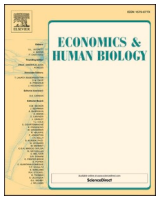
Economics and Human Biology 52 (2024) 101337

Contents lists available at ScienceDirect

Economics and Human Biology

journal homepage: www.elsevier.com/locate/ehb



Global pain levels before and during the COVID-19 pandemic

Lucía Macchia [a,*], Liam Delaney [b], Michael Daly [c]

[a] School of Health & Psychological Sciences, City, University of London, UK
[b] Department of Psychological & Behavioural Science, London School of Economics & Political Science, UK
[c] Department of Psychology, John Hume Building, Maynooth University, Ireland

ARTICLE INFO

Keywords:
Physical pain
COVID-19
Pandemic
Global evidence
Survey research

ABSTRACT

Physical pain has trended upward globally over the last decade. Here, we explore whether the COVID-19 pandemic modified this alarming trend. We used data from 146 countries worldwide (510,247 respondents) to examine whether pain levels changed during the COVID-19 pandemic. Adjusted regressions across countries revealed that 33.3% of people were in pain in 2019, 32.8% in 2020, 32.5% in 2021, and 34.1% in 2022. The change in pain from 2019 to each of the pandemic years was not statistically significant. This suggests that, on average, there was no significant change in pain during the pandemic. However, from 2019 to 2020 there was a significant *decline* in pain among individuals over 55 years of age, those who were widowed, and those without children in the household. On a global scale, the COVID-19 pandemic was not associated with a significant change in pain levels. The concerning pre-pandemic elevation in global pain continued during this challenging period.

1. Introduction

Prior to the pandemic there was a sharp rise in the prevalence of pain in the US and around the world (Macchia, 2022; Nahin et al., 2019). This is a highly important trend because pain has detrimental effects on people's life. For instance, pain plays a key role in life satisfaction (McNamee and Mendolia, 2014), employment (Blanchflower and Bryson, 2022), and has been linked to harmful behaviours like drug use (Garland et al., 2013). Pain also represents a challenge to the healthcare system and the economy (Gaskin and Richard, 2012). This study builds on and complements the work presented in Macchia (2022) by explicitly estimating changes in the prevalence of pain immediately prior to and during the COVID-19 pandemic.

Following the emergence of the pandemic, major concerns were raised about the consequences of the pandemic-related psychosocial and economic stress, social distancing, and lockdown periods. One of these concerns is that these factors may lead to a further rise in pain levels (Attal et al., 2021; Clauw et al., 2020). The pandemic was also associated with a rise in sleep problems (Jahrami et al., 2022) and physical inactivity (Wunsch et al., 2022) which, alongside the presence of notable stressors, could have contributed to an increase in pain (Clauw et al., 2020). Furthermore, acute joint and muscle pain, headache, and generalized discomfort are commonly reported symptoms of COVID-19 infection (Weng et al., 2021). While this acute pain typically remits quickly following infection, there is evidence that COVID-19 infection can trigger persistent musculoskeletal pain symptoms in patients with long COVID-19 (Khoja et al., 2022).

Yet, despite predictions suggesting that the prevalence of pain would increase in the immediate and long-term aftermath of the pandemic, whether this has happened remains unclear. A small set of studies have found that pain levels increased from before to during the pandemic in the United Kingdom (Fallon et al., 2021), Japan (Yoshimoto et al., 2021), and France and Turkey (Papalia et al., 2022). In contrast, a study on people over 65 years of age showed that the prevalence of chronic pain did not differ significantly from 2019 to 2020 in the US (Manhapra et al., 2023). In a separate US study, pain-related prescriptions declined by 15.1% between 2019 and 2020 (Manchikanti et al., 2021), although this can be explained by fewer visits to the doctor during the pandemic. As such, current evidence on changes in pain experiences during the pandemic is mixed and limited to a small number of nations. To address these limitations in prior work, we drew on a worldwide sample of 146 countries and the most recent data available until 2022 to examine changes in the prevalence of pain reported immediately prior to and during the COVID-19 pandemic.

