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Original article

# Chronic Pain in Schoolchildren and its Association With Psychological Wellbeing Before and During the COVID-19 Pandemic



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## A B S T R A C T

**Purpose:** The current longitudinal observational study aimed to explore how chronic pain among schoolchildren changed before and during the COVID-19 pandemic, and how changes in chronic pain were related to changes in psychological wellbeing and COVID-19-related experiences.

**Methods:** Data were collected from N = 777 German schoolchildren (aged 9–17 years) at two assessments before and one assessment during the COVID-19 pandemic lockdown. Participants self-reported chronic pain experience, anxiety, depression, and quality of life across all assessments; and COVID-19-related experiences at the last assessment. Trajectories of anxiety, depression, and quality of life as well as COVID-19-related experiences were analyzed separately for groups of stable chronic pain trajectories compared to chronic pain trajectories that changed during the pandemic.

**Results:** Chronic pain prevalence was lowest at the assessment during the COVID-19 pandemic (22.8% vs. 29.2% and 29.9% before the pandemic). However, 4.6% experienced new chronic pain onset during the COVID-19 pandemic. This was preceded by heightened depression and anxiety, as well as lowered quality of life scores. These students were also more likely to describe time with their family during the COVID-19 pandemic as tense compared to students who did not develop chronic pain. During the COVID-19 pandemic boys were more likely to recover from ongoing chronic pain than girls.

**Conclusions:** Overall, during the COVID-19 pandemic the prevalence of chronic pain decreased. However, stressful situations and pre-existing vulnerabilities in psychological wellbeing can facilitate the development of chronic pain during the pandemic.

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## IMPLICATIONS AND CONTRIBUTION

The current study provides unique insights to changes in chronic pain experience during the COVID-19 pandemic in a large longitudinal school sample. Moreover, it provides evidence of psychological vulnerability and pandemic-related stress as being possible mechanisms behind the development of chronic pain during the pandemic-induced lockdown.

**Conflicts of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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The COVID-19 has changed the lives of children and adolescents dramatically. Through governmental mitigation measures such as lockdowns, school closures, and social distancing, young people have been facing drastic alterations to their routines and a massive reduction in peer contact. Evidence from the COVID-19 pandemic as well as previous epidemics suggests that these changes could have a notable effect on young people's psychological wellbeing [1]. This includes increased anxiety, depression, or reduced quality of life [2–6]. However, these times could also be beneficial: the usual external stressors schoolchildren face might be removed (e.g., bullying, tight schedules [7,8]) and more frequent time together might result in stronger family bonds [5,9].

Positive and negative experiences, for example, during a pandemic, could influence psychosomatic conditions such as chronic pain in children and adolescents. For instance, pediatric pain patients report an increased number of stressful life events [10] and lower quality of life [11,12] compared to young people without chronic pain. Social support and family functioning, however, can act as resilience factors against chronic pain in young people [13,14]. Findings of studies investigating chronic pain in young people during the COVID-19 pandemic are sparse; the two identified studies include pediatric patients already diagnosed with recurrent headaches and point toward an overall decrease in chronic pain prevalence [15,16].

The current study's overall aim is to explore how chronic pain among young people changes during the COVID-19 pandemic. Specifically, it aims to explore chronic pain prevalence before and during the pandemic and to identify young people who develop or recover from chronic pain. It further aims to investigate if these changing chronic pain trajectories are associated with trajectories of general psychological wellbeing and/or with experiences related to COVID-19.

## Methods

### Participants and design

Participants were recruited at three German schools of diverse educational levels (total eligible population:  $N = 2,209$ ). Students from the 5th to 11th grades were included if both the students and their parents provided informed consent to the original project aim (development of a pediatric chronic pain grading and of an artificial neural network to predict the course of chronic pain) and did not withdraw consent after being informed about the COVID-19 study amendments described below. The  $N = 1,358$  included participants were invited to complete questionnaires at three time points: T1 (October/November 2019), T2 (January/February 2020), and T3 (June/July 2020). Originally, all assessments should have taken place at school every 3 months and filled in on tablet PCs. However, due to the COVID-19 mitigation measures the last assessment was emailed to the participants and completed online. The first two assessments (T1 and T2) took place before the COVID-19 pandemic; the last assessment took place during and directly after the first lockdown in Germany (T3). During this lockdown, schools were mostly closed (online schooling), only one other person was allowed to be met outside, and meeting for sports or at playgrounds was prohibited (for more details, see lockdown measures dataset for Germany [17]). The retention rate at T3 was 54.9% (for participant flow, see Figure 1). In the current paper,

