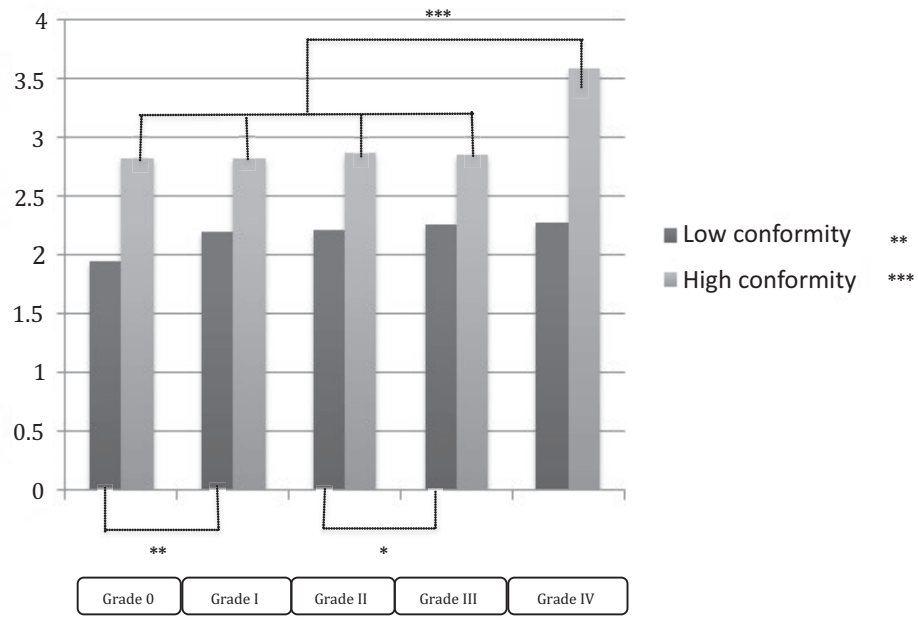

Figure 1 Mean frequency of alcohol use as a function of pain grade (0–IV) and low (1 SD below the mean) and high (1 SD above the mean) levels of conformity motives. *$P < 0.05$; **$P < 0.005$; ***$P < 0.001$.

Similar findings were observed for the interaction between pain grade and coping motives (see Figure 3). Specifically, findings indicated that the association between pain severity and drunkenness frequency was significant only at high levels of coping motives ($F(4, 6{,}203) = 28.47$, $P < 0.001$). Contrast analyses indicated that at high levels of coping motives, drunkenness frequency decreased from grade 0 to grade I; yet, from grade II onwards, drunkenness frequency steadily increased with each elevation in pain grade ($M_{grade0} = 1.99 > M_{grade1} = 1.68 < M_{grade2} = 1.73 < M_{grade3} = 1.86 < M_{grade4} = 2.24$) (see Figure 3). There was no association between pain grade and drunkenness frequency at low levels of coping motives ($F(4, 6{,}203) = 1.99$, ns; $M_{grade0} = 0.99 = M_{grade1} = 1.11 = M_{grade2} = 1.08 = M_{grade3} = 1.03 = M_{grade4} = 0.99$) (see Figure 3).

Discussion

The present study aimed to examine the relationship between pain severity, drinking motives, and alcohol consumption in a large representative sample of Flemish-speaking school-aged children and adolescents. More specifically, we examined the moderating role of specific drinking motives in the association between pain severity and alcohol consumption (drinking frequency and drunkenness frequency). Based on observations that alcohol use among pain patients is often motivated by the pursuit of pain relief [25], we hypothesized that higher pain severity would be linked to higher alcohol consumption particularly among adolescents who endorsed a high level of coping motives—drinking to achieve relief of an internal negative state.

Pain severity was classified into one of five levels (pain grades) based on a slightly modified version of the Graded Chronic Pain Scale developed by Von Korff et al. [31]. Although the majority of children and adolescents in our sample reported either no pain problems (grade 0) or only slightly disabling pain (grades I and II), nearly 15% were classified as grade III or IV, suggesting that a substantial proportion of our sample was suffering from moderately to severely disabling pain. This observation is in accordance with findings reported by Huguet and Miró [37].