* Correspondence to: City, University of London, School of Health and Psychological Sciences, Rhind Building, St John St, London EC1R 0JD, UK.
E-mail address: lucia.macchia@city.ac.uk (L. Macchia).

https://doi.org/10.1016/j.ehb.2023.101337
Received 2 October 2023; Received in revised form 24 November 2023; Accepted 30 November 2023
Available online 10 December 2023

2. Methods

2.1. Data

The Gallup World Poll is a nationally representative, cross-sectional dataset that includes 165 countries and territories. Gallup interviews around 1000 individuals in each country and year from 2005 to 2022. Thus, our main analysis includes 146 countries (see Appendix for the list of countries) with 510,247 respondents providing data on their pain experiences from 2019 to 2022. To illustrate pandemic-related changes in pain in the context of longer-term trends in global pain levels we drew on data from 146 countries spanning the period 2009–2022 (N = 1858,091). Our study used data from 2009 instead of 2005 because our demographic variables were available from 2009. This set of countries is the same as the one used in Macchia (2022). The dataset used here also contains 2022 data which was not available by the time the study in Macchia (2022) was conducted. It is also worth noting that Table 2 in the original paper (see Table 1 in the SM of this article) presents raw means whereas this study presents regression adjusted estimates to account for changes in sample composition and socio-demographic factors that might affect pain levels.

In regions where telephone coverage represents at least 80% of the population, Gallup uses random-digit-dialling of a nationally representative list of telephone numbers. These regions include Northern America, Western Europe, Confucian Asia and Pacific countries or territories including Japan, Australia, New Zealand and Taiwan, and Gulf Cooperation Council (GCC) countries. In nations with less extensive telephone coverage like Africa, Latin America, and some Middle east countries, Eastern Europe, and Southern Africa surveys were administered face-to-face, and households were still randomly selected. In 2020, due to the COVID-19 pandemic, Gallup changed the survey mode and used telephone interviews in countries that had in-person interviews before the pandemic. As secondary data was used, institutional ethical approval was not required.

Physical pain. Respondents were first asked to "…please think about yesterday, from the morning until the end of the day. Think about where you were, what you were doing, who you were with, and how you felt." They were then asked "Did you experience the following … during a lot of the day yesterday? How about … Physical Pain?" and could answer yes (1) or no (0). We multiplied this variable by 100 to represent the percentage of people in pain in each country and year (Mean= 30.86, Std. Deviation = 46.19).

Table 1
Estimated changes in the prevalence of physical pain from 2019 to 2020, 2021, and 2022 in 146 countries, N= 510,247.