only data from participants who completed all three assessments were analyzed ( $N = 777$ ;  $M_{\text{age}} = 12.9$ ;  $SD_{\text{age}} = 2.0$ ;  $\text{range}_{\text{age}}: 9\%–17\%$ ; 53.3% girls; 96.9% born in Germany). Dropout analyses showed that retained participants had higher quality of life ( $t(731.05) = 3.35$ ,  $p = .001$ ,  $d = -.20$ ) and were more likely born in Germany ( $\chi^2(1,347) = 14.0$ ,  $p < .001$ , Cramer's  $V = .11$ ) compared to schoolchildren who did not participate at T3; both effects were small. Subanalyses reported in this paper do not include all  $N = 777$  participants (for details, see Analyses section).

### Material

Besides demographic information (age, gender, country of birth) participants completed questions about their pain, depression, anxiety, and quality of life. At T3, additional COVID-19-related questions were asked.

**Pain assessment.** Participants reported the locations of any pain, as well as the frequency and duration of their main pain (German Pain Questionnaire for Children and Adolescents [18]). Participants were classified as having chronic pain if their main pain started more than 3 months ago, was present within the last 4 weeks, and recurred weekly or more often [19].

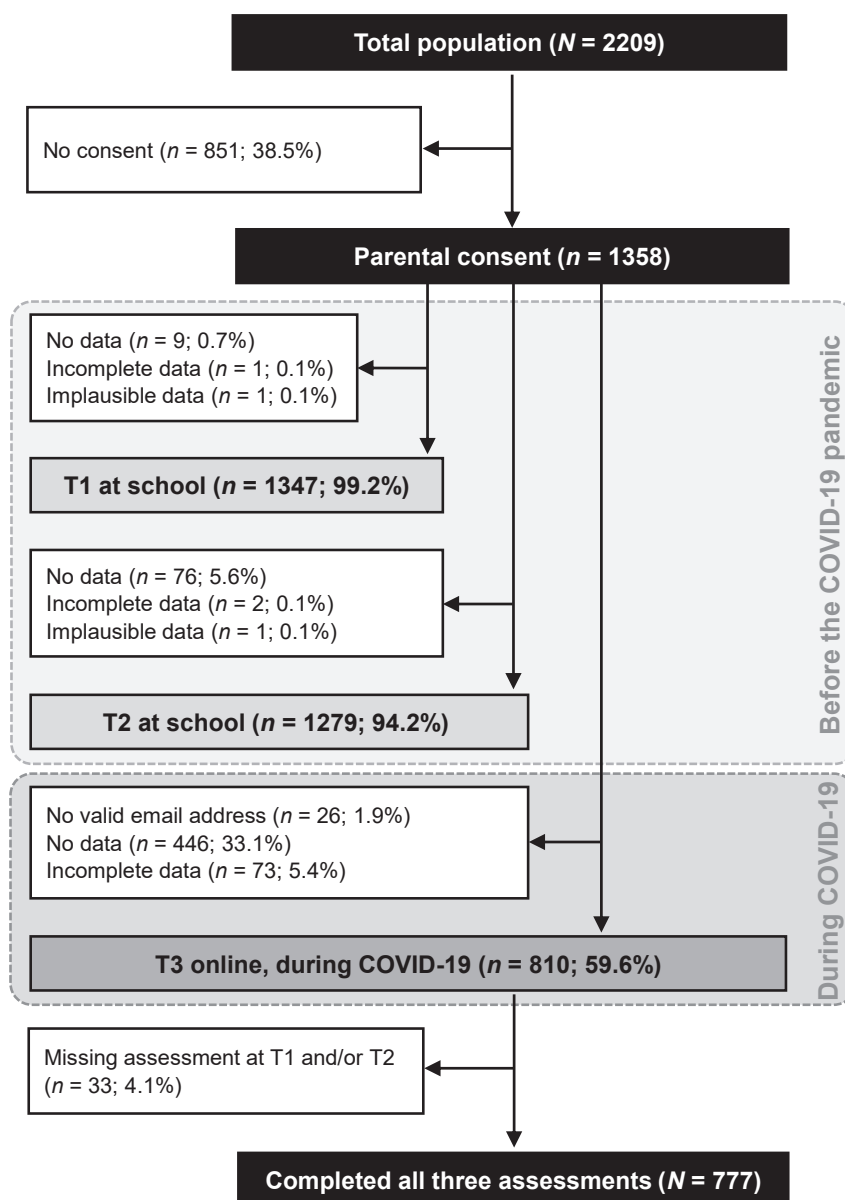
**Psychological wellbeing.** Anxiety and depression were assessed with the German version [20] of the Revised Children's Anxiety and Depression Scale (RCADS; [21]). The RCADS provides anxiety and depression subscales (37 and 10 items, respectively; 4-point Likert scale: 0 = "never" to 3 = "always"). Depression and anxiety total scores are formed by summing across all items of each subscale [20]. In the current sample, both RCADS scales showed excellent internal consistency across all assessments (Cronbach's  $\alpha_{\text{depression}} = .87–.90$  and  $\alpha_{\text{anxiety}} = .95–.96$ ).

