


## RESEARCH ARTICLE

# Problematic alcohol use in young adults exposed to childhood trauma: The Trøndelag Health (HUNT) Study

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## Funding information

Oslo University Hospital; Southern and Eastern Norway Regional Health Authority, Grant/Award Number: 2020059; Norwegian Centre for Violence and Traumatic Stress Studies; Foundation Dam, Grant/Award Number: 2020/FO283043

## Abstract

Problematic alcohol use (PAU) severely impacts the health, functioning, and long-term prospects of young people. Prior research indicates that childhood trauma exposure may be an important risk factor for PAU, but few longitudinal studies have looked at how specific trauma types influence this risk. The aim of this study was to investigate the association between childhood trauma exposure and PAU in a large, population-based cohort of young people. The study sample included 1,913 adolescents who participated in the Trøndelag Health Study (HUNT) between 2006 and 2008 (age range: 12–20) and completed follow-up 10 years later as young adults (age range: 22–32). The results revealed an increased risk of PAU in young adults exposed to childhood trauma, especially direct physical violence,  $OR = 2.38$ , [95% CI 1.56, 3.64]. Young adults who had witnessed violence,  $OR = 1.55$ , [95% CI 1.11, 2.17], or experienced an accident, disaster, or other traumatic event,  $OR = 1.60$ , [95% CI 1.19, 2.15], also had higher odds of PAU compared to those without such experiences. These associations remained consistent after adjusting for symptoms of headaches and pain as well as post-traumatic and general psychological distress as reported by the participants in adolescence. Future prevention efforts targeting PAU among adolescents and young adults should address violence and other trauma exposure as potential drivers of problematic drinking.

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Problematic alcohol use (PAU) severely impacts the health, functioning, and long-term prospects of young people (Degenhardt et al., 2016), with adverse consequences including an increased immediate and long-term risk of psychological and somatic morbidity. Alcohol use has consistently been found to be a leading global risk factor for premature mortality among young and older adults alike (Griswold et al., 2018), and may contribute to significant harm to both the drinker and others (Rehm et al., 2017). PAU, which generally corresponds with mild alcohol use disorder (AUD) and typically debuts in young adulthood, is a risk factor for more chronic and severe AUD (American Psychiatric Association [APA], 2013; Grant et al., 2015). Although some risk factors for the development of PAU are well established, such as being male, having a low socioeconomic status (SES), poor family support, and genetic vulnerability (Carvalho et al., 2019), a better understanding of other important early risk factors is needed to help guide prevention and intervention efforts (Stockings et al., 2016).

In this regard, childhood trauma exposure may represent an important early risk factor. Trauma-related symptoms and alcohol problems commonly co-occur, with comorbidity estimates of posttraumatic stress disorder (PTSD) and AUD ranging between 30% and 50% (Hawn et al., 2020). Moreover, in adult samples, individuals with PAU often provide retrospective accounts of potentially traumatic event (PTE) exposure, including childhood trauma (Degenhardt et al., 2022). Previous longitudinal studies in samples of youth and young adults have found that childhood maltreatment is a risk factor for heavy drinking episodes and PAU and that exposure to multiple adverse childhood experiences (ACEs) is a risk factor for more frequent drinking (Kisely et al., 2021; Rogers et al., 2021; Shin et al., 2013; Valério et al., 2022). Results from studies with various population subgroups, such as college students, also indicate that direct exposure to interpersonal PTEs (e.g., physical or sexual assault) is associated with a higher risk of posttrauma psychopathology, including increased alcohol use, compared to noninterpersonal PTEs (e.g., natural disasters or transportation accidents; Overstreet et al., 2017). However, longitudinal evidence for the wider range of childhood trauma types and polymultivictimization in relation to PAU in young people is still limited.

Reactions to trauma vary from transient psychological and somatic stress reactions and behavior changes to a range of enduring mental and physical health problems and related functional impairment, which can persist even in the absence of personal injury (Cohen et al., 2021; Nelson et al., 2022; Stensland et al., 2018). The “self-medication hypothesis,” which postulates that some individuals turn to alcohol as a way to cope with pain and

psychological distress (Khantzian, 1997), offers one explanation for how childhood trauma may influence the development of alcohol problems. Alcohol may be used as an accessible analgesic for physical pain or as a way to cope with psychological distress, although symptoms often overlap (Hawn et al., 2020; Karimi et al., 2022). Early trauma-related symptoms may, therefore, contribute to the likelihood of developing PAU following trauma exposure in young people, but, thus far, few longitudinal studies have explored this (Borges et al., 2021; Dubowitz et al., 2021).