	Physical pain level % (95% CI)				Change in physical pain (95% CI)		
	2019	2020	2021	2022	Δ 2019–2020	Δ 2019–2021	Δ 2019–2022
Full sample	33.3	32.8	32.5	34.1	-0.5	-0.8	0.7
	(32.5, 34.1)	(31.6, 34.1)	(31.7, 33.2)	(33.1, 35.1)	(−1.8, 0.9)	(−1.8, 0.1)	(−0.1, 1.6)
Age (y.o)							
< 35	26.8	27.9	26.5	28.2	1.1	-0.3	**1.4**
	(25.8, 27.7)	(26.7, 29.2)	(25.7, 27.3)	(27.1, 29.4)	(−0.3, 2.7)	(−1.4, 0.9)	**(0.4, 2.5)**
35–54	33.9	33.7	33.8	35.4	-0.2	-0.1	**1.5**
	(32.9, 34.9)	(32.3, 35.2)	(32.9, 34.7)	(34.1, 36.8)	(−1.9, 1.6)	(−1.4, 1.2)	**(0.2, 2.8)**
≥ 55	45.4	41.7	42.7	43.7	**-3.7**	**-2.7**	**-1.7**
	(44.1, 46.6)	(40.1, 43.3)	(41.5, 43.9)	(42.5, 44.9)	**(−5.3, −1.8)**	**(−4.5, −0.7)**	**(−3.6, −0.1)**
Gender							
Women	36	35.6	35.7	36.8	-0.4	-0.3	0.8
	(35, 36.9)	(34.2, 37)	(34.7, 36.6)	(35.5, 38)	(−2.1, 1.2)	(−1.5, 0.9)	(−0.3, 1.9)
Men	30.5	30	29.2	31.3	-0.5	**-1.3**	0.8
	(29.9, 31.2)	(28.7, 31.2)	(28.4, 29.9)	(30.4, 32.2)	(−1.9, 0.7)	**(−2.4, −0.3)**	(−0.1, 1.6)
Education							
Elementary	43	43.6	41.9	44.9	0.6	-1.1	**1.9**
	(41.9, 44.1)	(41.1, 46.1)	(40.7, 43.1)	(43.5, 46.3)	(−2.1, 3.2)	(−2.5, 0.3)	**(0.7, 3.1)**
Secondary	28.6	28.1	27.9	28.9	-0.5	-0.7	0.3
	(27.7, 29.4)	(27.2, 29.1)	(27.2, 28.7)	(27.8, 29.9)	(−1.6, 0.7)	(−1.8, 0.52)	(−0.8, 1.4)
Tertiary	22.3	21.5	22.3	22.4	-0.8	0	0.1
	(21.4, 23.1)	(20.5, 22.6)	(21.4, 23.2)	(21.4, 23.4)	(−2.1, 0.6)	(−1.3, 1.3)	(−1.3, 1.5)
Marital status							
Single	25.2	26	25.1	26.7	0.8	-0.1	**1.5**
	(24.4, 26)	(25.1, 26.9)	(24.3, 25.8)	(25.8, 27.7)	(−0.4, 1.9)	(−1.3, 0.9)	**(0.4, 2.6)**
Dom. partner	30.5	30.8	31.2	33.1	0.3	0.7	**2.6**
	(29.4, 31.7)	(29.2, 32.5)	(29.6, 32.8)	(31.6, 34.5)	(−1.80, 2.4)	(−1.1, 2.4)	**(0.8, 4.2)**
Married	35.8	35	34.6	36.3	-0.8	-1.2	0.5
	(34.8, 36.9)	(33.2, 36.8)	(33.6, 35.5)	(34.9, 37.8)	(−2.9, 1.2)	(−2.6, 0.1)	(−0.7, 1.7)
Separated	39.6	39.4	37.3	40.8	-0.2	-2.3	1.2
	(37.5, 41.7)	(36.6, 42.2)	(35, 39.7)	(38.5, 43.1)	(−3.6, 3.2)	(−5.3, 0.8)	(−1.8, 4.2)
Divorced	35.9	33.8	34.9	35.1	-2.1	-1	-0.8
	(34.3, 37.6)	(31.8, 35.8)	(33.1, 36.7)	(33.3, 36.9)	(−4.8, 0.5)	(−3.3, 1.3)	(−3.4, 1.8)
Widowed	54.3	50.2	52.2	52.5	**-4.1**	-2.1	-1.8
	(52.4, 56.1)	(47.4, 53.1)	(50.4, 54.1)	(50.8, 54.1)	**(−7.2, −0.8)**	(−4.7, 0.7)	(−4, 0.5)
Children							
No	31.8	30.4	30.4	31.9	**-1.4**	**-1.4**	0.1
	(31.1, 32.6)	(29.4, 31.4)	(29.8, 31.1)	(31, 32.9)	**(−2.6, −0.2)**	**(−2.4, −0.3)**	(−0.8 1.1)
Yes	34.6	35.2	34.3	36	0.6	-0.3	**1.4**
	(33.7, 35.5)	(33.6, 36.8)	(33.3, 35.2)	(34.7, 37.3)	(−1.3, 2.4)	(−1.5, 0.8)	**(0.3, 2.4)**