Quality of life was assessed using the German 10-item short form of the KIDSCREEN [22]. All items were answered on a five-point Likert scale (1 = "not at all" to 5 = "very"). Rasch-scaled scoring of the sum across all items and subsequent  $T$ -transformation was applied as suggested in the KIDSCREEN manual [23]. Internal consistency in the current study was good (Cronbach's  $\alpha = .87–.88$  across all assessments). Descriptive statistics of depression, anxiety, and quality of life scores across all three assessments are presented in Table 1.

**COVID-19 experiences.** Participants were asked how exhausting they found home schooling during COVID-19. They also rated how often they had moved or exercised outside during the lockdown (e.g., going for a walk, biking, or running) and how difficult the cancellation of important events (e.g., holidays) was for them. Participants further reported if time spent with their family during the pandemic was tense, harmonious, hectic, or relaxed. Finally, changes in participants' relationships with their family and friends during the lockdown were assessed. Exact phrasing of questions is provided in Supplemental Material S1.

### Analyses

All analyses were conducted with R [24] and RStudio [25] (for used R packages, see Supplemental Material S2). Significance



**Figure 1.** Flowchart of participation. T = time of assessment. Vertical arrows represent retained participants; horizontal arrows represent participants who dropped out or were excluded. Percentages refer to the next higher number of participants in the chart (e.g., 1,347/1,358 = 99.2%). One participant gave extreme and inconsistent answers throughout the survey and was therefore excluded from data analysis (i.e., implausible data).

level is set to  $\alpha = .05$ . Cohen's  $d$  effect sizes are interpreted as small ( $|d| = .1$ ), moderate ( $|d| = .3$ ), or large ( $|d| = .5$ ) [26].

**Analysis of change over time.** To test if chronic pain prevalence changed over time, logistic multilevel model analyses were employed using the total sample. Maximum likelihood estimation was used when comparing models. Contrasts for post hoc tests regarding the three assessments were set to compare T1 to T2 and T2 to T3 (variable "time"; T2–T1; T3–T2).

**Chronic pain trajectory groups.** Participants were grouped by the course of their chronic pain experience. Participants not experiencing chronic pain at any assessment (T1 through T3) were

allocated to the "stable no chronic pain" group, while those who experienced chronic pain throughout were allocated to the "stable chronic pain" group. Participants who had chronic pain at T3 but not at T1 and T2 were allocated to the "rising chronic pain" group. Those who had chronic pain at T1 and T2 but not at T3 were allocated to the "falling chronic pain" group. Other chronic pain trajectories were not considered further in the current work (analyzed trajectories:  $n = 616$ ).