The aim of this study was to investigate the association between childhood trauma exposure and PAU in young adulthood according to various trauma types and the number of PTEs to which an individual was exposed. We also aimed to investigate how early symptoms of physical pain and psychological distress influence the likelihood of PAU among trauma-exposed young adults. We formulated three research questions: (a) Does exposure to different trauma types in childhood contribute to the likelihood of PAU in young adulthood?, (b) Does exposure to multiple types of childhood trauma contribute to the likelihood of PAU in young adulthood?, and (c) Can early symptoms of physical pain and psychological distress help explain the likelihood of PAU in young adults following childhood trauma exposure?

## METHOD

### Participants and procedure

This prospective cohort study used data from the two waves of the large, population-based Trøndelag Health Study (HUNT; Åsvold et al., 2023; Krokstad et al., 2013), Young-HUNT 3 and HUNT 4. Both waves included a series of health measures primarily collected through self-report questionnaires. Data on sociodemographic and socioeconomic factors, trauma exposure, and early somatic and psychological symptoms were obtained from the adolescent survey, Young-HUNT 3, whereas data on PAU were obtained from the adult survey, HUNT 4. For the purpose of this study, Young-HUNT 3 is referred to as Wave 1, and HUNT 4 is referred to as Wave 2.

### Wave 1: Young-HUNT 3 (2006–2008)

Between 2006 and 2008, all 10,464 adolescents living in the Norwegian county formerly known as Nord-Trøndelag, now part of the county of Trøndelag, were invited to take part in a school-based survey, including 5,614 junior high school students, 4,357 senior high school students, and 493

adolescents who were not attending school (Holmen et al., 2014). Students who were absent at the time of data collection were encouraged to complete the questionnaire at a later date within 1 month of the original date, and adolescents who were not attending school were invited to participate by mail. A total of 8,199 (78.4%) adolescents participated. Most participants were ethnic Norwegian, 50.3% were female, and participants ranged in age from 12 to 20 years.

## Wave 2: HUNT 4 (2017–2019)

Approximately a decade later, in 2017–2019, all participants in Wave 1 were invited to participate in Wave 2 as young adults (age range: 22–32 years), including individuals who were still residing in Trøndelag county (i.e., the primary study area) and those who had emigrated out of the county. A total of 3,068 (37.4%) participants from Wave 1 responded to the main Wave 2 questionnaire, 1,913 of whom (23.3% of Wave 1 participants) responded to an additional age cohort-specific questionnaire that included a measure of PAU (Lauvsnes et al., 2021). The study was approved by the Regional Committees for Medical and Health Research Ethics (reference 2017/2229). The study is part of the overarching Killing Pain project, the rationale for which was preregistered through ClinicalTrials.gov (<https://clinicaltrials.gov/ct2/show/record/NCT04336605>). The study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cohort studies (Von Elm et al., 2014).

## Measures

### Sociodemographic and socioeconomic factors in adolescence (Wave 1)

#### *Age and sex*

Data on age and sex were obtained from the Norwegian National Population Register.

#### *SES*

Participants were asked, “How well-off do you think your family is compared to most others?.” Response options were: “about the same as most others,” “better financial situation,” and “worse financial situation.” Participants who endorsed one of the first two response options were combined and compared to those who endorsed the third response option (Holstein et al., 2009).

### *Household structure*

Participants were asked which family members they were currently living with. Responses were then dichotomized between adolescents who were living with both of their own parents, including adoptive parents, and those living in other types of households (Turner et al., 2013).

## Childhood PTEs (Wave 1)

### *Overall exposure*

Exposure to PTEs in childhood was measured using a brief lifetime trauma screening based on the UCLA PTSD Reaction Index (PTSD-RI; Steinberg et al., 2004) adapted to fit a Norwegian context. Participants were asked, “Have any of the following things happened to you?” with the response options of “no;” “yes, last year;” and “yes, in my life.” Participants who responded “yes” to any event, regardless of when it occurred, were categorized as exposed.