Note: Estimates are based on ordinary least squares regressions including survey year as a categorical variable, country fixed effects, age, gender, level of education, marital status, whether respondents had children under 15 in the household, and sampling weights. Each row represents a different regression. Predictive margins were used to estimate the adjusted prevalence of pain for each survey year. Given that the year variable was categorical, we obtained one adjusted average pain estimate per year. For example, the 33.3 in the 'Full sample-2019' cell represents the adjusted average pain for 2019 in the full sample. We also explored the difference across the adjusted average pain estimates in each year. For instance, the −0.5 in the 'Full sample-Δ 2019–2020' cell shows the difference between the 2020 and 2019 adjusted average pain in the full sample. 95% CIs including zero are not statistically significant at the $p < 0.05$ level. Changes in bold are significant at the $p < 0.05$ level.

Demographics. Respondents reported their gender (women and men), age which was combined into different groups for the analysis (under 35, between 35 and 54, and over 55), level of education (elementary, secondary, tertiary), marital status (single/never married, domestic partner, married, separated, divorced, widowed), and whether people had children under 15 in the household (Yes, No).

2.2. Statistical analyses

We used Ordinary Least Squares (OLS) regressions with a categorical year variable to estimate pandemic-related changes in pain levels from 2019 to 2020, 2021, and 2022 in the full sample, and across demographic groups, and continents. In line with the general prediction that pain would increase during the pandemic, we expected to find a rise in pain across continents and demographic groups. It was anticipated that older adults would be particularly vulnerable, given their increased likelihood of experiencing severe COVID-19 and the stress accompanying such risks (Barek et al., 2020). All models controlled for demographic characteristics including gender, age, level of education, marital status, and whether people had children under 15 in the household.

We clustered standard errors at the country level to account for the correlation of physical pain among individuals surveyed in each country. Country-fixed effects were also included to adjust for between-country differences in physical pain. We also applied sampling weights to account for oversampling and other factors like the possibility of differential selection into the sample due to household size. All countries received the same weight in the analyses.

We also conducted several sensitivity analyses. First, we examined the potential impact of the mode change from in-person to telephone interviews in some countries in 2020. As the change in survey mode coincides with the start of the pandemic, it might be possible that the mode change might have an impact in the change in pain before and after the pandemic. For example, if we assume that people who have access to a telephone are richer than those who do not have access to a telephone, based on prior work that showed that the rich report lower pain than the poor (Macchia, 2022), we could expect a significant decrease in pain from 2019 (when in-person interviews were still conducted) to 2020 (when all interviews were conducted by telephone). To rule out the possibility that the mode change is affecting our results, we compared the adjusted average of pain before and after the change and we repeated our analyses using the sample of countries where telephone interviews were conducted both prior to and during the COVID-19 pandemic. If the findings in the sample that traditionally used telephone surveys (no change in mode during the pandemic) are the same as in the full sample, we can conclude that our main findings do not appear to be driven by the countries that experienced a change in the survey mode. We also examined whether changes in the sample composition (e.g., some countries dropping in some survey years) were influencing the results. To do so, we conducted analyses using a balanced panel of countries that had data both immediately before the pandemic in 2019 and during the pandemic. This sample consisted of 94 countries.

3. Results

Table 1 shows estimates from ordinary least squares regressions including survey year as a categorical variable adjusting for demographic characteristics. Each row represents a different regression. Predictive margins were used to estimate the adjusted prevalence of pain for each survey year. Given that the year variable was categorical, we obtained one adjusted average pain estimate per year. The adjusted averages shown in Table 1 revealed that, in 2019, 33.3% of people were experiencing physical pain around the world (unadjusted means can be found in Table S.1). We found that although physical pain appears to have declined slightly from 2019 levels to 2020 (32.8%) and 2021 (32.5%), these declines were not statistically significant (2020: −0.5; 95% CI (−1.8, 0.9). 2021: −0.8; 95% CI (−1.8, 0.1)). We also found that the percentage of people in pain did not change significantly between 2019 (33.3%) and 2022 (34.1%) (2022: 0.7; 95% CI (−0.1, 1.6)). Our analysis of overall global changes in pain suggests the prevalence was stable throughout the 2019–2022 period. These results also held across all continents where no significant changes in the prevalence of pain were found during the pandemic (see Table S.2).

