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Exposure to traumatic events and use of over-the-counter analgesics in adolescents: cross-sectional findings from the Young-HUNT study

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ABSTRACT

Objective Frequent and increasing use of over-the-counter analgesics (OTCA) among adolescents is a public health concern. Prior research indicates that adolescents exposed to traumatic events may be at increased risk of suffering from headaches and musculoskeletal pain. In this study, we assessed the association between trauma exposure and use of OTCA for headaches and musculoskeletal pain.

Design A cross-sectional population study among adolescents, self-reported data on trauma exposure, pain and use of OTCA.

Setting and participants All 10 608 adolescents aged 13–19 years in a region of Norway were invited in this school-based survey, participation rate was 76%.

Outcome measure Frequency of OTCA use for headache and musculoskeletal pain served as separate outcomes in ordinal logistic regression analyses.

Results Trauma exposure was significantly and consistently related to higher frequency use of OTCA for headache and musculoskeletal pain, of which associations for bullying (OR 1.79, 95% CI 1.50 to 2.12, and OR 2.12, 95% CI 1.70 to 2.66), physical violence (OR 1.49, 95% CI 1.25 to 1.78 and OR 1.83, 95% CI 1.45 to 2.32) and sexual abuse (OR 1.83, 95% CI 1.55 to 2.18 and OR 1.53, 95% CI 1.18 to 1.90) were particularly strong. A dose–response relationship was found between interpersonal violence and OTCA use for headache (OR 1.46, 95% CI 1.29 to 1.66 for one type and OR 1.81, 95% CI 1.53 to 2.14 for two or more types) and musculoskeletal pain (OR 1.61, 95% CI 1.91 to 3.00 for one type and OR 2.39, 95% CI 1.91 to 3.00 for two or more types). The associations remained significant after adjustment for pain, although an attenuation in strength was observed.

Conclusion Trauma exposed adolescents use OTCA for headaches and musculoskeletal pain more frequently than those not exposed. The higher frequency of pain conditions among trauma exposed only partially explained their more frequent OTCA use, indicating an increased risk relating to features beyond frequency of pain.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the first study exploring the relation of trauma exposure to use of over-the-counter analgesics in a representative adolescent population.
⇒ The general participation rate was high.
⇒ Participation rate was lower among adolescents not enrolled in school.
⇒ The study is cross-sectional and does not allow for causal assumptions.
⇒ Trauma-specific treatment was not assessed.

INTRODUCTION

Over-the-counter analgesics (OTCA) are commonly used among adolescents,[1–4] and use appears to have increased over the past decades.[1] In studies on adolescents, it is consistently found that girls use more pain medication than boys, and that analgesic use increases from early to late adolescence.[1 5] Pubertal development plays a part in this sudden increase and discrepancy in use between the sexes.[6 7] Socioeconomic factors appear to be related to use, and largely it has been found that lower socioeconomic status is associated with using more OTCA.[8 9]

Frequent use of OTCA poses a risk of unwanted health outcomes. In an adolescent population, the most important known somatic health risk is medication overuse headache,[10 11] although it should be noted that the efficacy and safety of common non-prescription analgesics such as ibuprofen and paracetamol is not well examined in adolescents.[12] It is also a concern that medication use in adolescence may prevent development of more favourable coping strategies, as studies have shown that adolescents establish habits of medication use that they carry with them into adulthood.[13] Further, adolescents who frequently use pain medication, smoke more and drink more alcohol than peers who do not use such medication.[14] For these reasons, the highly prevalent and frequent use of OTCA among adolescents may constitute a present and future public health concern.

Headache and musculoskeletal pain are among the worldwide leading causes of morbidity in children and adolescents.[15 16] The recommended management of chronic pain in adolescents involves use of analgesics only after an individual assessment of the patient and with the shortest possible duration.[17 18] For migraine headaches, it is recommended that analgesics are used for acute attacks.[19] There seems to be a discrepancy between these restrictive guideline recommendations and actual use.