### *Direct interpersonal PTEs*

Physical violence was assessed by asking participants whether they had “been violently hurt (beaten or injured).” To assess sexual abuse, participants responded whether they had “been subjected to sexually uncomfortable/abusive acts” by someone around their own age and whether they had been subjected to such acts by an adult; responses were combined into one variable indicating exposure to sexual abuse. To assess bullying, participants were asked whether they had “been threatened or physically harassed by other students at school for a long time.” A sum score for direct PTE exposure was computed (range: 0–3; World Health Organization, 2016). Due to low counts, the two upper categories were collapsed, leaving the final categories 0, 1, and 2 or more.

### *Other PTEs*

To assess witnessing violence, participants were asked if they had “seen others violently hurt.” The illness or death of a close person was assessed by asking participants whether “someone in your family has been seriously ill” or they experienced the “death of a loved one;” responses were combined to measure exposure to severe illness or death of a close person. Finally, to assess exposure to accidents, disasters, or other events, participants were asked whether they had experienced “a disaster (fire, avalanche, tidal wave, hurricane, etc.),” experienced a “serious accident (e.g., very serious car accident),” had “received painful or frightening treatment at the hospital while being treated for an illness or injury,” or had “experienced something else that was very frightening, dangerous

or violent.” Participants who responded “yes” to one or more of these events were categorized as exposed.

## Physical pain and psychological distress in adolescence (Wave 1)

### *Headache*

Headache was assessed using a validated headache interview (Zwart et al., 2003). Participants were asked about recurrent headaches over the last 12 months and the frequency of their symptoms, with response options of “less often than 1 day a month,” “1–3 days a month,” “1–4 days a week,” and “more than 4 days a week.”

### *Musculoskeletal pain*

Musculoskeletal pain was assessed using a pain questionnaire, that asked participants, “How often have you had any of the pain listed below during the last 3 months?” (Mikkelsen et al., 1997). Response options were “never or seldom,” “about once a month,” “about once a week,” “more than once a week,” and “almost every day.” Participants who reported pain symptoms weekly or more often in one or more of eight locations (i.e., neck or shoulders, chest, upper back, lower back, left arm, right arm, left leg, and right leg) were categorized as having frequent musculoskeletal pain symptoms. A continuous sum score was created based on the number of pain sites reported (range: 0–8 sites).

### *Posttraumatic stress symptoms (PTSS)*

PTSS were assessed using three questions on intrusion and avoidance derived from the UCLA PTSD-RI (Steinberg et al., 2004). Participants were asked to answer “yes” or “no” to three items: “Do you have frightening thoughts, see images or hear sounds from the actual experience even when you don’t want to?,” “When something reminds you about what happened do you become distant, afraid, or sad?,” and “Do you try to avoid talking about it, thinking about it, or feel any feelings about what happened?” A sum score for PTSS was computed (range: 0–3), with a higher score indicating higher levels of PTSS.

### *Anxiety and depressive symptoms*

Anxiety and depressive symptoms were assessed using a validated short form of the Hopkins Symptoms Checklist–25 (HSCL-5; Schmalbach et al., 2021). Participants were asked how much they had been bothered by five symptoms measuring fear, nervousness, hopelessness about the future, feeling blue, and excessive worrying over the last 14 days. Response options included “not bothered,” “a little bothered,” “quite bothered,” and “very bothered,” scored on a scale of 1–4 ( $\alpha = .82$ ). Mean scores were calculated to

indicate the overall level of anxiety and depressive symptoms for each participant. A score higher than 2.0 has been established to be indicative of clinically significant symptoms (Strand et al., 2003). In the present sample, Cronbach’s alpha was .82.

## Problematic alcohol use (PAU) in young adulthood (Wave 2)

The Cut Down, Annoyed, Guilty, and Eye-Opener (CAGE; Ewing, 1984) questionnaire was used to assess PAU in young adulthood. It includes the opening question, “Do you drink alcohol?” with the response options of “yes” and “no.” Respondents who answer “yes” are asked four questions measuring alcohol misuse: “Have you ever felt that you should reduce your alcohol intake?,” “Have other people ever criticized your use of alcohol?,” “Have you ever felt bad or guilty because of your use of alcohol?,” and “Have you ever had a drink first thing in the morning as a pick-me-up or to calm your nerves or to cure a hangover?.” Responses are scored as 0 for “no” and 1 for “yes,” with higher scores indicating alcohol misuse. The CAGE has previously been validated for use in adult populations but has been found to be somewhat less sensitive when used with young adults (Bühler et al., 2004; Skogen et al., 2011). In this study, PAU was defined as a score of 2 or higher, which is the recommended cutoff score and is in line with previous studies with young people (Lauvsnes et al., 2021). This definition generally corresponds to mild AUD, which is defined as the presence of two or three criteria indicating problematic drinking as outlined in the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; APA, 2013).