Analyses in different groups of the population showed similar patterns. In most demographic groups, there was no significant change in pain during the pandemic, as shown in Table 1. However, among individuals over 55 years of age, those who were widowed, and those without children in the household, physical pain declined significantly (see coefficients in bold in Table 1 and below). These findings are also illustrated in Fig. 1. This figure shows the adjusted trends in physical pain across age groups, marital status, and whether people had children from 2009 to 2022. In particular, a notable decline in the prevalence of pain is evident from 2019–2020 among individuals over 55 years of age (−3.7, 95% CI (−5.3, −1.8)) and those who were widowed (−4.1, 95% CI (−7.2, −0.8)). Those without children in the household showed a small decline in pain prevalence (−1.4, 95% CI (−2.6, −0.2)) between 2019 and 2020. These results held using logit regressions (Table S.3) and the balanced panel of countries (Tables S.4 and S.5).

We also examined changes in pain among these groups of the population from 2020, the peak of the pandemic, to 2022, the year in which people returned to pre-pandemic lifestyles. Pain levels showed evidence of an increase from 2020 to 2022 among individuals over 55 years of age (2 increase, 95% CI (0.04, 3.9)), those who were widowed (2.2 increase, 95% CI (−1.1, 5.5)), and those without children (1.5 increase, 95% CI (0.3, 2.7)).

We also explored whether a mode change implemented by Gallup during the pandemic could have influenced the patterns of change in pain observed in our main analyses. In 2020, Gallup used telephone survey in the countries in which interviews were held face-to-face, for example, Sub-Saharan Africa. To address this point, we replicated our regressions in a sample of traditional telephone countries only. In this set of nations, 25.9% of people were in pain in 2019, 24.8% in 2020, 25.6% in 2021, and 26.1% in 2022. Changes in pain levels from 2019 to the pandemic years were not statistically significant (2020: −1.1 difference; 95% CI (−2.7, 0.6). 2021: −0.3 difference; 95% CI (−1.6, 1.1). 2022: 0.2 difference; 95% CI (−1.3, 1.8)). Regressions across demographic groups showed the same patterns found in the sample with all the countries (see Table S.6).

4. Discussion

Using a representative sample of 146 countries worldwide, this study provides global evidence on changes in the prevalence of pain in the aftermath of the COVID-19 pandemic. Contrary to predictions that pain would have increased during the pandemic, we found that pain levels did not change significantly from 2019 to any of the pandemic years. This finding complements prior research that has provided mixed evidence on the topic (Fallon et al., 2021; Manchikanti et al., 2021; Manhapra et al., 2023; Papalia et al., 2022; Yoshimoto et al., 2021) and sheds light on the sensitivity of global pain experiences to the stress of a major worldwide crisis.

Despite the pandemic's immediate impact on mental health (Robinson et al., 2022) economic stability, and daily routines (Haug et al., 2020), the prevalence of pain remained remarkably stable. This may reflect the short-lived nature of the perceived economic and health risks associated with the pandemic (Robinson et al., 2022; Robinson and Daly, 2021). Alternatively, individuals may have developed adaptive strategies to cope with pain or to avoid an escalation in pain levels. It is also likely that changes in pain during the pandemic reflect a complex interaction of demographic, and context-specific factors. As such, overall stability in the prevalence of pain while suggestive of a pattern of adaptation and resilience (Robinson et al., 2022), may mask divergent