In line with expectations, greater pain severity was associated with higher drinking and drunkenness frequency. This observation is in line with several other studies of adults [11–13] and adolescents [8,14], which report greater alcohol consumption among individuals suffering from pain in comparison with pain-free counterparts. Likewise, respective endorsement of drinking motives in the current study—with social motives reported most frequently, followed by enhancement, coping, and conformity motives—was comparable with studies of adolescent samples across multiple European and North American countries [22,45–48]. Thus, despite subtle differences in drinking culture between countries—for example, greater acceptance of frequent moderate consumption in southern Europe vs heavy drinking on special occasions in northern Europe [49]—it can be assumed that our findings are not specific to Belgium

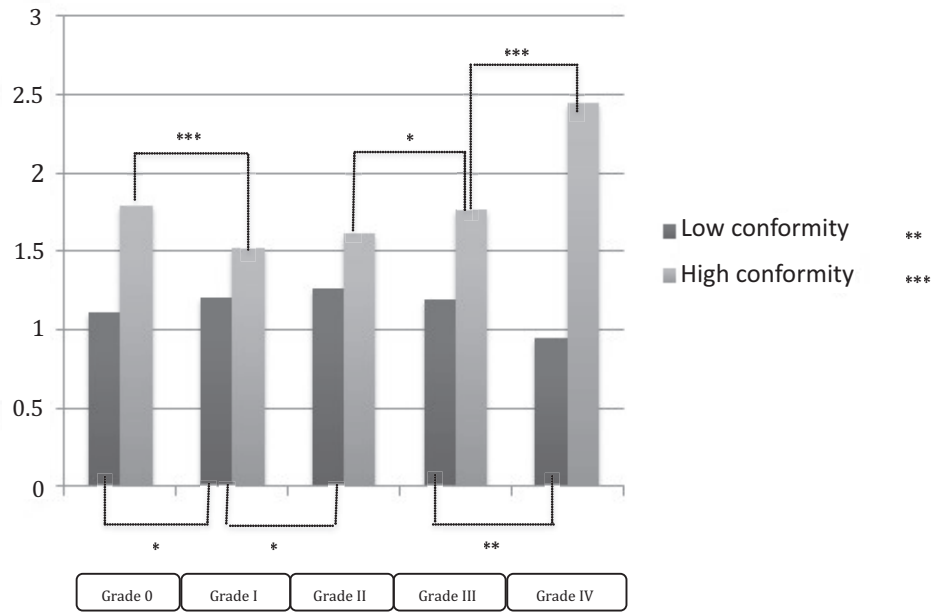

Figure 2 Mean instances of drunkenness as a function of pain grade (0–IV) and low (1 SD below the mean) and high (1 SD above the mean) levels of conformity motives. *$P < 0.05$; **$P < 0.005$; ***$P < 0.001$.