**Analysis of differences in chronic pain trajectory groups.** For sub-population analyses, data of "stable no chronic pain" and "rising chronic pain" groups were analyzed separately from "stable chronic pain" and "falling chronic pain" groups in multilevel

analyses [27]. This way, participants who had the same chronic pain status before and during the COVID-19 pandemic (“stable”) were compared to participants with a comparable chronic pain status before the pandemic but who had a different status during the pandemic (“changing”). In addition to the time variable described above, group membership (0: stable trajectory; 1: changing trajectory) and the interaction between group and time were included in the models of depression, anxiety, and quality of life.

**Associations of COVID-19-related items with chronic pain trajectory groups.** The most relevant variables distinguishing groups at T3 compared to their respective control group of stable chronic pain trajectories were identified through least absolute shrinkage and selection operator (LASSO) regressions. All nine ordinal COVID-19 questions were investigated as predictors in the models; demographic variables (age, gender) were control variables. All predictor variables were standardized and centered around the mean. Additional univariate analyses were performed and results supplied in [Supplemental Material S3](#).

#### Ethical approval

This study including its COVID-19-related amendments was approved by the Witten/Herdecke University Ethics Committee (reference number: 75/2019, June 6, 2020).

## Results

### Chronic pain prevalence and trajectories

Chronic pain prevalence was highest at T2 (before COVID-19) and lowest at T3 (after the lockdown). The most commonly reported main pain locations were musculoskeletal and the head ([Table 1](#)). Most participants did not experience chronic pain throughout the study period (“no chronic pain” group,  $n = 431$ , 55.5%).  $N = 88$  participants showed “stable,”  $n = 61$  “falling,” and  $n = 36$  “rising” chronic pain trajectories (11.3%, 7.8%, and 4.6%, respectively).

Using logistic multilevel modeling, time effects on chronic pain prevalence were investigated ( $N = 777$ ). The main effect of time was statistically significant ( $\chi^2(2) = 21.533$ ,  $p < .001$ ). Post hoc analyses showed a small increase in chronic pain prevalence from T1 to T2 (OR = 1.06, 95% confidence interval [CI] .75–1.50,  $t(552) = 1.994$ ,  $p = .039$ ,  $d = .101$ ), and a moderate decrease from T2 to T3 (OR = .52, 95% CI .36–.75,  $t(1552) = -4.652$ ,  $p < .001$ ,  $d = -.236$ ).

### Emotional wellbeing in different chronic pain trajectories

To explore differences in depression, anxiety, and quality of life over time between participants with “stable” and “changing” chronic pain trajectories, separate multilevel models were calculated ([Figure 2](#) and [Table 2](#)). The subsample of “rising chronic pain” and “stable no chronic pain” trajectory groups ( $n = 467$ ) differed significantly for all three outcomes (main effect of chronic pain group). Participants with “rising chronic pain” trajectories showed significantly higher depression and anxiety as well as lower quality of life scores than those with “no chronic pain.” Significant differences over time between the two groups emerged only in depression scores (interaction). Post hoc analyses showed that this is due to a significantly larger rise in

**Table 1**  
Pain and psychological characteristics across all three assessments

	T1	T2	T3
	n (%)	n (%)	n (%)
Chronic pain	227 (29.2%)	232 (29.9%)	177 (22.8%)
Main pain locations <sup>a</sup>			
Musculoskeletal	129 (56.8%)	136 (58.6%)	103 (58.2%)
Head	122 (53.7%)	109 (47.0%)	80 (45.2%)
Abdomen	58 (25.6%)	67 (28.9%)	34 (19.2%)
	M (SD)	M (SD)	M (SD)
Depression	6.27 (5.30)	6.70 (5.93)	5.41 (5.35)
Anxiety	24.4 (17.7)	25.1 (19.1)	21.1 (17.0)
Quality of life	51.4 (13.1)	51.0 (13.2)	52.3 (13.9)

M (SD) = mean (standard deviation); N = 777; T = time of assessment.

<sup>a</sup> Multiple choice item; sample with chronic pain.

depression scores from T2 to T3 in the “rising chronic pain” group compared to the “stable no chronic pain” group. When analyzing the subsample of “falling chronic pain” and “stable chronic pain” trajectory groups ( $n = 149$ ), there were no main effects of chronic pain group, indicating no significant differences between both groups. There were also no significant differences between the two groups over time (interaction), indicating parallel trajectories in all measures of wellbeing for both groups.