## Data analysis

To assess selection bias among responders and nonresponders, we first explored the distribution of sociodemographic and socioeconomic factors, trauma exposure, and symptoms of physical pain and psychological distress in adolescence among all individuals who participated in Wave 1. Second, the same measures were described for the full study sample. Logistic regression analyses were conducted to test the association between childhood trauma exposure and subsequent PAU in young adulthood, with PAU operationalized as a dichotomous outcome. Four models were estimated based on a priori selection. Model 1 was adjusted for age and sex only (i.e., sociodemographic factors), Model 2 was additionally adjusted for SES and household structure in adolescence (i.e., socioeconomic factors), Model 3 was further adjusted for early

symptoms of physical pain (i.e., headache and musculoskeletal pain), and Model 4 was additionally adjusted for psychological distress (i.e., anxiety and depressive symptoms). Moreover, to be able to adjust for PTSS, sensitivity analyses were conducted using the same four models with the subset of participants who reported exposure to childhood trauma, with PTSS added to Model 4 as an additional measure of psychological distress. Likelihood ratio tests were conducted to assess the association between the direct interpersonal PTE exposure (range: 0–3), which served as the multilevel categorical predictor, and PAU. The “half rule” was used to handle missingness and compute scale scores for physical pain and anxiety and depressive symptoms, PTSS, and PAU (Fairclough, 2010). Of note, we used a slightly higher cutoff for the HSCL-5 than the “half rule,” as that is what has been recommended in previous validation studies, excluding participants with two or more missing values (Strand et al., 2003). Furthermore, multiple imputation was used with 200 imputations to handle missingness in the logistic regression analyses. All analyses were conducted in R (Version 4.1.2) using the *haven*, *dplyr*, and *lrm* packages to import and prepare the data for analyses and *mice* for multiple imputation.

## RESULTS

Most participants in the study sample were female ( $n = 1,238$ , 64.7%). The mean participant age at Wave 1 was 16 years, and at Wave 2, the mean age was 27 years (Table 1). As adolescents, 8.4% of participants reported low SES, whereas 41.9% reported not living with both of their parents. Among all Wave 1 participants, Wave 2 nonresponders were slightly younger, more likely to be male, and more likely not to have lived with both parents as an adolescent. Wave 2 nonresponders also reported somewhat higher rates of childhood exposure to physical violence; witnessing violence; and accidents, disasters, and other events. In contrast, Wave 2 responders reported more symptoms of headache, anxiety, and depression in adolescence compared to nonresponders (Table 2 and Table 3).

The results of the logistic regression analyses revealed strong and consistent associations between certain types of childhood trauma exposure and PAU in young adulthood (Table 4). Adolescents exposed to direct physical violence were found to have a higher risk of PAU in young adulthood compared with peers who had not been exposed to direct physical violence, odds ratio ( $OR$ ) = 2.38, 95% confidence interval ( $CI$ ) [1.56, 3.64]. Similarly, young adults who reported having witnessed violence,  $OR = 1.55$ , 95%  $CI$  [1.11, 2.17], or experienced an accident, disaster, or other event in childhood,  $OR = 1.60$ , 95%  $CI$  [1.19, 2.15], had significantly higher odds of PAU, as compared to peers without such

trauma exposure. In contrast, no significant associations were found between PAU in young adulthood and childhood exposure to sexual abuse, bullying, or severe illness or the death of a close person. Regarding polyvictimization, the results revealed a significant association between having experienced one type of direct interpersonal trauma (i.e., physical violence, sexual abuse, or bullying) and subsequent PAU,  $OR = 1.97$ , 95%  $CI$  [1.33, 2.92], but no significant association between PAU and exposure to multiple trauma types (i.e., two or more). Adjustment for known sociodemographic and socioeconomic risk factors (Models 1–2), physical pain (Model 3), and psychological distress in adolescence (Models 4) did not appreciably attenuate the strength of these results. The results also remained consistent after adjusting for PTSS in the sensitivity analyses ( $n = 1,151$ , 60.2%; Supplementary Table S1).

