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The impact of the Coronavirus disease 2019 pandemic on pain and psychological functioning in young adults with chronic pain

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Introduction

Chronic pain is highly prevalent, and impacts up to 21.9% of young adults ages 18 to 25 years [30, 36]. Since the pandemic began, young adults represent an increasing proportion of the population infected and hospitalized with COVID-19 [8]. In addition, numerous studies have reported on the impact of social restrictions on young adults' emotional well-being and health risk behaviors, showing alarming increases in anxiety, depression, and substance use [9, 16, 52]. However, these studies were limited by reliance on convenience samples from community and university settings. Little is known about the impact of COVID-19 pandemic on the health and well-being of young adults with chronic pain.

Indeed, young adults with chronic pain may be vulnerable to the unique stressors presented by the pandemic. Compared to their healthy peers, this cohort is more likely to report psychiatric comorbidities, engage in substance use, and experience challenges in meeting typical milestones (e.g., securing a first job, living independently) [36, 48]. Public health policies to limit the spread of COVID-19 may exacerbate psychosocial vulnerabilities, with downstream effects on pain and disability [25]. Furthermore, most young adults with chronic pain do not receive specialty pain care due to access barriers, further increasing vulnerability and risk for poor health outcomes [3, 17, 20]. To our knowledge, no reports have described physical or psychosocial functioning among young adults with chronic pain.

The majority of studies have enrolled older adults using cross-sectional designs where participants provided retrospective reports on perceived changes in pain since the pandemic [6, 22, 39]. Findings have been equivocal, some indicating increases in pain intensity

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and disability [6, 22, 39], while others demonstrating mixed results [2, 15, 27, 35] or improvements in pain [1, 5, 10, 13]. Moreover, few have utilized prospective designs. In adolescents with chronic pain, Law and colleagues found that the majority reported elevated pain, anxiety, depression, and insomnia symptoms that persisted over the initial 4 months of the pandemic [28]. However, this study was limited by lack of pre-pandemic data and narrow focus on early adaptation. We are aware of one prospective study in older adults that assessed pain intensity pre-pandemic, that remained stable during the pandemic [15]. However, the impact of the pandemic on changes in symptom burden for young adults with chronic pain remains largely unknown.

To address this gap, we compared pain, psychological functioning, and substance use behaviors one year before the pandemic, to six months after its onset in young adults with chronic pain. We hypothesized that there would be increases in pain intensity and interference, anxiety, depression and substance use, on the basis that normative transitions (e.g., career development, financial independence) and healthcare may be disrupted, with potential downstream negative impact on overall functioning, including pain outcomes. Second, we tested the associations between COVID-19 exposures (i.e., COVID-19 diagnosis, decreased income) and impact (i.e., emotional wellbeing) to changes in pain intensity and interference; and hypothesized that greater exposure and impact would be associated with worse pain intensity and interference, after accounting for age, sex, race/ethnicity.

Methods

Participants and procedure

All study procedures were approved by the Institutional Review Board at our academic medical center. Participants were recruited from an existing longitudinal cohort of young adults with a history of chronic pain in childhood. Participants had previously participated in a randomized controlled trial (RCT) of an internet-delivered pain management program during childhood [40]. The original cohort included 273 adolescents (ages 11–17 years) with mixed chronic pain conditions (e.g., head, abdomen, and musculoskeletal pain) recruited from 15 interdisciplinary pediatric pain clinics located across the United States and Canada. For this study, the inclusion criteria were that participants had to be at least 18 years old at the time of study enrollment. Young adults were contacted via email, text, or phone and consent was obtained using REDCap (Research Electronic Data Capture), a secure web-based data collection platform. Participants completed REDCap surveys at 2 time points: T1 (before the pandemic between October 2018 and August 2019), and T2 (during the pandemic between October and November 2020). Participants were reimbursed for study participation with gift cards at both assessment time points.

At T1, 224 participants completed study procedures; at T2, 196 participants completed study procedures, resulting in 87.5% of whom completed assessments at both timepoints. Those who completed both timepoint assessments were more likely to be female than those who only completed the first time point assessment ($\chi 2$ (1) = 6.93, $p = 0.01$). There were no differences by age, race, ethnicity, and level of education between participants who completed the first versus both assessment time points.

Measures

Participant characteristics.—At T1, young adults reported on sociodemographic information including age, sex, race/ethnicity.