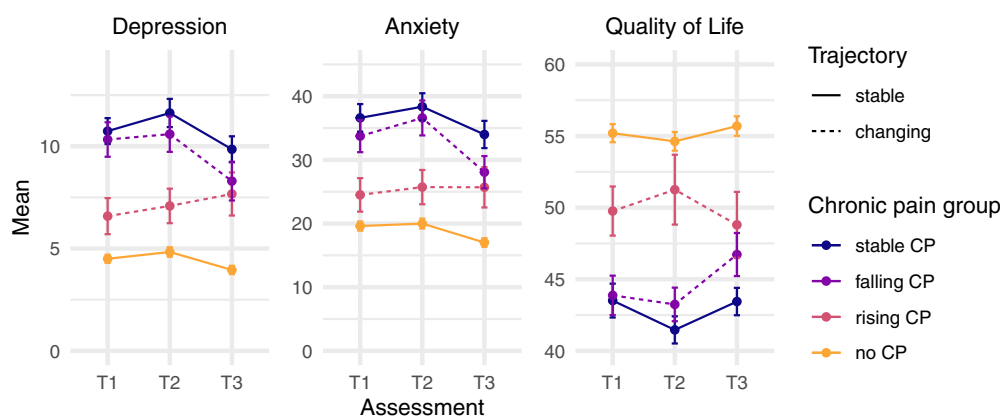
### COVID-19-related experiences

All participants answered questions on COVID-19-related experiences ( $N = 777$ ). Completing tasks during home schooling was very exhausting for 11.1% ( $n = 87$ ) of students. Most participating students reported moving outside every day (45.7%;  $n = 355$ ) or multiple times a week (40.7%;  $n = 316$ ). The cancellation of events during COVID-19 was at least a bit difficult for about 77.3% ( $n = 601$ ). Students experienced time spent with their family during the COVID-19 pandemic more often positively than negatively. About one third reported a change in relationship with their parents (32.4%;  $n = 252$ ), of which most experienced a change for the better (23.0%;  $n = 179$ ). The relationships with their friends changed for  $n = 306$  students (39.4%), of which about half reported a change for the better (19.6%;  $n = 152$ ). Means and standard deviations of COVID-19 items for each analyzed chronic pain group can be found in [Table 3](#).

In the LASSO regression comparing the “rising chronic pain” and “stable no chronic pain” trajectory groups ( $n = 467$ ;  $\lambda_{\min} = .019$ ), experiencing family time as tense was the only variable that remained in the model (OR = 1.32). Rating time with family as more tense was associated with higher odds of having a “rising chronic pain” trajectory.

The best LASSO model distinguishing “falling chronic pain” from “stable chronic pain” trajectory groups ( $n = 149$ ;  $\lambda_{\min} = .033$ ) included gender (OR<sub>girl</sub> = .65) and the following COVID-19-related items: experiencing cancellation of events as difficult (OR = 1.06), experiencing time with family as harmonious (OR = 1.06), and experiencing time with family as tense (OR = 1.00). Overall, boys had 1.35 times higher odds of having a “falling chronic pain” trajectory than girls. Furthermore, students who found cancelled events more difficult as well as students who experienced family time as more harmonious had higher odds of having “falling chronic pain” trajectories. Results





**Figure 2.** Trajectories across three assessments of depression, anxiety, and quality of life stratified by groups with different chronic pain trajectories. Error bars represent standard errors. Stable chronic pain trajectories are represented by solid lines, while trajectories that changed at the last assessment are represented by broken lines. CP = chronic pain. Orange: “stable no chronic pain” = participants not experiencing chronic pain in any assessment. Blue: “stable chronic pain” = participants experiencing chronic pain in all assessments. Red: “rising chronic pain” = participants who started experiencing chronic pain at T3 while having no experiences of chronic pain before. Purple: “falling chronic pain” = participants who stopped experiencing chronic pain at T3 while having stable experiences of chronic pain before.

of explorative univariate binomial regression analyses for all predictors can be found in [Supplemental Material S3](#).