Findings from cross-sectional and qualitative studies indicate a relationship between bullying and more frequent use of analgesics among adolescents.[20 21] Bullying is a form of interpersonal violence, the subgroup of traumatic events that includes direct or indirect exposure to physical, sexual or psychological violence and neglect.[22] Interpersonal violence and other traumatic events are common stressful exposures in a youth population,[23 24] and interpersonal violence has been found to be related to chronic pain conditions in adolescents.[25–27]

The impact of trauma exposure as risk factor for frequent use of OTCA remains to be explored. The main purpose of the present study was to assess the association between trauma exposure and use of OTCA for headaches and musculoskeletal pain among adolescents.

METHODS

The study is based on cross-sectional data from the population-based survey Young-HUNT4.[28] Among the complete cohort of 10 608 invited adolescents (aged 13–19 years) living in the region formerly called Nord-Trøndelag in Norway, 8066 (76%) participated in the Young-HUNT4 between 2017 and 2019. Most adolescents completed the survey during school hours as an electronic questionnaire including questions assessing OTCA use for headache and musculoskeletal pain, frequency of headaches and musculoskeletal pain and trauma exposure. Adolescents in apprentice positions were invited to participate in Young-HUNT4 on apprentice gatherings. They were informed about the survey and how to participate in advance of these gatherings. Adolescents not enrolled in school were invited to participate through the follow-up service for adolescents not enrolled in school, a service that is regularly in contact with these adolescents. Although measures were made to recruit participants outside of school, participation rate was lower among apprentices (40%, n=237) and adolescents not enrolled in school (10%, n=42).

Patient and public involvement

Youth representatives were involved in planning the survey, and adolescents in pilot schools gave feedback to optimise conduction of the full survey.

Measures

Data on age and sex were obtained from the Norwegian National Population Registry. Pubertal development stage was assessed using a four-item version of the pubertal development scale by Carskadon and Acebo.[29] The participants were asked two questions regarding members of their household(s) and time spent in different households, and were categorised as 'living with both parents' or 'living in other type of household'. The adolescents were asked whether they perceived their family's economy as below average, average or above average and were grouped into 'family economy average or better' and 'family economy below average'.

Use of OTCA for headaches and musculoskeletal pain

Self-reported use of OTCA for (i) headache and (ii) musculoskeletal pain served as two separate outcomes. Participants were asked 'How often during the last 3 months have you used non-prescription medication to treat the following complaints? (medication not prescribed by a doctor, for instance bought at a pharmacy or grocery store) for (i) headache and (ii) muscle or joint pain'. Response alternatives were 'never/rarely'=0, '1–3 days per month'=1, '1–3 days per week'=2, '4–6 days per week'=3 and 'daily'=4. We combined the frequency categories '4–6 days/week' and 'daily' into one group, giving a range of 0–3 for frequency.[10 11] A similar question has previously been used for the purpose of assessing frequency of use of OTCA in adults.[30]

Exposure to traumatic events

Bullying

The participants were asked to report the frequency of being exposed to four types of bullying for the past 6 months. Questions were derived from validated questionnaires.[31 32] Participants were asked the introductory question 'How many times has this happened to you the last 6 months?' and then assessed the four statements 'I have been made fun of, teased, called names', 'I have been hit, kicked, attacked, got my hair pulled', 'I have been excluded, not allowed to participate' and 'I have received unpleasant messages or photos by phone or online' by how often it had occurred. Response alternatives were 'never', '1–3 times per month', 'once per week', '2–4 times per week' and 'almost daily'. Responders reporting bullying weekly or more frequently were categorised as being bullied.

Lifetime trauma screen

Exposure to *physical violence*, *sexual abuse* and *other traumatic events* was assessed by a brief lifetime trauma screen, derived from the UCLA Stress Disorder Reaction Index, part I,[33] adapted to a Norwegian context. All events were listed under the question 'Did you ever experience any of these events?'. Response alternatives were 'never', 'once' and 'more than once' for all items, and participants responding 'once' or 'more than once' were labelled exposed.