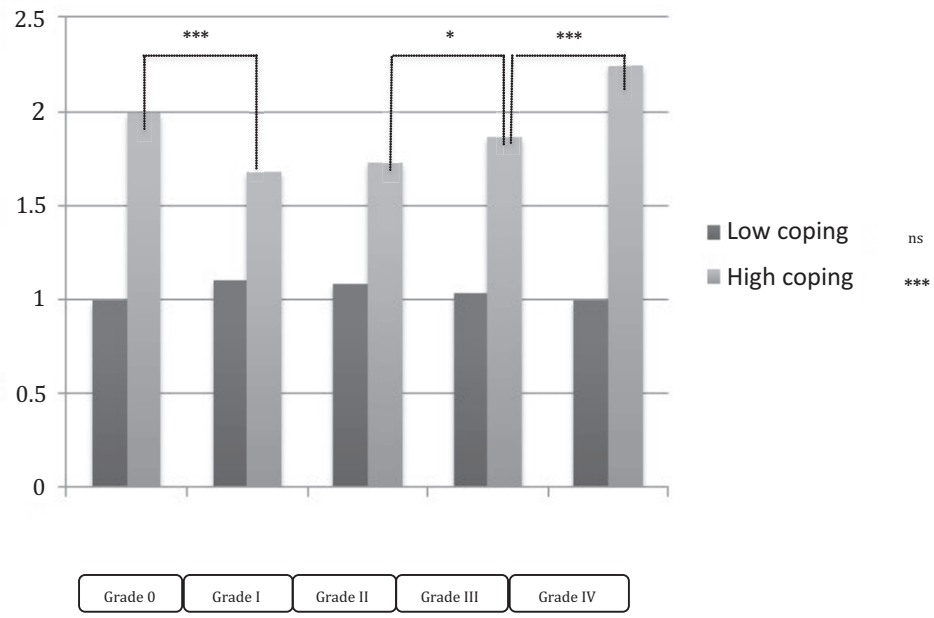

Figure 3 Mean instances of drunkenness as a function of pain grade (0–IV) and low (1 SD below the mean) and high (1 SD above the mean) levels of coping motives. *$P < 0.05$; **$P < 0.005$; ***$P < 0.001$.

but can be generalized at least to other European countries. However, it has to be mentioned that the prevalence of alcohol consumption in our sample was higher compared with prevalence estimates reported for adolescent samples from North American countries [50]. This finding is in accordance with other studies reporting

higher rates of alcohol consumption for Europe than for North America [51,52]. Results of a recent cross-cultural study [53] suggest that these differences are at least partly attributable to differences in national drinking patterns and alcohol control policies. Finally, all four drinking motives were positively associated with indices of alcohol consumption, indicating that higher motivation for alcohol consumption is generally associated with more frequent drinking and drunkenness.

Critically, results corroborated our hypothesis that the association between pain severity and alcohol consumption was moderated by drinking motives. As hypothesized, the association between pain severity and drunkenness frequency (but not between pain severity and drinking frequency) was moderated by coping motives, such that higher pain severity was associated with heavy drinking among youth who endorsed a greater degree of coping motives for drinking. This is in line with previous research reporting positive associations between coping motives and heavy episodic drinking [22,45,54,55]. Reflecting on these findings, Goldstein and Flett [56] argued that coping-motivated drinkers might require relatively high doses of alcohol to achieve noticeable changes in their physiological and affective state. Following this reasoning, children/adolescents endorsing high pain-related disability and elevated coping motives might engage in heavy drinking to reach satisfactory relief from pain symptoms and negative affect stemming from stressors associated with pain/disability, for example, school difficulties, family stress [3–5]. Such an explanation may account for why this effect was observed specifically for drunkenness rather than general drinking frequency.

The association between pain severity and alcohol consumption was likewise moderated by conformity motives; this was the case for both drinking frequency and drunkenness frequency. These findings were somewhat surprising as conformity motives have previously been linked to less frequent alcohol consumption [22,45,47,48,55] as conformity drinkers are most likely to consume alcohol during relatively infrequent instances of high peer pressure—for example, at parties [22]. However, conformity motives might be particularly relevant in the context of pain as children and adolescents with pain problems may regularly experience feelings of loneliness and social exclusion due to pain-associated limitations in social activity [57–59]. Accordingly, children/adolescents with pain problems who endorse high conformity motives may feel pressured to drink more often and more heavily to avoid feelings of exclusion resulting from pain-associated limitations in peer contact.