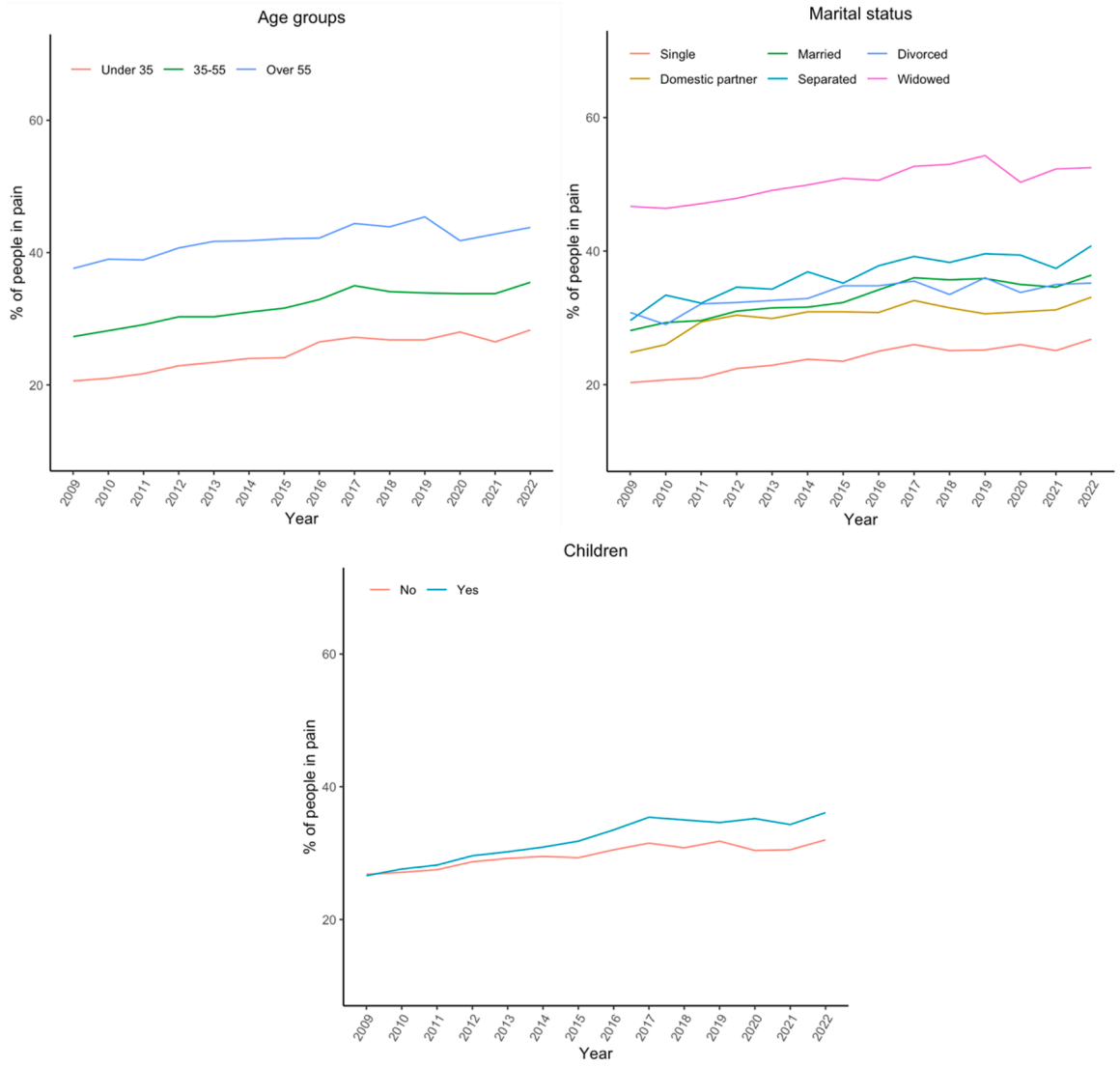


Fig. 1. Adjusted trends in physical pain among age groups, marital status, and whether people had children, 146 countries, N = 1858,091.

changes in the prevalence of pain across groups or nations.

To provide an initial test of this idea we examined changes in the prevalence of pain across continents and demographic groups. The prevalence of pain was stable during the pandemic period across all continents examined. Analyses across different groups of the population showed no significant change in pain during the pandemic except for the elderly, individuals who were widowed and those without children. These groups were less likely to experience pain during the pandemic than before, which could be explained by changes in lifestyle experienced during the pandemic such as reduced physical and social demands. This explanation is supported by the finding that the prevalence of pain tended to increase from the peak of the pandemic in 2020 to 2022 in older adults and people without children, potentially reflecting the impact of a return to pre-pandemic lifestyles (e.g., greater frequency in commuting to work). Given that our data set does not provide measures on these aspects, future research should explore these possibilities.