Physical violence

Lifetime exposure to physical violence was measured by two items worded 'subjected to violence (beaten/harmed) by someone close to you' and 'subjected to

violence (beaten/harmed) by others'. Participants were also asked if they had 'seen someone else being subjected to violence', this question was used to define the item *witness to violence*.

Sexual abuse

Lifetime exposure to sexual abuse was measured by two items worded 'subjected to unpleasant sexual act by a peer' and 'subjected to unpleasant sexual act by an adult', and reports of any exposure were categorised as *sexual abuse*.

Other traumatic events

The participants were asked about lifetime occurrence of five other traumatic events, these items were worded: 'that you or someone in your family were seriously ill', 'the death of someone close to you', 'a disaster (fire, hurricane or similar)', 'a serious accident (eg, serious car accident)', 'another experience that was very frightening, dangerous or violent'. These questions were used to define the two items *severe illness or death of close person* and *accident, disaster or other potentially traumatic event*.

Number of types of trauma exposure

Two separate sum scores (ranging 0 to ≥2) for (i) *interpersonal violence* (bullying, physical violence, witness to violence and sexual abuse, ranging 0–4) and (ii) *other traumatic events* (illness/death and accident/disaster/other), were calculated for each individual.

Musculoskeletal pain, headache and juvenile idiopathic arthritis

Musculoskeletal pain

Participants were asked 'How often during the past 3 months have you experienced any of these complaints?'. The complaints in question were pain in seven locations (jaw, neck, chest, upper back, lower back, arms and legs). Response alternatives were 'never/rarely', 'monthly', 'weekly', 'several times per week', 'almost daily'. The questions are based on an instrument developed to assess musculoskeletal pain in adolescents.[34] We counted all sites from which participants reported weekly or more frequent pain, in compliance with measures of chronic multisite musculoskeletal pain in adolescents from other studies.[3 35 36] For regression analysis, we grouped responders based on number of pain sites: 0, 1, 2 and 3 or more sites.

Headache

The interview part of the survey included a validated headache interview.[37] Participants were asked if they had experienced headaches for the past 12 months, and if they had experienced reoccurring headaches for the past 12 months. Further, they were asked about headache characteristics to assess type of headache (migraine, tension-type headache or other headache). Headache frequency was assessed for each type of headache, with the following response alternatives: '<1 day per month', '1–3 days per month', '1–3 days per week' and 'more than 4 days per week'. Participants reporting weekly or more frequent headaches were coded 1 for headache, whereas participants reporting less frequent or no headaches were coded 0.[10 11]

Juvenile idiopathic arthritis

Participants reporting that they had received a diagnosis of juvenile idiopathic arthritis (JIA) from a doctor were classified as having JIA.

Pain-related disability

Level of pain-related disability was measured using a six-item version of the Mikkelsson *et al* disability index.[34] In the questionnaire, six specific complaints were stated, and the adolescents were asked to assess if the statement was a true or false description of their disability due to pain. The complaints stated were 'pain makes it difficult to fall asleep', 'pain disrupts my sleep at night', 'pain makes it hard for me to be in lectures in school', 'pain makes it hard for me to walk more than one kilometre', 'due to pain, I have problems with physical education classes', 'pain limits my leisure activities'. One point was given for each affirmative answer to the questions on impairment of function due to pain. The two questions about sleep were combined to give one point for affirmative answer to either or both questions, in compliance with the original index ranging from 0 to 5. Cronbach's alpha for the six items was 0.74.