## DISCUSSION

The results of the present study revealed consistent associations between certain types of childhood trauma exposure and PAU in young adulthood. Exposure to direct physical violence was found to be associated with an increased risk of PAU, as were witnessing violence and experiencing an accident, disaster, or other traumatic event. In contrast, there was no evidence for an association between PAU in young adulthood and having experienced sexual abuse, bullying, or the severe illness or death of a close person in childhood. Furthermore, polyvictimization, defined as having experienced two or more types of direct interpersonal PTEs (i.e., physical violence, sexual abuse, or bullying), was not found to be associated with an increased risk of PAU. The findings remained consistent after adjusting for sociodemographic and socioeconomic factors and symptoms of physical pain and psychological distress during adolescence.

The prevalence rate of PAU in the study sample was 12.7%. This rate is consistent with the rate of 12.1% that has been reported among all young adults in the HUNT 4 study sample (Lauvsnes et al., 2021) and is similar to rates reported for other samples of young adults across Europe, which range from 8.2% to 13% (Canan et al., 2019; Kjær et al., 2022; Kraus et al., 2000). Moreover, the prevalence rates of exposure to direct interpersonal PTEs ranged from 5.5% to 7.5%, and the rates of exposure to other PTEs ranged from 18.9% to 73.8%. Although these findings are similar to prevalence estimates reported in other studies, it is difficult to make direct comparisons, as the rates of trauma exposure in young people vary considerably depending on age group; population type; and, in particular, the type of traumatic events being assessed (Carlson et al., 2020).

TABLE 1 Sociodemographic characteristics, socioeconomic factors, and trauma exposure in responders and nonresponders

Variable	All <sup>a</sup>			Female			Male					
	N = 8,199			N = 4,128			N = 4,071					
	W1 + W2 (n = 1,913)	W1 only (n = 6,286)	p	W1 + W2 (n = 1,238, 30.0%)	W1 only (n = 2,890, 70.0%)		W1 + W2 (n = 675, 16.6%)	W1 only (n = 3,396, 83.4%)				
Total (N)	M	SD	Total (N)	M	SD	Total (N)	M	SD				
<b>W1 characteristics</b>												
Age (years)	1,913	16.02	1.79	6,286	15.84	1.72	16.03	15.85	1.73	16.01	15.82	1.72
	<b>Total (N)</b>	<b>n</b>	<b>%</b>	<b>Total (N)</b>	<b>n</b>	<b>%</b>	<b>p</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>%</b>
Low SES	1,806	152	8.4	5,830	556	9.5	.165	102	8.6	297	10.9	8.0
Not living with parents	1,881	788	41.9	6,152	2,917	47.4	< .001	514	42.4	1,350	47.6	41.0
<b>Childhood PTEs (W1)</b>												
<b>Direct interpersonal PTEs</b>												
<b>Exposure type</b>												
Physical violence	1,832	138	7.5	5,977	651	10.9	< .001	66	5.5	238	8.5	72
Sexual abuse	1,829	100	5.5	5,980	330	5.5	.980	88	7.4	236	8.5	12
Bullying	1,829	136	7.4	5,974	492	8.2	.293	85	7.1	211	7.6	51
<b>Number of exposure types</b>												
None	1,821	1,541	84.6	5,924	4,861	82.1	.013	1,011	84.9	2,277	82.7	530
1	1,821	206	11.3	5,924	762	12.9	.087	135	11.3	329	11.9	71
≥ 2	1,821	74	4.1	5,924	301	5.1	.088	45	3.8	148	5.4	29
<b>Other PTEs</b>												
Witness to violence	1,833	347	18.9	5,979	1,463	24.5	< .001	188	15.7	534	19.2	159
Illness or death	1,834	1,353	73.8	5,989	4,404	73.5	.863	914	76.3	2,150	77.0	439
Accident/disaster/other	1,827	546	29.9	5,960	1,935	32.5	.041	369	30.9	935	33.7	177

Note: W1 = Wave 1; W2 = Wave 2; SES = socioeconomic status; PTE = potentially traumatic event.

<sup>a</sup>Comparisons for sex across all participants were significant at  $p < .001$ .