COVID-19 exposure and impact.—Young adults completed the COVID-19 Exposure and Family Impact Survey – Adolescents and Young Adult Version (CEFIS-AYA) at T2 [26]. The survey includes two subscales, COVID-19 Exposure and COVID-19 Impact subscales. The COVID-19 Exposure subscale includes 28 items assessing exposure and events related to COVID-19 (e.g., “I lost my job permanently”, “My education was disrupted”, “Someone in my family had symptoms or was diagnosed with COVID-19”). Responses were coded as ‘No’ = 0 and ‘Yes’ = 1 and summed to create a total score (0 - 28), with higher scores indicating higher levels of exposure to COVID-19 related events. The COVID-19 Impact subscale consists of 16 items measuring the impact of COVID-19 on family, emotional, and physical wellbeing, including the ability to be independent, sedentary behavior, substance use, loneliness, relationship with friends, and romantic relationships. Of these, 15 items have a four-point Likert response scale (1 = ‘Made it a lot better’ to 4 = ‘Made it a lot worse’ and 5 = ‘Not applicable’). These items were averaged to create a total score; higher scores indicate greater COVID-19 impact. Participants with more than 3 missing and/or not applicable responses were not included in analyses using the COVID-19 Impact score. There is also a single item measuring distress on a 10-point scale, with higher scores denoting higher distress. The CEFIS has demonstrated acceptable internal consistency across both exposure (α = .80) and impact scales (α = .92) [26].

Pain characteristics, intensity, and interference.—Participants completed the Brief Pain Inventory to assess pain intensity and pain interference at both time points [42]. Pain intensity was assessed as average pain in the past 7 days on an 11-point numerical rating scale ranging from 0 (“no pain”) to 10 (“pain as bad as you can imagine”). The pain interference subscale consists of 7 items of daily activities (e.g., general activity, walking, work, enjoyment of life), each scored from 0 (“does not interfere”) to 10 (“completely interferes”). The interference subscale score is the mean of these 7 items, where a higher score represents greater interference with daily activities. The BPI has demonstrated good internal consistency for pain intensity and pain interference [50]. Participants also reported on pain location, duration, and frequency over the past 3 months at both time points.

Anxiety.—The 7-item Generalized Anxiety Disorder Questionnaire [47] was completed by participants at both time points. Response options range from 0 (“not at all”) to 3 (“nearly every day”). Items are summed to a total score from 0 to 21, with higher scores indicating greater severity of generalized anxiety symptoms. A cutoff score of 8 or higher is classified as clinically significant anxiety [41].

Depression.—Participants completed the 9-item Patient Health Questionnaire (PHQ-9) [46] at both time points to assess severity of depressive symptoms over the past 2 weeks. Each item is rated from 0 (“not at all”) to 3 (“nearly every day”), with total scores ranging from 0 to 27, with higher scores indicating more severe depressive symptoms. A cutoff score of 10 or higher is classified as clinically significant depression [31].

Substance use.—The 8-item Alcohol, Smoking and Substance Involvement Screening Test v3.1 (ASSIST) [23] was completed by participants at both time points to screen for substance use behaviors. For this study, items examining the frequency of tobacco, alcohol, and cannabis use in the past 3 months were examined. The response options for use of each substance in the past 3 months are “never”, “once to twice”, “monthly”, “weekly”, and “daily”. The responses were recategorized to a binary variable denoting the use of each substance in the past 3 months (yes = 1, no = 0), with “never” as “no”, and “once to twice”, “monthly”, “weekly”, and “daily” as “yes”.

Data analyses.

We performed analyses using IBM SPSS (IBM Corp. Released 2020. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY: IBM Corp) and STATA 14 (StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP). Descriptive statistics were used to characterize the sample, including means, standard deviations, and frequencies of demographic and pain characteristics at each time point, as well as the exposure and impact of COVID-19. To address the first aim, we used paired samples t-tests to assess changes in pain intensity, pain-related disability, anxiety, depression, and substance use fromT1 to T2. For the second aim, separate linear mixed-effects models were used to examine COVID-19 exposure and impact as predictors of pain intensity and pain interference from T1 to T2. Each model accounted for the effects of age, sex, race, and ethnicity.

Results

Baseline participant characteristics.

As shown in Table 1, prior to the pandemic, 196 young adults between the ages of 18 and 24 years (M = 21.1 years, SD = 1.6) participated in this study. The sample was predominantly female (79.6%), with 81.6% residing in the United States and 18.4% in Canada. The majority self-identified as non-Hispanic White (76.5%) and multi-racial (9.2%); 8.6% were Hispanic. Young adults had an average pain duration of 10 years (SD = 4.3), with 46.9% reporting daily pain over the past three months. At T1, 60% of young adults were employed in some capacity whether full or part-time, and 50% of the sample were students (full or part-time).