We also found that the overall global percentage of people in pain in 2022 (34.1%) remained at a similar elevated level to that observed in 2019 (33.3%). This high level of pain indicates that the COVID-19 pandemic did not alter the high prevalence of pain documented on a worldwide level before the pandemic. The persistence of elevated pain levels is concerning given the established societal and individual burdens associated with pain.

This study uses global data, but it is limited as it relies on a binary measure of pain which does not allow to infer the severity or the type of pain. Future research should explore global pandemic-related changes in severe and chronic pain as well as specific types of pain like back and neck pain (Attal et al., 2021; Clauw et al., 2020). Furthermore, while we could examine the role of demographic factors and broad country groupings in modifying pain trends, incorporating additional variables would have shed further light on the potential complex interplay of factors shaping pain levels.

In summary, this study revealed that the percentage of people in physical pain was unchanged on a global level during the COVID-19 pandemic. However, the persistence of already markedly elevated pain levels during the pandemic is a critical issue requiring attention from policymakers.

Conflict of interests

The authors declare no conflict of interests.

Author statement

All authors conceptualized the study, analysed the data, and wrote the paper.

CRediT authorship contribution statement

Macchia Lucía: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Daly Michael:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Delaney Liam:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing.

Data Availability

The Gallup World Poll data belong to Gallup, Inc. For more information, see: https://www.gallup.com/analytics/318875/global-research.aspx. Scripts for analyses are available through the OSF.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ehb.2023.101337.

References

Attal, N., Martinez, V., Bouhassira, D., 2021. Potential for increased prevalence of neuropathic pain after the COVID-19 pandemic. Pain. Rep. 6, 1–6. https://doi.org/10.1097/PR9.0000000000000884.

Barek, M.A., Aziz, M.A., Islam, M.S., 2020. Impact of age, sex, comorbidities and clinical symptoms on the severity of COVID-19 cases: a meta-analysis with 55 studies and 10014 cases, 1–24 Heliyon 6. https://doi.org/10.1016/j.heliyon.2020.e05684.

Blanchflower, D.G., Bryson, A., 2022. Further decoding the mystery of American pain: the importance of work. PLoS ONE 17, e0261891. https://doi.org/10.1371/journal.pone.0261891.

Clauw, D.J., Häuser, W., Cohen, S.P., Fitzcharles, M.A., 2020. Considering the potential for an increase in chronic pain after the COVID-19 pandemic. Pain 161, 1694–1697. https://doi.org/10.1097/j.pain.0000000000001950.

Fallon, N., Brown, C., Twiddy, H., Brian, E., Frank, B., Nurmikko, T., Stancak, A., 2021. Adverse effects of COVID-19-related lockdown on pain, physical activity and psychological well-being in people with chronic pain. Br. J. Pain. 15, 357–368. https://doi.org/10.1177/2049463720973703.

Garland, E.L., Froeliger, B., Zeidan, F., Partin, K., Howard, M.O., 2013. The downward spiral of chronic pain, prescription opioid misuse, and addiction: cognitive, affective, and neuropsychopharmacologic pathways. Neurosci. Biobehav. Rev. 37, 2597–2607. https://doi.org/10.1016/j.neubiorev.2013.08.006.

Gaskin, D.J., Richard, P., 2012. The economic costs of pain in the United States. J. Pain. 13, 715–724. https://doi.org/10.1016/j.jpain.2012.03.009.

Haug, N., Geyrhofer, L., Londei, A., Dervic, E., Desvars-Larrive, A., Loreto, V., Pinior, B., Thurner, S., Klimek, P., 2020. Ranking the effectiveness of worldwide COVID-19 government interventions. Nat. Hum. Behav. 4, 1303–1312. https://doi.org/10.1038/s41562-020-01009-0.