TABLE 2 Early symptom levels in responders and nonresponders

	All participants				Female				Male						
	N = 8,199		N = 4,128		N = 4,071		N = 1,238, 30.0%		N = 2,890, 70.0%		N = 675, 16.6%		N = 3,396, 83.4%		
	n	%	N	%	n	%	n	%	n	%	n	%	n	%	
<b>W1 symptoms</b>															
Headache															
Less than monthly	140	7.7	5,809	411	7.1	.371	89	7.6	169	6.3	51	8.0	242	7.7	
1–3 days per month	240	13.3	5,809	850	14.6	.156	189	16.2	479	18	51	8.0	371	11.8	
1–4 days per week	157	8.7	5,809	363	6.2	< .001	131	11.2	246	9.2	26	4.1	117	3.7	
> 4 days per week	22	1.2	5,809	75	1.3	.896	22	1.9	57	2.1	0	0.0	18	0.6	
Anxiety and depression score > 2	261	13.9	6,086	783	12.9	.253	217	17.9	571	20.2	44	6.7	212	6.5	
	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>	<b>N</b>	<b>M</b>	<b>SD</b>
PTSS sum score	1,151	0.62	1.00	3,724	0.64	1.03	0.78	1.06	0.92	1.15	0.30	0.74	0.39	0.82	
Anxiety and depression sum score	1,875	1.52	0.54	6,086	1.50	0.56	1.62	0.57	1.67	0.61	1.35	0.44	1.35	0.45	
Musculoskeletal pain sum score	1,886	0.72	1.22	6,149	0.69	1.23	0.82	1.28	0.85	1.29	0.54	1.08	0.55	1.15	

Note: N = 8,199; W1 = Wave 1; W2 = Wave 2; PTSS = posttraumatic stress symptoms.

Relatively few longitudinal studies have investigated different trauma types as a risk factor for subsequent PAU in young people, but the results of the current study are largely in line with those that have been conducted. For example, physical violence has consistently been identified as a risk factor for increased alcohol use in samples of young people across Australia, Brazil, Mexico, and the United States, whereas sexual abuse has not (Borges et al., 2021; Dubowitz et al., 2021; Kisely et al., 2021; Valério et al., 2022). In one study, Borges et al. (2021) included “having committed or witnessed violence” and “having experienced a life-threatening accident” in their assessment and found that exposure to these PTEs significantly increased the risk of developing AUD as well, whereas “death or a traumatic experience of a loved one” did not. In contrast, the current study did not find support for an association between bullying and PAU, which is in conflict with previous studies (Kelly et al., 2015; Laroque et al., 2022; Rowe et al., 2019; Tharp-Taylor et al., 2009). However, studies on the association between exposure to bullying and PAU have often produced mixed results, with some evidence suggesting that victims of bullying who are also perpetrators are more likely to engage in problematic drinking than individuals who are victims only (Maniglio, 2017). It is also unclear why sexual abuse does not seem to be a risk factor for PAU even though it is a direct interpersonal PTE; however, as victims of sexual abuse most often are female (Barth et al., 2013), and individuals with PAU are predominantly male (Schulte et al., 2009), this may have affected the findings.

The findings did not support an association between exposure to multiple types of direct interpersonal PTEs and PAU. These results are, to some degree, contradictory to a previous longitudinal study that found that exposure to multiple types of physical, emotional, and sexual abuse in childhood predicted AUD in a sample of Australian young adults (Kisely et al., 2021) as well as other studies that have investigated the association between alcohol use and multiple ACEs (Hughes et al., 2017; Rogers et al., 2021). However, the present study may have been limited in comparison, as the measure of polyvictimization only included direct interpersonal PTEs and was restricted to three types of trauma exposure.

Interestingly, adjusting for early symptoms of physical pain and psychological distress did not appreciably attenuate the strength of the associations between PAU and childhood exposure to direct physical violence; witnessing violence; and having experienced an accident, disaster, or other event. This indicates that trauma-exposed adolescents do not necessarily drink to cope with their physical pain or psychological distress, as some previous studies have suggested and as the self-medication hypothesis postulates (Dubowitz et al., 2021; Hawn et al.,

**TABLE 3** Sociodemographic and socioeconomic factors, trauma exposure, and early symptoms, by problematic alcohol use group (PAU)