Statistical procedures

Descriptive data were presented stratified by frequency of OTCA use and by sex. Categorical variables were described with counts and percentages, while continuous variables were described with mean and SD. Half-rule was used to handle missing, meaning that for mean scores, participants answering at least half of the questions used to calculate the score, were included in the analysis. Self-reported frequency of use of OTCA for (i) headaches and (ii) musculoskeletal pain served as separate outcomes in ordinal logistic regression analyses. The impact of exposure to the five categories of potentially traumatic events, as well as the impact of number of types of (i) exposure to interpersonal violence and (ii) exposure to other traumatic events were assessed in separate ordinal logistic regression analyses. All analyses were adjusted for the predefined background factors age,[2] sex,[38] pubertal development,[39] socioeconomic status[8 40] and household structure,[9 41 42] and conducted as complete case analyses. In model 1, analyses were adjusted for background factors only. Indications for OTCA use, including variables of headache and musculoskeletal pain frequency and JIA, were added in model 2, in order to account for pain. All ordinal logistic regression analyses were tested with Brant test. Outcome variables for which the assumption of proportional odds was violated according to Brant test, were examined by comparing the ORs for each group comparison in the ordinal logistic regression. Analyses were conducted using Stata V.16.

Table 1 Sociodemographic characteristics, trauma exposure and symptoms in adolescence stratified by frequency of use of over-the-counter analgesics to treat headache

	N	Total	Never	Monthly	Weekly	Daily
		N (%)/mean (SD)	N (%)/mean (SD)	N (%)/mean (SD)	N (%)/mean (SD)	N (%)/mean (SD)
All participants	7829	7829 (100)	4739 (60.5)	2326 (29.7)	577 (7.4)	187 (2.4)
Female		3989 (51.0)	2032 (42.9)	1374 (59.1)	435 (75.4)	148 (79.1)
Male		3840 (49.1)	2707 (57.1)	952 (40.9)	142 (24.6)	39 (20.9)
Age	7829	16.1 (1.8)	15.9 (1.8)	16.3 (1.7)	16.6 (1.6)	16.5 (1.7)
Family economy	7757					
Average or better		7145 (92.1)	4395 (93.6)	2108 (91.3)	488 (85.8)	154 (83.7)
Below average		612 (7.9)	301 (6.4)	200 (8.7)	81 (14.2)	30 (16.3)
Household	7256					
Living with both parents		4290 (59.1)	2706 (61.3)	1253 (58.4)	259 (49.2)	72 (42.4)
Other type of household		2966 (40.9)	1707 (38.7)	894 (41.6)	267 (50.8)	98 (57.7)
Pubertal development score	7390	3.1 (0.7)	3.0 (0.7)	3.2 (0.6)	3.3 (0.6)	3.3 (0.6)
Exposure to traumatic event						
Bullying	7686	641 (8.3)	322 (6.9)	206 (9.0)	75 (13.2)	38 (20.5)
Physical violence	7668	658 (8.6)	342 (7.4)	196 (8.6)	84 (15.0)	36 (19.8)
Sexual abuse	7665	655 (8.6)	263 (5.7)	236 (10.3)	108 (19.3)	48 (26.4)
Witness to violence	7650	1150 (15.0)	647 (14.0)	344 (15.1)	108 (19.4)	51 (28.3)
Illness/death of someone close	7689	6219 (80.9)	3636 (78.2)	1950 (85.0)	481 (85.4)	152 (82.2)
Disaster/accident/other	7681	2477 (32.3)	1325 (28.6)	808 (35.2)	262 (46.6)	82 (44.8)
Interpersonal violence, number of types	7718					
0		5592 (72.5)	3548 (76.1)	1619 (70.4)	334 (58.4)	91 (49.2)
1		1421 (18.4)	769 (16.5)	458 (19.9)	145 (25.4)	49 (26.5)
≥2		705 (9.1)	344 (7.4)	223 (9.7)	93 (16.3)	45 (24.3)
Weekly or more frequent headache	7259	1129 (15.6)	264 (6.0)	407 (18.9)	327 (62.2)	131 (77.1)
Musculoskeletal pain, number of sites	7745					
0		4685 (60.5)	3223 (68.8)	1241 (53.8)	179 (31.4)	42 (22.7)
1		1320 (17.0)	735 (15.7)	460 (20.0)	95 (16.6)	30 (16.2)
2		719 (9.3)	347 (7.4)	274 (11.9)	71 (12.4)	27 (14.6)
≥3		1021 (13.2)	379 (8.1)	330 (14.3)	226 (39.6)	86 (46.5)
Disability index, mean	6278	1.3 (1.4)	1.0 (1.3)	1.3 (1.4)	2.1 (1.6)	2.5 (1.5)