Jahrami, H.A., Alhaj, O.A., Humood, A.M., Alenezi, A.F., Fekih-Romdhane, F., AlRasheed, M.M., Saif, Z.Q., Bragazzi, N.L., Pandi-Perumal, S.R., BaHammam, A.S., Vitiello, M.V., 2022. Sleep disturbances during the COVID-19 pandemic: a systematic review, meta-analysis, and meta-regression. Sleep. Med. Rev. 62, 101591 https://doi.org/10.1016/j.smrv.2022.101591.

Khoja, O., Passadouro, B.S., Mulvey, M., Delis, I., Astill, S., Tan, A.L., Sivan, M., 2022. Clinical characteristics and mechanisms of musculoskeletal pain in long COVID. J. Pain. Res. 15, 1729–1748. https://doi.org/10.2147/JPR.S365026.

Macchia, L., 2022. Pain trends and pain growth disparities, 2009–2021. Econ. Hum. Biol. 47, 101200 https://doi.org/10.1016/j.ehb.2022.101200.

Manchikanti, L., Vanaparthy, R., Atluri, S., Sachdeva, H., Kaye, A.D., Hirsch, J.A., 2021. COVID-19 and the opioid epidemic: two public health emergencies that intersect with chronic pain. Pain. Ther. 10, 269–286. https://doi.org/10.1007/s40122-021-00243-2.

Manhapra, A., Fortinsky, R.H., Berg, K.M., Ross, J.S., Rhee, T.G., 2023. Pain management in older adults before and during the first year of COVID-19 pandemic: prevalence, trends, and correlates. J. Gerontol.: Med. Sci. 1–14.

McNamee, P., Mendolia, S., 2014. The effect of chronic pain on life satisfaction: evidence from Australian data. Soc. Sci. Med. 121, 65–73. https://doi.org/10.1016/j.socscimed.2014.09.019.

Nahin, R.L., Sayer, B., Stussman, B.J., Feinberg, T.M., 2019. Eighteen-year trends in the prevalence of, and health care use for, noncancer Pain in the United States: data from the medical expenditure panel survey. J. Pain. 20, 796–809. https://doi.org/10.1016/j.jpain.2019.01.003.

Papalia, G.F., Petrucci, G., Russo, F., Ambrosio, L., Vadalà, G., Iavicoli, S., Papalia, R., Denaro, V., 2022. COVID-19 pandemic increases the impact of low back pain: a systematic review and metanalysis. Int. J. Environ. Res. Public Health 19.

Robinson, E., Daly, M., 2021. Explaining the rise and fall of psychological distress during the COVID-19 crisis in the United States: longitudinal evidence from the Understanding America Study. Br. J. Health Psychol. 26, 570–587. https://doi.org/10.1111/bjhp.12493.

Robinson, E., Sutin, A.R., Daly, M., Jones, A., 2022. A systematic review and meta-analysis of longitudinal cohort studies comparing mental health before versus during the COVID-19 pandemic in 2020. J. Affect. Disord. 296, 567–576. https://doi.org/10.1016/j.jad.2021.09.098.

Weng, L.M., Su, X., Wang, X.Q., 2021. Pain symptoms in patients with coronavirus disease (COVID-19): a literature review. J. Pain. Res. 14, 147–159. https://doi.org/10.2147/JPR.S269206.

Wunsch, K., Kienberger, K., Niessner, C., 2022. Changes in physical activity patterns due to the COVID-19 pandemic: a systematic review and meta-analysis. Int. J. Environ. Res. Public Health 19. https://doi.org/10.3390/ijerph19042250.

Yoshimoto, T., Fujii, T., Oka, H., Kasahara, S., Kawamata, K., Matsudaira, K., 2021. Pain status and its association with physical activity, psychological stress, and telework among Japanese workers with pain during the covid-19 pandemic. Int. J. Environ. Res. Public Health 18. https://doi.org/10.3390/ijerph18115595.