Variable	No PAU at W2 ( <i>n</i> = 1,649)				PAU at W2 ( <i>n</i> = 239)				<i>p</i>
	<i>n</i>	%	<i>M</i>	<i>SD</i>	<i>n</i>	%	<i>M</i>	<i>SD</i>	
Socioeconomic and sociodemographic factors									
Female sex	1,913	1,123	68.1		104	43.5			< .001
Age at W1	1,913			16.07	1.79		15.72	1.82	.004
Age at W2	1,908			27.07	1.96		26.89	1.99	.176
Low SES at W1	1,806	129	8.3		20	8.9			.842
Not living with parents at W1	1,881	678	41.8		100	42.7			.841
W1 PTEs									
Direct interpersonal PTEs									
PTE type									
Physical violence	1,832	101	6.4		35	15.5			< .001
Sexual abuse	1,829	87	5.5		10	4.4			.603
Bullying	1,829	112	7.1		23	10.2			.131
Number of PTE types									
None	1,821	1348	85.8		172	76.8			< .001
1	1,821	164	10.4		39	17.4			.003
≥ 2	1,821	60	3.8		13	5.8			.220
Other PTEs									
Witness to violence	1,833	280	17.7		60	26.5			.002
Illness or death	1,834	1171	74.0		163	72.1			.610
Accident, disaster, or other	1,827	452	28.7		85	37.4			.009
Early symptoms of physical pain and psychological distress at W1									
Headache									
Less than monthly	1,810	122	7.8		18	8.1			.992
1–3 days per month	1,810	206	13.2		31	13.9			.843
1–4 days per week	1,810	134	8.6		22	9.9			.604
> 4 days per week	1,810	20	1.3		2	.9			.757
Musculoskeletal pain	1,886			0.72	1.22		.74	1.20	.765
PTSS	1,151			0.63	1.00		.59	1.02	.600
Anxiety and depression	1,875			1.52	0.54		1.59	.58	.066
Anxiety and depression > 2	1,875	218	13.5		41	17.4			.134

Note: W1 = Wave 1; W2 = Wave 2; SES = socioeconomic status; PTE = potentially traumatic event; PTSS = posttraumatic stress symptoms.

2020; Laroque et al., 2022). One explanation for this could be that symptoms of psychological distress and PAU are thought to belong to two separate underlying trait vulnerabilities in individuals exposed to trauma (Flory & Yehuda, 2022). That is, individuals who are vulnerable to developing internalizing symptoms, including sadness, fear, and rumination, may be more inclined to develop psychological distress, whereas individuals who are more vulnerable to developing externalizing symptoms, including disinhibition, and aggression, may be more likely to develop PAU (Castillo-Carniglia et al., 2019). If so, individuals who are vulnerable to externalizing symptoms may

be more frequently exposed to both direct and indirect physical violence as well as accidents, disasters, and other events, as they are likely more susceptible to risky behavior. Indeed, externalizing psychopathology has been found to increase the risk of exposure to interpersonal violence, and other trauma, including witnessing events, in adolescents (Carliner et al., 2017) and may also contribute to risky driving and traffic accidents in young adults (Constantinou et al., 2011).

The strengths of this study include that it is one of few longitudinal studies to date that has investigated the association between childhood trauma exposure and PAU in a



**TABLE 4** Risk factors for problematic alcohol use in young adults exposed to childhood trauma

Trauma category	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>			Model 4 <sup>d</sup>		
	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>	OR	95% CI	<i>p</i>
Direct interpersonal PTEs												
PTE type												
Physical violence	2.38	[1.56, 3.64]	< .001	2.37	[1.54, 3.64]	< .001	2.30	[1.49, 3.56]	< .001	2.14	[1.37, 3.32]	< .001
Sexual abuse	1.10	[0.55, 2.19]	.787	1.09	[0.55, 2.16]	.815	1.04	[0.52, 2.07]	.921	0.89	[0.44, 1.80]	.747
Bullying	1.42	[0.88, 2.30]	.150	1.40	[0.86, 2.27]	.178	1.30	[0.79, 2.14]	.295	1.16	[0.70, 1.91]	.572
Number of PTE types			.002			.003			.006			.026
0	Ref.			Ref.			Ref.			Ref.		
1	1.97	[1.33, 2.92]	< .001	1.97	[1.32, 2.92]	< .001	1.91	[1.28, 2.86]	.002	1.77	[1.18, 2.65]	.006
≥2	1.69	[0.90, 3.17]	.110	1.68	[0.88, 3.17]	.113	1.57	[0.82, 3.03]	.174	1.38	[0.71, 2.68]	.342
Other PTEs												
Witness to violence	1.55	[1.11, 2.17]	.010	1.55	[1.11, 2.17]	.010	1.50	[1.07, 2.12]	.019	1.41	[1.00, 1.99]	.049
Illness or death	1.02	[0.74, 1.40]	.925	1.01	[0.74, 1.39]	.942	0.99	[0.72, 1.36]	.950	0.95	[0.69, 1.31]	.760
Accident, disaster, or other	1.60	[1.19, 2.15]	.002	1.59	[1.18, 2.14]	.003	1.54	[1.13, 2.09]	.006	1.44	[1.05, 1.96]	.022