## Discussion

The current study aimed to explore how young people’s chronic pain changed before and during the COVID-19 pandemic. Chronic pain prevalence significantly declined during the COVID-19 pandemic. Students who developed chronic pain during the pandemic showed significantly reduced psychological wellbeing already before. The occurrence of chronic pain during the pandemic was possibly triggered by perceiving time spent with their families as tense. Students who recovered from their chronic pain during the pandemic did not significantly differ in their psychological wellbeing from students who continued experiencing chronic pain; however, gender differences in favor of boys emerged.

In general, the 29%–30% prevalence of chronic pain before the COVID-19 outbreak in the current sample is comparable to other school samples [19,28], which adds to the body of evidence suggesting that a considerable number of school-aged children experience recurrent pain [11]. However, chronic pain prevalence dropped by 7% during the COVID-19 pandemic. One mechanism behind this drop could be the reduced exposure to risk factors of chronic pain, such as stress [10], bullying [7], or not liking school in general [19]. This is in line with findings of reduced headache prevalence during the COVID-19 lockdown in Italian pediatric headache patients [15]. Furthermore, the lockdown might have changed circumstances of social functioning for schoolchildren: While usually young people with chronic pain report it being hard to keep up with their friends [29] or being anxious regarding their pain [30], increased digitalization during the pandemic might have helped taking part in online activities, increased social integration, and built social resources, which in turn might have had positive effects on pain [31]. Although the majority of students did not experience chronic pain throughout the study period, there were still some who developed chronic pain during the COVID-19 pandemic who had not experienced

chronic pain at the prior two assessments. This proportion of students is comparable to the incidence in similar samples [32].

Furthermore, it was explored if groups of “changing” compared to “stable” chronic pain trajectories differed in their psychological wellbeing. Students developing chronic pain during the COVID-19 pandemic already had higher depression and anxiety scores and lower quality of life before the pandemic. This suggests that the absence of psychological wellbeing could be associated with a higher vulnerability of chronic pain development in children and adolescents. Regarding depression, the difference in mean scores between “rising chronic pain” and “stable no chronic pain” groups increased during the COVID-19 pandemic in the current study. Where young people without chronic pain showed a reduction in depression, scores rose for children who developed chronic pain during the pandemic. This suggests that students without chronic pain benefitted from the circumstances present during the pandemic regarding their psychological wellbeing, while students with an existing vulnerability experienced the opposite effect. An explanation for this could be mutual maintenance: not only have depression, anxiety, or stress been shown to precede the development of chronic pain, their co-occurrence can have a mutual detrimental effect [31].

The current results may even be an indicator that the pandemic acted as a trigger or additional stressor; the “grain that tipped the scales” of vulnerability for the development of chronic pain [31]. This is supported by the current study’s findings that students who developed chronic pain during COVID-19 more often viewed their time with family as tense compared to students who did not experience chronic pain throughout the study period. Nevertheless, the direction of the association among the development of chronic pain, psychological wellbeing, and stress factors is unclear. A family crisis could facilitate the development of chronic pain [33], but a child’s development of chronic pain could also have a negative impact on family functioning [13,34,35].

No significant difference in psychological wellbeing emerged between students with “stable chronic pain” throughout the study and those who recovered from chronic pain during the

**Table 2**

Results of multilevel models including time (T1, T2, T3) and chronic pain group ("rising" vs. "no chronic pain"; "falling" vs. "stable chronic pain") for depression, anxiety, and quality of life