RESULTS

Close to 10% of all the 8066 adolescents in the study reported at least weekly use of OTCA for headache (table 1), while about 4% reported weekly OTCA use for musculoskeletal pain (table 2). Overall, girls reported weekly use of OTCA for headaches or musculoskeletal pain about three times more frequently than boys. About 8.5% reported exposure to each type of direct interpersonal violence (bullying, sexual abuse and physical violence), while 15% reported having witnessed violence. 9% reported exposure to two or more interpersonal events. The proportion of adolescents exposed to traumatic events increased with increasing frequency of OTCA use, this trend was particularly pronounced for interpersonal violence (bullying, sexual abuse, physical violence and witnessing violence), and for experiencing two or more interpersonal events. Almost 40% of adolescents reported musculoskeletal pain in at least one location weekly or more often, while 15.5% reported weekly headaches. Females reported such symptoms 2–3 times more often than males (online supplemental table 1). Disability index was higher with higher frequencies of OTCA use (tables 1 and 2). Missing data for variables of interest were in the range of 1.5%–7.0%.

Ordinal logistic regression for frequency of use of OTCA for headache by type of trauma, showed a significant association with all the types of traumatic events that were analysed (table 3, model 1). The strongest associations were found for bullying and sexual abuse. Following adjustment for headache and musculoskeletal

Table 2 Sociodemographic characteristics, trauma exposure and symptoms in adolescence stratified by frequency of use of over-the-counter analgesics to treat musculoskeletal pain

		Total	Never	Monthly	Weekly	Daily
	N	N (%)/mean SD	N (%)/mean (SD)	N (%)/mean (SD)	N (%)/mean (SD)	N (%)/mean (SD)
All participants	7776		6902 (88.8)	586 (7.5)	173 (2.2)	115 (1.5)
Female		3954 (50.9)	3372 (48.9)	377 (64.3)	119 (68.8)	86 (74.8)
Male		3822 (49.2)	3530 (51.1)	209 (35.7)	54 (31.2)	29 (25.2)
Age	7776	16.1 (1.8)	16.1 (1.8)	16.4 (1.8)	16.5 (1.8)	16.2 (1.8)
Family economy	7705					
Average or better		7096 (92)	6336 (92.6)	519 (90.0)	145 (84.3)	96 (85.0)
Below average		609 (7.9)	507 (7.4)	58 (10.1)	27 (15.7)	17 (15.0)
Household	7210					
Living with both parents		4266 (59.2)	3825 (59.8)	304 (55.6)	94 (59.5)	43 (41.0)
Other type of household		2944 (40.8)	2575 (40.2)	243 (44.4)	64 (40.5)	62 (59.1)
Pubertal development score	7503	3.1 (0.66)	3.1 (0.66)	3.2 (0.62)	3.2 (0.61)	3.3 (0.63)
Exposure to traumatic event						
Bullying	7641	637 (8.3)	509 (7.5)	78 (13.4)	29 (17.1)	21 (18.3)
Physical violence	7629	654 (8.6)	536 (7.9)	65 (11.3)	28 (16.7)	25 (22.3)
Sexual abuse	7625	650 (8.5)	518 (7.7)	80 (13.9)	25 (14.9)	27 (23.9)
Witness to violence	7610	1140 (15.0)	962 (14.2)	109 (19.0)	37 (22.3)	32 (28.3)
Illness/death of someone close	7642	6180 (80.9)	5436 (80.2)	488 (84.3)	155 (91.7)	101 (88.6)
Disaster/accident/other	7640	2467 (32.3)	2101 (31.0)	233 (40.2)	82 (48.5)	51 (44.7)
Interpersonal violence, number of types	7671					
0		5563 (72.5)	5045 (74.2)	364 (62.4)	98 (57.7)	56 (48.7)
1		1407 (18.3)	1202 (17.7)	138 (23.7)	39 (22.9)	28 (24.4)
≥2		701 (9.1)	556 (8.2)	81 (13.9)	33 (19.4)	31 (27.0)
Weekly or more frequent headache	7213	1116 (15.5)	876 (78.5)	128 (11.5)	67 (6.0)	45 (4.0)
Musculoskeletal pain, number of sites	7708					
0		4664 (60.5)	4429 (64.7)	200 (34.4)	27 (15.9)	8 (7.1)
1		1316 (17.1)	1137 (16.6)	132 (22.7)	28 (16.5)	19 (16.8)
2		716 (9.3)	587 (8.6)	89 (15.3)	25 (14.7)	15 (13.3)
≥3		1012 (13.1)	690 (10.1)	161 (27.7)	90 (52.9)	71 (62.8)
Disability index, mean	6247	1.3 (1.4)	1.1 (1.4)	1.8 (1.5)	2.6 (1.5)	3.0 (1.5)