Taken together, our findings suggest that higher pain severity is associated with higher alcohol consumption, particularly among children and adolescents who endorse high levels of coping or conformity motives. The common denominator of these two motives is that they both relate to negative reinforcement—that is, avoidance of (internal or external) negative outcomes. Thus, it important to understand whether children and adolescents endorsing high "negative reinforcement motives" can be characterized by a specific psychological profile. Interestingly, previous research on personality factors and drinking motives suggests a link between neuroticism and coping motives [56,60–63]. Thus, individuals scoring high on neuroticism appear to use alcohol consumption as a maladaptive strategy for coping with negative affect [61]. Negative reinforcement motives might also be linked to catastrophizing as high neuroticism may predispose individuals to catastrophic thinking [64] which in turn has a tendency to exacerbate pain experience [65]. As catastrophizing is more proximal to pain behavior than personality traits like neuroticism [65], it may provide a better target for prevention and/or therapeutic intervention. However, further research is needed to clarify how these and other psychological constructs relate to drinking motives, particularly in the context of pain in childhood/adolescence.

The current study has a number of limitations, each highlighting directions for future research. First, the current study employed a cross-sectional design, thereby precluding conclusions about direction of effects. Future research using longitudinal designs is needed to clarify whether pain is indeed the cause for alcohol consumption or vice versa. In addition, longitudinal research should address the question of whether and to what degree drinking motives can change over time and whether such changes differ between children and adolescents with and without pain problems. For instance, previous research suggests a shift from external (i.e., social and conformity) toward internal (i.e., enhancement and coping) drinking motives over the course of adolescence [62,66]; however, it has also been shown that coping motives can predict conformity motives at a later time point [66]. Children and adolescents with pain problems might consume alcohol due to coping motives at a younger age than pain-free peers; later on, they might generalize the pain-relieving properties of alcohol to other situations—for example, utilizing alcohol consumption to facilitate social inclusion. Second, while alcohol consumption was assessed by means of items commonly used within drug use surveys [39–41] that are considered to be valid items, the prompts of the two items assessing alcohol use specifically referred to drinking on occasions like parties so that drinking in other situations (e.g., alone at home) might not have been covered by these items; this might have led to underreporting and thus underestimation of actual alcohol consumption. Furthermore, our sample consisted of school-attending children and adolescents so that the generalizability to clinical samples may be limited. We purposely decided on investigating the association between pain and alcohol consumption in a nonclinical sample as children at risk should be identified as early as possible before the escalation of pain and associated problems can further complicate intervention. However, differences and similarities between treatment-seeking

youth and community samples like ours should be explored in future research. Self-medication by alcohol use might be less pronounced in adolescents who are treated for pain as their symptoms might be successfully reduced by psychotherapeutic interventions and/or adequate medication and because opportunities to consume alcohol might be limited. In line with this, one study reporting lower alcohol consumption in treatment-seeking adolescents with chronic pain compared with pain-free peers found that greater activity limitations were associated with lower consumption in the chronic pain group [18]. Alternatively, higher prevalence of self-medication in clinical samples might occur due to more severe symptomatology and more associated problems, for example, limitations in social activities.

Future studies may also wish to include variables that could not be assessed in the current study due to the already extensive set of items. In addition to individual difference variables (e.g., neuroticism, catastrophizing), family and peer influence might be of particular interest due to demonstrated association with alcohol consumption [67,68]. Finally, it may be informative to ask children/adolescents whether they consume alcohol specifically to dampen pain symptoms or regulate pain-associated negative affect as items assessing coping motives were not related to pain but rather a general tendency to use alcohol consumption to deal with problems.

Conclusions

Despite limitations, our study is the first to highlight the role of drinking motives in the association between pain and alcohol consumption in a large representative sample of school-attending children and adolescents. The observation that negative reinforcement motives (i.e., coping and conformity) are associated with heightened alcohol consumption among youth with higher pain severity suggests that treatment programs for children and adolescents suffering from pain should consider assessing drinking motives and offer targeted intervention. For example, children endorsing high coping motives may benefit from learning alternative strategies to cope with pain and associated negative affect, whereas children endorsing high conformity motives may benefit from self-efficacy training. However, our findings require replication in future studies, which should likewise employ longitudinal designs to address the temporal dynamics of alcohol consumption and drinking motives among children and adolescents suffering from pain.

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