Rising versus no CP		Depression			Anxiety			Quality of life		
ANOVAs	df	$\chi^2$	p value		$\chi^2$	p value		$\chi^2$	p value	
Time ME	2	21.371	<b>&lt;.001</b>		30.430	<b>&lt;.001</b>		1.845	.397	
Group ME	1	14.688	<b>&lt;.001</b>		7.218	<b>.007</b>		6.939	<b>.008</b>	
Interaction	2	8.456	<b>.015</b>		4.005	.135		2.603	.272	
Rising versus no CP		Depression			Anxiety			Quality of life		
Post hoc tests	df	t	p value	d	t	p value	d	t	p value	d
T1–T2	930	.721	.471	.047	2.300	<b>.021</b>	.151	.073	.941	.005
T2–T3	930	–4.802	<b>&lt;.001</b>	–.445	–5.822	<b>&lt;.001</b>	–.540	1.478	.140	.137
Group	465	3.854	<b>&lt;.001</b>	.253	2.691	<b>.007</b>	.176	–2.638	<b>.009</b>	–.173
(T2–T1) × CP	930	–1.684	.093	–.110	–1.340	.181	–.088	–.160	.873	–.011
(T3–T2) × CP	930	2.895	<b>.004</b>	.190	1.955	.051	.128	–1.308	.191	–.086
Falling versus stable CP		Depression			Anxiety			Quality of life		
ANOVAs	df	$\chi^2$	p value		$\chi^2$	p value		$\chi^2$	p value	
Time ME	2	23.569	<b>&lt;.001</b>		19.839	<b>&lt;.001</b>		12.380	<b>.002</b>	
Group ME	1	1.093	.296		1.424	.233		1.587	.207	
Interaction	2	1.902	.386		2.454	.293		3.863	.145	
Falling versus stable CP		Depression			Anxiety			Quality of life		
Post hoc tests	df	t	p value	d	t	p value	d	t	p value	d
T1–T2	294	0	1	0	.282	.778	.033	1.281	.201	.149
T2–T3	294	–2.868	<b>.004</b>	–.473	–2.277	<b>.024</b>	–.376	1.159	.247	.191
Group	147	–1.040	.300	–1.213	–1.188	.237	–.139	1.254	.212	.146
(T2–T1) × CP	294	1.222	.223	1.423	.408	.683	.048	–1.679	.094	–.196
(T3–T2) × CP	294	–1.152	.250	–1.343	–1.507	.133	–.176	1.713	.088	.200

p-values <.05 are set in bold.

ANOVA = analysis of variance; CP = chronic pain; d = Cohen's d; ME = main effect.

pandemic. This recovery could rather be related to the change in external circumstances (e.g., not having to go to school) than to internal processes such as psychological wellbeing. Moreover, experiences during COVID-19 were similar for children who stopped experiencing chronic pain during the pandemic compared to children who continued experiencing chronic pain. Even though describing time with family as tense or harmonious and finding the cancellations of events difficult were included in the LASSO model, the differences in the odds were minute (ORs

close to 1) and can therefore be neglected. Moreover, spending time moving outside, dealing with schoolwork at home, and relationships with family and friends were not significantly different in any of the two-group comparisons. This could be due to differences only emerging for specific subpopulations. For instance, boys were more likely than girls to stop experiencing chronic pain after having had chronic pain throughout the previous months. This is in line with findings that girls are more vulnerable to chronic pain than boys [11], and that girls express

**Table 3**

Means (standard deviations) of COVID-19 items and demographics for different chronic pain trajectories

CP trajectory	Total sample	Stable CP	CP falling at T3	CP rising at T3	No CP
n	777	88	61	36	431
<b>Demographics</b>					
Gender (girl)	53.3%	79.5%	65.6%	47.2%	44.5%
Age (at T1)	12.9 (2.0)	13.5 (1.8)	13.4 (2.0)	12.8 (1.9)	12.7 (2.0)
<b>COVID-19 items (scale description)</b>					
School work exhausting (1: little; 3: very)	1.8 (.6)	2.0 (.6)	2.0 (.7)	1.8 (.7)	1.7 (.6)
Moving outside (0: never; 4: daily)	3.2 (.9)	3.2 (.8)	3.2 (1.0)	3.3 (.7)	3.3 (.8)
Cancelled events difficult (0: not at all; 4: very)	1.7 (1.3)	1.7 (1.2)	2.0 (1.4)	1.8 (1.2)	1.6 (1.2)
<b>Time with family (0: never; 4: always)</b>					
Tense	1.3 (1.1)	1.6 (1.0)	1.7 (1.2)	1.8 (1.1)	1.2 (1.1)
Harmonious	2.5 (1.1)	2.2 (1.1)	2.4 (1.1)	2.4 (1.0)	2.6 (1.0)
Hectic	1.2 (1.0)	1.5 (1.0)	1.5 (1.1)	1.5 (1.0)	1.1 (1.0)
Relaxed	2.8 (1.0)	2.5 (1.1)	2.5 (1.1)	2.6 (1.1)	2.9 (1.0)
<b>Change in relationship (1: a lot worse; 5: a lot better)</b>					
Family	3.2 (.7)	3.1 (.8)	3.1 (.9)	3.1 (.7)	3.2 (.7)
Friends	3.0 (.8)	2.9 (.8)	3.0 (.9)	2.9 (.7)	3.0 (.8)