pain frequency and JIA (model 2) all trauma types except for physical violence remained significantly associated with OTCA use, although an attenuation in strength was observed. Ordinal logistic regression for frequency of use of OTCA for headache by number of types of interpersonal violence, showed a trend of increasing strength of association with increasing number of types (table 3, model 1). The strength of the associations was attenuated with adjustment for headache, musculoskeletal pain and JIA (model 2). Ordinal logistic regressions for frequency of use of OTCA for headache by number of types of other traumatic events showed similar results (online supplemental table 2).

Ordinal logistic regression for frequency of use of OTCA for musculoskeletal pain by type of trauma, showed a significant association with all the types of potentially traumatic experiences that were analysed (table 4, model 1). The association was particularly strong for bullying. When adding pain to the model (model 2); bullying, witnessing violence and other potentially traumatic experiences, including disasters and serious accidents remained significantly associated with the outcome, although the strength of association was attenuated. Ordinal logistic regression for frequency of use of OTCA for musculoskeletal pain by number of types of interpersonal violence, showed a trend of increasing strength of association with increasing number of types (table 4, model 1). The associations were attenuated when adding pain (model 2) to the model, although still significant. Ordinal logistic regressions for frequency of use of OTCA for musculoskeletal pain by

Table 3 Ordinal logistic regression analyses for outcome (i), frequency of use of over-the-counter analgesics to treat headache, by type of event and number of types of interpersonal violence

	Model 1*			Model 2*†		
	n	OR (95% CI)	P value	n	OR (95% CI)	P value
Exposure to potentially traumatic events, by type						
Bullying	6818	1.79 (1.50 to 2.12)	<0.001	6679	1.31 (1.09 to 1.57)	0.004
Sexual abuse	6806	1.83 (1.55 to 2.18)	<0.001	6669	1.37 (1.15 to 1.64)	0.001
Physical violence	6807	1.49 (1.25 to 1.78)	<0.001	6671	1.12 (0.93 to 1.34)	0.248
Witness to violence	6792	1.35 (1.18 to 1.55)	<0.001	6656	1.16 (1.00 to 1.34)	0.046
Severe illness or death of someone close	6814	1.36 (1.19 to 1.55)	<0.001	6672	1.27 (1.11 to 1.46)	0.001
Severe accident, disaster or other potentially traumatic event	6813	1.48 (1.33 to 1.64)	<0.001	6675	1.23 (1.10 to 1.37)	<0.001
Exposure to interpersonal violence, number of types						
1 type of interpersonal violence	6830	1.46 (1.29 to 1.66)	<0.001	6689	1.25 (1.10 to 1.43)	0.001
≥2 types of interpersonal violence	6830	1.81 (1.53 to 2.14)	<0.001	6689	1.26 (1.01 to 1.51)	0.010

*Models 1 and 2 are ordinal logistic regression models estimating odds for a higher frequency of use of over-the-counter analgesics for headache. Each trauma type was assessed by separate complete case analysis. Both models are adjusted for background factors: sex, age, pubertal development, household and family economy.
†Ordinal logistic regression model adjusted for headache, musculoskeletal pain and juvenile idiopathic arthritis in addition to background factors.

number of types of other traumatic events showed similar results (online supplemental table 3).