Note: Likelihood ratio tests were used to assess the association between direct interpersonal potentially traumatic events (PTEs) and problematic alcohol use. OR = odds ratio; CI = confidence interval.

<sup>a</sup>Adjusted for age and sex.

<sup>b</sup>Adjusted for age, sex, socioeconomic status, and household structure.

<sup>c</sup>Adjusted for sociodemographic and socioeconomic factors and symptoms of physical pain.

<sup>d</sup>Adjusted for sociodemographic and socioeconomic factors and symptoms of physical pain and psychological distress.

large, general population of young people. The study also assessed several types of PTEs and controlled for a range of symptom clusters that are common in trauma-exposed individuals. There are also important limitations to discuss. Although we controlled for a number of confounders, some selection bias cannot be ruled out, as study participants were found to differ from survey nonresponders on certain measures (Langhammer et al., 2012). Furthermore, some participants likely were exposed to PTEs after responding to the Wave 1 questionnaire, and as PAU was not measured at this time, it is possible that some of the participants were already engaging in PAU at Wave 1. Low specificity of the short-form and single-item measures may also have impacted the results; for example, the PTSS measure was limited to only include three items in the Wave 1 (i.e., adolescent) questionnaire (Allen et al., 2022). Finally, the survey did not formally assess whether reported PTEs met PTSD Criterion A per the DSM (APA, 2013).

The current findings indicate that childhood trauma exposure may put adolescents at an increased risk of developing PAU by young adulthood. Future prevention and early intervention efforts should address exposure to childhood trauma, particularly physical violence and accidents, disasters, and other events, as important risk factors for PAU. Pathways linking trauma exposure to the development of PAU need to be explored further, as a better

understanding of the mechanisms at play may help guide the development of timely and effective measures.

## OPEN PRACTICES STATEMENT

The study is part of the overarching Killing Pain project. The rationale behind the Killing Pain research was pre-registered through ClinicalTrials.gov on April 7th, 2020 (Registration Number NCT04336605; <https://clinicaltrials.gov/ct2/show/record/NCT04336605>). The data that support the findings of this study are available from HUNT Research Centre. Restrictions apply to the availability of these data, which were used under license for this study. Data are available at <https://www.ntnu.edu/hunt> with the permission of HUNT's Data Access Committee.

## AUTHOR NOTE

The Trøndelag Health Study (HUNT) is a collaboration between the HUNT Research Centre (Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology [NTNU]), Trøndelag County Council, Central Norway Regional Health Authority, and the Norwegian Institute of Public Health, (Reference 2019/11398). The Killing Pain project received funding from the Foundation

Dam (2020/FO283043), South-Eastern Norway Regional Health Authority (2020059), Norwegian Centre for Violence and Traumatic Stress Studies (NKVTS), and Oslo University Hospital.

The authors wish to thank the participants and everyone involved with the HUNT Study, the Division of Clinical Neuroscience at Oslo University Hospital, the Norwegian Centre for Violence and Traumatic Stress Studies, and the Norwegian Council for Mental Health for their collaboration. There are no conflicts of interest to declare.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Stangeland, H., Aakvaag, H. F., Baumann-Larsen, M., Wentzel-Larsen, T., Storheim, K., Zwart, J. A., Dyb, G., & Stensland, S. Ø. (2023). Problematic alcohol use in young adults exposed to childhood trauma: The Trøndelag Health (HUNT) Study. *Journal of Traumatic Stress*, 36, 968–979. <https://doi.org/10.1002/jts.22965>