COVID-19 exposure and impact

The mean COVID-19 exposure score was 7.76 (SD = 3.53), representing the number of exposures that each individual experienced during this early stage of the pandemic, which is slightly lower than the CEFIS validation sample (M = 9.08, SD = 4.22) [26]. About half of the young adults reported pandemic-related reduction in income (49.2%). Specifically, for those who were employed (n = 132), 20.4% stopped working, 32.1% cut back their hours and 9.6% lost their jobs permanently. For those attending school (n = 110), 50.5% reported pandemic-related disruptions (e.g., virtual learning, schooling put on hold). At this early stage into the pandemic (6 months), a substantial proportion of young adults and their families were exposed to COVID-19, with 20.9% who were symptomatic, 5.1% were hospitalized, and 3.1% of young adults reported death in a family member from COVID-19.

The mean COVID-19 impact score was 3.06 (SD = 0.46), which is slightly higher than the CEFIS validation sample (M = 2.82, SD=0.60) [26]. The items rated as being most impacted for young adults were anxiety/worry (M = 3.47, SD = 0.65), loneliness (M = 3.39, SD = 0.68), sedentary behaviors (M = 3.38, SD = 0.65), mood (M = 3.30, SD = 0.62), relationship with friends (M = 3.14, SD = 0.72), exercise/physical activity (M = 3.13, SD = 0.78) and sleeping (M = 3.01, SD = 0.85).

Self-reported distress due to COVID-19 pandemic was moderate at 5.53 (SD = 2.14) and was higher in females compared to males (M = 5.69, SD = 2.17 vs M = 4.90, SD = 1.95, p = 0.02).

Pain intensity, pain interference, anxiety, depression and substance use from T1 to T2

At T1, young adults reported mild to moderate levels of pain intensity (M = 3.75, SD = 2.33) and pain interference (M = 3.44, SD = 2.69; Table 2). Contrary to our hypothesis, as a group, the ratings of pain intensity and pain interference remained stable from T1 to T2 (Table 2).

Anxiety symptoms significantly increased from T1 (M = 8.21, SD = 5.84) to T2 (M = 8.89, SD = 5.95, p = 0.04; Table 2). At T1, 45.9% reported clinically significant anxiety, increasing to 51.0% during the pandemic. In contrast, depressive symptoms remained stable (T1: M = 9.05, SD = 6.74; T2: M = 9.16, SD = 6.77, p = 0.40), with 36.2% who met criteria for clinically significant depression pre-pandemic, and 37.2% during the pandemic.

Tobacco, alcohol, and cannabis use in the past 3 months was stable from T1 to T2 (see Table 2). At both time points, about 20% of participants used tobacco products, 70% used alcohol, and 35% used cannabis in the past 3 months (Table 2).

COVID-19 exposure and impact: Association with changes in pain intensity and pain interference from T1 to T2

Contrary to our expectations, results from mixed linear models revealed that COVID-19 exposure and impact were not associated with changes in pain intensity or pain interference from T1 t oT2. In the models, only female sex (β = .86, p = .02) was associated with increased pain intensity (F (5, 279.5) = 1.470, p = 0.22). These findings were similar for pain interference, with only female sex (β = 0.87, p = .02) associated with increased pain interference (F (5, 280.5) = 1.98, p = .08; Table 3).

Discussion

Our study included longitudinal assessments of young adults with chronic pain: the first before the pandemic, and the second, at more than six months after the onset of the pandemic. Findings revealed that as a group, levels of pain intensity, pain interference and depression symptoms remained stable from before to during the pandemic. In contrast, there was a small but significant increase in anxiety symptoms. With respect to substances, rates of tobacco, alcohol, and cannabis use were unchanged. We used a new measure of COVID-19 exposure and impact developed for young adults (CEFIS) [26], and found that rates of exposures were slightly lower compared to the validation sample, but perceived

COVID impact was slightly higher. Contrary to hypotheses, COVID-19 exposure and impact were not related to changes in pain or pain interference from pre- to during the pandemic.