DISCUSSION

This population study shows a strong and consistent relationship between trauma exposure and higher frequency use of OTCA for headache and musculoskeletal pain among adolescents. The strongest associations were found for bullying, physical violence and sexual abuse. Overall, with increasing trauma exposure, we observed higher use of OTCA, indicating a dose–response relationship. The associations remained significant after adjustment for headache and musculoskeletal pain frequency and JIA, although an attenuation in strength was observed. Thus, the higher frequency of pain conditions among trauma-exposed only partially explained their more frequent use of OTCA. The finding indicates that trauma-exposed adolescents may be at particular risk

Table 4 Ordinal logistic regression analyses for outcome (ii), frequency of use of over-the-counter analgesics to treat musculoskeletal pain, by type of event and number of types of interpersonal violence

	Model 1*			Model 2*†		
	n	OR (95% CI)	P value	n	OR (95% CI)	P value
Exposure to potentially traumatic events, by type						
Bullying	6778	2.12 (1.70 to 2.66)	<0.001	6655	1.43 (1.12 to 1.82)	0.004
Sexual abuse	6768	1.53 (1.18 to 1.90)	<0.001	6645	1.05 (0.82 to 1.35)	0.698
Physical violence	6771	1.83 (1.45 to 2.32)	<0.001	6647	1.29 (1.00 to 1.66)	0.051
Witness to violence	6755	1.71 (1.40 to 2.07)	<0.001	6632	1.40 (1.13 to 1.72)	0.002
Severe illness or death of someone close	6773	1.35 (1.09 to 1.67)	0.006	6648	1.17 (0.93 to 1.46)	0.183
Severe accident, disaster or other traumatic event	6775	1.57 (1.34 to 1.83)	<0.001	6651	1.22 (1.03 to 1.44)	0.020
Exposure to interpersonal violence, number of types						
1 type of interpersonal violence	6789	1.61 (1.34 to 1.94)	<0.001	6665	1.31 (1.07 to 1.60)	0.008
≥2 types of interpersonal violence	6789	2.39 (1.91 to 3.00)	<0.001	6665	1.52 (1.20 to 1.94)	0.001

*Models 1 and 2 are ordinal logistic regression models estimating odds for a higher frequency of use of over-the-counter analgesics for musculoskeletal pain. Each trauma type was assessed by separate complete case analysis. Both models are adjusted for background factors: sex, age, pubertal development, household and family economy.
†Ordinal logistic regression model adjusted for headache, musculoskeletal pain and juvenile idiopathic arthritis in addition to background factors.

of using OTCA, relating to features beyond frequency of pain.

Close to 10% of the adolescents in our study reported using OTCA for headache weekly or daily and 3.5% reported use for musculoskeletal pain weekly or daily. These findings comply with previous studies showing that a substantial subgroup of adolescents use OTCA frequently.[2 4 10] Such weekly use will generally represent overuse and may have negative health effects.[11 43]

In this study, all events with potential to induce a long-lasting stress response were included, and 83.1% of participants reported life-time exposure to at least one potentially traumatic event. Studies with a similar approach have shown a similarly high prevalence.[24 44 45] Different types of trauma have been found to impact future health differently, with interpersonal violence being particularly detrimental.[24 44 46] In compliance with this, we found that bullying, physical violence and sexual abuse were the types of trauma most strongly associated with higher frequency use of OTCA. Not only type of traumatic event, but also number of types of trauma exposure has been shown to be relevant for future health.[45 47] The observed dose–response relationship between number of types of both interpersonal violence and other traumatic events and higher frequency use of OTCA in this study is in compliance with this.