Only participants who completed all three assessments were included in this table. COVID-19-related items are described in detail in [Supplemental Material S1](#). CP = chronic pain.

more pain symptoms during the COVID-19 pandemic than boys [5]. Boys with chronic pain might have benefitted from the change in external circumstances more than girls with chronic pain. Future research could shine more light on how boys and girls experience lockdowns differently and how this interacts with chronic pain.

### Practical implications

Chronic pain is of biopsychosocial origin; biological, psychological, and social factors add to vulnerability and can act as triggers [36]. The current study's findings are in line with this: identifying as a girl decreases the chance of recovering from chronic pain (biological vulnerability), low psychological wellbeing is associated with the development of chronic pain already before its occurrence (psychological vulnerability), and a stressful atmosphere at home is associated with an increased risk of developing chronic pain during a lockdown (possible social triggers). In the current study, the COVID-19 pandemic can be seen as a nonmodifiable external condition. Therefore, it cannot be known which factors are causal and to which other situations the current study's findings can be transferred. However, the current study's findings likely underline the importance of fostering psychological wellbeing early in life to build resilience against the development of conditions like chronic pain during adverse times such as pandemics. For example, schoolchildren with lower psychological wellbeing could be supported by regular experience exchanges with peers led by a school counsellor—especially during situations of social isolation.

### Strengths and limitations

The current study provides a rich and large longitudinal dataset containing assessments before and during the COVID-19 pandemic. T1 and T2 provide a baseline and give an indication of stability before COVID-19, while T3 hints at young people's experiences during the COVID-19 pandemic. The students were of a broad age range and were recruited from schools of diverse educational levels.

However, the following limitations need to be considered when interpreting the results. Although completion and retention rates were comparatively high in the current sample [37], a considerable number of students could not be retained for the last follow-up. Although dropout analyses did not indicate a serious systematic effect of variables assessed at baseline, participants coping well during the pandemic might be more likely to partake.

The current longitudinal observational study compared groups of chronic pain trajectories that changed at the last assessment with groups that experienced stable (no) chronic pain throughout. These “stable” groups have been treated as natural control groups to the “changing” groups with the goal of identifying factors associated with this change in chronic pain status. However, causal links between the occurrence of the pandemic and changes in chronic pain cannot be drawn; it cannot be assumed that all students in the “rising” and “falling” groups would have continued with their “stable” trajectory if the COVID-19 pandemic had not happened. Moreover, chronic pain history before the study period is unknown. Cohort studies could give deeper insights on the true incidence of chronic pain during adverse times such as the COVID-19 pandemic.

### Future research

Future research should replicate the current study's findings in a longitudinal cohort study to investigate the life course of chronic pain and its associated circumstances in depth. Informed by the current study's findings, future research could focus more on youth home environments and investigate the co-occurrence of family crises and chronic pain incidence. Along that line, parents' viewpoints, such as parental stress levels and perception of time spent with family, could be taken into account to explore dyadic dynamics of chronic pain development in the face of adverse times.

The current study sheds light on how schoolchildren felt during the beginning of the pandemic and the first lockdown. Further into the pandemic however, adolescents' psychological wellbeing might decrease [38,39], making them more vulnerable to the development of chronic pain. Future research could focus on how schoolchildren with chronic pain react to getting back to school after a long period of home schooling [40].

The present study paints a positive picture of young people's experiences during the beginning of the COVID-19 pandemic; overall, chronic pain prevalence seems to decrease. Although most students seem to benefit from these unusual circumstances, stressful situations at home and general vulnerability could facilitate less positive developments in chronic pain and mental health in some children and adolescents.

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### Supplementary Data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jadohealth.2021.07.027>.

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