This cohort of young adults with chronic pain demonstrated relative stability of pain symptoms from pre-pandemic to during the pandemic. Our findings are consistent with two published pediatric studies with chronic pain [28, 49]. Law and colleagues found that during the early months of the pandemic, adolescents with chronic pain experienced stable levels of pain interference. In another study of children with chronic abdominal pain, there was a reduction in the frequency of abdominal pain [49]. Findings from adult populations have been equivocal with some studies reporting worsening pain experiences during the pandemic [6, 22, 39], while other studies documented stability or reduction of pain symptoms during the pandemic [2, 15, 19, 35]. A number of positive impacts of the pandemic have been described among youth and adults including flexibility in work and school schedules, and increased time with family, that may serve as protective factors in coping with chronic pain [11, 32]. Additionally, this cohort of young adults had previously received care in pediatric pain clinics, and had participated in an internet delivered pain management program. They may have developed skills in the active management of pain, stress and anxiety/depression symptoms, drawing on resilience strategies during the social and economic disruptions secondary to the pandemic. Together, these findings highlight the variability in pandemic effects among individuals with chronic pain.

Initially, clinicians and investigators in the pain community were concerned about the public health impact of the pandemic on individuals with chronic pain [14]. In particular, because healthcare resources and personnel were redistributed to areas with acute patient care, such as Emergency Departments and Intensive Care Units, there was diversion of resources (e.g., cancelling elective surgery and outpatient procedures) and delays of care for non-urgent and long-term conditions, including chronic pain [43]. Mobility restrictions due to lockdowns also made healthcare less accessible. Eccleston et al. predicted that the effect of the pandemic would be differentially distributed across and within patient populations depending on population characteristics emerging as determinants of the pandemic [14]. This has been partially borne out in that several social determinants (ethnicity/race and socioeconomic status) have emerged as contributing factors of both worse pain outcomes [22, 25, 35] and worse COVID outcomes [11, 28, 51]. Pediatric studies of COVID-19 impact have found that economic stress predicted worse pain outcomes [28]; however, our young adult sample may not have had adequate representation and we may not have adequately measured family resources to uncover the differential impact of the pandemic on chronic pain.

Consistent with findings in the literature, there was a small increase in anxiety symptoms during the pandemic for this cohort of young adults. The clinical meaningfulness of this elevation is not clear and warrants further study, particularly to understand persistence of elevated anxiety. On the global level, an additional 76.2 million cases of anxiety disorders emerged among the general population during the pandemic, with younger populations being more impacted than older populations.[7, 45] Young adulthood is a vulnerable period for the emergence of anxiety disorders, and current reports of young adults affected by anxiety are unprecedented [4, 9, 24]. Numerous factors likely contribute to this heightened

mental health crisis. First, young adults had greater job insecurity during the pandemic, as noted by the high rate of changes in employment noted by our study participants. National labor force data from the Current Population Survey revealed pronounced age-related disparities, with large increases in unemployment for adults between 20 and 29 years of age in the early months of the pandemic [34]. Furthermore, employment losses were found to contribute to significant mental health burden [18]. Second, young adults traditionally derive psychosocial support from peer networks, which had been disrupted with enforced isolation policies. There are clear associations between loneliness and increased risk of mental health problems in youth [29]. A multi-dimensional approach is needed to address the burden of mental health problems in young adults, including those with chronic pain. In addition to increasing access to mental health services, state and federal policies need to address social threats unmasked during the pandemic including economic and social inequalities [25, 37, 38].

A key health concern during young adulthood is the initiation and escalation of substance use [12]. Our findings show that patterns of substance use in young adults remained stable from pre- to during the pandemic, contrary to research in community samples of healthy young adults which have shown an escalation in substance use [21]. In the adult populations, available studies also indicate that rates of substance use have increased during the pandemic, in particular for alcohol and cannabis [9, 33, 44]. At the individual level, only increased age predicted increased alcohol use over the course of the pandemic. This was expected due to age maturation of this sample from older adolescents to young adults. While our finding of stability in rates of substance use is reassuring, it is possible that differences in the timing of measurements during the pandemic may account for some of the variability between studies and warrant continued monitoring.

The strengths of this study include a longitudinal study design with data obtained before and during the pandemic. This prospective evaluation of changes for both pain and psychological outcomes provided important information at the within-person level. To our knowledge, this is the first study that has focused on exploring COVID-19 impact among young adults with chronic pain, And that utilized a specific measure of COVID-19 exposure and impact to assess pandemic effects. Other strengths included that use of validated measures of anxiety, depression, substance use, and pain outcomes. Finally, there was a high response rate with over 80% participation across the two time points.