Our results indicate that the higher use of OTCA by adolescents exposed to traumatic events could only partially be explained by the higher frequency of headaches and musculoskeletal pain experienced by this group. However, the adolescents using OTCA frequently did report higher level of disability due to pain than adolescents using OTCA less frequently, possibly relating to higher pain severity. Thus, there is a possibility that the more frequent use of OTCA among adolescents exposed to trauma relates to this group running increased risk of experiencing a combination of higher frequency and severity of pain. Findings from neurobiological studies could lend some evidence to such a potential explanation, as pathophysiological (mal)adaptations are considered to contribute to increased pain among young people exposed to trauma, including dysregulation of stress response systems such as the hypothalamic–pituitary–adrenal axis[48 49] and central sensitisation, where pain receptors of the central nervous system become sensitive to normally subthreshold stimuli.[50]

In addition to biological factors linking traumatic events and pain, experiencing traumatic events in childhood is related to the later development of a wide spectrum of psychopathology.[42 51–54] The mechanisms involved may overlap with mechanisms increasing risk of chronic pain,[51 55] including catastrophising, negative pain appraisal, depression and anxiety.[49] Recent studies have found that adolescents also report using OTCA as an aid in stressful situations and that frequency of use is associated with reporting higher symptom load for psychological distress.[2 4 56] In terms of depression and anxiety, these conditions have been found to be associated with using OTCA more frequently also after adjusting for pain.[4] There is also an overlap between social factors related to trauma and to chronic pain, including a less favourable family environment and poorer peer relational skills.[49] Thus, it is plausible that physiological and psychological trauma reactions and related social problems may contribute to more frequent use of OTCA among trauma-exposed adolescents. As such, overlapping treatment opportunities for trauma and chronic pain could favourably impact both psychological distress, chronic pain and OTCA use.[57]

Total sales of analgesics that are also available over-the-counter, are increasing rapidly,[58] perhaps reflecting an increasing inclination to alleviate complaints by use of pain medication. Such overarching societal trends may be relevant for the association between traumatic events and use of OTCA, as the adolescents exposed to trauma may be a group at increased risk, due to the factors described above. Adolescents exposed to interpersonal trauma and other multiple traumatic events may represent a marginalised group left with few options for coping with stress and pain.[41 59] Lack of other options could explain a higher tendency to use easily accessible OTCA.[2 60]

STRENGTHS AND LIMITATIONS

Strengths of this study were the large sample size and high participation rate, the use of a questionnaire derived from validated instruments and questions allowing for a thorough assessment of exposures and symptoms. The relationship between exposure to traumatic events and higher frequency use of OTCA shown in this study on a representative youth population in Norway, is likely to be transferrable to other adolescent populations with high availability of OTCA.

A limitation of this study is that the cross-sectional design does not allow for causal assumptions based on our analyses. The response rate among the small group of adolescents not enrolled in school was low, which may introduce a selection bias and possibly a slight underestimation of the associations, due to under-representation of a group of adolescents at increased risk.[61] Sample weights were not available for this survey. It is possible that well-calculated sample weights could improve the accuracy of our estimates. Health problems and use of OTCA were measured across various time frames, ranging from 3 to 12 months. Despite the variation, all of these measures use a time frame of ≥3 months, in coherence with current definitions of more persistent or chronic symptomatology or use.[62] It is also a limitation that exposure to bullying was assessed for the previous 6 months as opposed to lifetime exposure for the remaining items.

We did not have data on trauma-specific or other treatment, which hindered assessment of whether OTCA were used in combination with treatment.

CONCLUSION AND IMPLICATIONS

This representative population study shows higher frequency use of OTCA among adolescents exposed to traumatic events, which may increase the health burden of exposed adolescents. Findings from this study indicate that trauma-exposed adolescents may be at particular risk of using OTCA, relating to features beyond frequency of pain. The increased risk of frequent OTCA use could relate to pain severity, possibly related to potentially malleable post-traumatic stress reactions. Future studies on OTCA use in adolescence should assess trauma exposure as a potential risk factor. Longitudinal studies to examine if there is a long-term risk of frequent analgesics use after exposure to childhood trauma are needed. Further, we need studies that assess the impact of trauma-specific treatment on OTCA use after trauma, as there are some indications of overlapping treatment opportunities for trauma and chronic pain.

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