Findings should also be interpreted in light of several limitations. We are limited to comparisons between two timepoints, before and 6 months into the pandemic, which captures earlier changes in response to the pandemic. Although there was a high likelihood that changes were secondary to consequences of the pandemic, further investigations to examine the trajectory of pain and psychological outcomes throughout the prolonged duration of the pandemic are warranted. Next, we wish to highlight measurement limitations that may influence our findings concerning pain interference. Given the mobility restrictions imposed by the pandemic and known impact on changes in usual routines (e.g., remote school or work), there was a lack of opportunity for individuals to engage and participate in some activities queried in pain interference measures. It is unknown what impact measurement issues may have on responses obtained at this timepoint during the pandemic,

but we believe this is an important factor that investigators should consider in their interpretation of this domain in clinical studies.

In summary, our key findings demonstrate the stability of pain symptoms in young adults with chronic pain from pre- to during the pandemic. There were increases in anxiety symptoms in our cohort, which speak to the need to escalate access to mental health treatment to support young adults with chronic pain. Given the prolonged duration of this pandemic, these efforts should also target the identification of unique pandemic-related stressors on young adults to support their transition to independence. Future investigations will need to study the trajectories of pain symptoms and psychological functioning over this unprecedented period of uncertainty. For young adults, understanding their adaptive and maladaptive strategies, and psychosocial adjustment may provide insight into individual differences on health outcomes. Additionally, the COVID-19 pandemic has unmasked existing structural and social inequalities, which are key areas for research given their influence on pain and psychological functioning. Therefore, the continued study of young adults with chronic pain, their mental health and substance use well into adulthood will likely be needed, even after recovery from the pandemic.

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Table 1.

Baseline demographic characteristics of sample (before COVID-19 pandemic, N = 196)

	Mean (SD)/ n(%)
Age (years)	21.05 (1.61)
Sex	
Male	40 (20.4%)
Female	156 (79.6%)
Ethnicity/Race	
White	150 (76.5%)
Hispanic	17 (8.6%)
Black	6 (3.1%)
Asian	4 (2.1%)
Multi-ethnicity/racial	18 (9.2%)
Personal Income	
Less than $24,999	160 (81.6%)
$25,000 - $49,999	22 (11.6%)
$50,000 - $74,999	6 (3.1%)
$75,000 - $99,999	1 (0.5%)
Highest level of education	
Less than high school	21 (10.7%)
High school or graduate or equivalence	75 (38.3%)
Some college	63 (32.1%)
Associates degree (2-year college)	16 (8.2%)
Bachelor’s degree (4-year college).	21 (10.7%)
Student and employment status	
Employed full-time	36 (18.4%)
Employed part-time	26 (13.3%)
Employed and a student	55 (28.1%)
Student, not employed	43 (21.9%)
Unemployed	31 (15.8%)
Military service/active duty	2 (1.0%)
On disability from work	2(1.0%)
Homemaker	1(0.5%)

Table 2.

Comparing pain, psychological functioning and substance use (past 3 months) before the COVID-19 pandemic to during the COVID-19 pandemic (N = 196)

	Time 1 Before COVID-19 pandemic	Time 2 During COVID-19 pandemic	p-value
Pain intensity (0 – 10) *, M (SD)	3.75 (2.33)	3.56 (2.10)	0.08
Pain interference (BPI) *, M (SD)	3.44 (2.69)	3.26 (2.49)	0.10
Anxiety (GAD-7) *, M (SD)	8.21 (5.84)	8.89 (5.95)	**0.04**
Depression (PHQ-9) *, M (SD)	9.05 (6.74)	9.16 (6.77)	0.40
Tobacco use (past 3 months), n (%)	37 (18.88)	37 (18.88)	
Alcohol use (past 3 months), n (%)	131 (66.84)	133 (67.86)	
Cannabis use (past 3 months), n (%)	66 (33.67)	66 (33.67)	

* Paired t-tests

Table 3.

Linear mixed models examining COVID-19 exposure and impact of pain intensity and pain interference

	Δ Pain intensity			Δ Pain interference		
	β	**SE**	**t**	***β***	**SE**	**t**
Intercept	3.35	1.98	1.70	4.14	2.32	1.79
COVID-19 Exposure	−0.03	0.04	−0.68	−0.05	0.04	−1.18
COVID-19 Impact	0.07	0.13	0.58	0.19	0.14	1.32
Age	−0.03	0.09	−0.34	−0.10	0.11	−0.99
Sex	0.87	0.36	2.38*	1.01	0.43	2.36*
Race/Ethnicity	0.28	0.35	0.81	0.56	0.41	1.37

*
$p < .05$