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# The changing association between pandemic-related stressors and child and adolescent mental health during the waning phase of the COVID-19 pandemic

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**This study examined the relation between pandemic-related stressors and mental health among young people (YP) in India during two time points in the waning phase of the pandemic. We use data from two cross-sectional waves of over 20,000 YP aged 5–19 in February 2022, during the peak of the Omicron wave, and October 2022, during a reduction in infections and easing of restrictions. COVID illness/death in the family's social network, current lockdown stringency, and significant change in household income were examined in relation to adult respondents' reports of YP internalizing symptoms. Internalizing symptoms declined slightly from February to October 2022. COVID-19 illness/death in the family's network was generally associated with more internalizing symptoms. Higher lockdown stringency was associated with lower levels of internalizing symptoms. YP in households with increases in income tended to have more internalizing symptoms. Many associations were driven by older adolescents and were stronger during the earlier (Feb-2022) than later (Oct-2022) data collection time-points. The findings illustrate the importance of anchoring results within a study's specific geographic context, including concurrent events during the study period. Importantly, findings that may initially seem counterintuitive ultimately illuminate the dynamic and complex processes underlying child and adolescent mental health.**

**Keywords** COVID-19 pandemic, Anxiety, Internalizing, Child and adolescent mental health, Stressors, Lockdowns, India

**Abbreviations**

| | |
|---|---|
| CI | Confidence Interval |
| CMIE | Centre for Monitoring Indian Economy |
| CPHS | Consumer Pyramids Household Survey |
| PSC | Pediatric Symptom Checklist |
| SCAS | Spence Child Anxiety Scale |
| SD | Standard Deviation |
| SEHAT | Survey of Health Trends |

## Background

During the peak of the COVID-19 pandemic (2020 and 2021), a large literature documented worsening of common mental health problems, including internalizing symptoms (both depression and anxiety), among

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children and adolescents[1,2]. This decline in mental health was particularly pronounced in older adolescents and girls[3]. Furthermore, many researchers found that pandemic-related stressors, such as lockdowns and increased household financial difficulties, were associated with worse common mental health problems among young people[4]. As the pandemic waned in 2022, questions remained about the degree and speed with which children's and adolescents' mental health would recover. So far, only a handful of published studies report on mental health data collected in 2022 or later. The few studies that have these data suggest that while young people's mental health problems are lower than they were earlier in the pandemic, they remain at elevated levels compared to before the pandemic[5–8].

Besides changes over time in prevalence, the magnitude of association between pandemic-related stressors and mental health might also be changing over time[8]. On the one hand, as families established new coping mechanisms and support networks, we might expect stressors, such as lockdown policies, to have a smaller impact on mental health later in the pandemic than towards the beginning. On the other hand, families' resources might be drained after multiple years of lockdowns, and children and adolescents might be even more susceptible to negative impacts of pandemic-related stressors. Therefore, in addition to the nature and level of a given pandemic stressor, the moment in time the study is conducted can be an important source of heterogeneity. This temporal aspect might be an important contributor to some of the inconsistencies reported in the literature[7–9]. Thus, data on pandemic-related stressors and youth mental health in the waning phases of the pandemic are needed to better understand the dynamic nature of young people's longer-term resiliency or vulnerability.

The COVID-19 pandemic spurred a significant growth in mental health research globally, much of it focused on children and adolescents. Although the majority of published studies were conducted in North America and Europe, many studies focused on populations in East Asian countries, especially China[10,11]. Studies from South Asia, including India, remain under-represented, especially considering that India's youth (children younger than 18) represent 36% of the world's children[12]. The few studies from India reporting on youth mental health problems during the pandemic rely on relatively small sample sizes and are limited in scope by focusing on a single snapshot in time[13–15]. More information from South Asian countries such as India is needed to better understand how stressors impact mental health across diverse social contexts.

Given these gaps in the literature, we present data from two cross-sectional interviews of Indian households, the first in February 2022, during the peak of the Omicron wave, and the second in October 2022, during a reduction in infection numbers and easing of restrictions. We examine the relation between pandemic-related stressors and caregivers' reports of young people's internalizing (depression and anxiety) symptoms among over 20,000 young people aged 5–19. The large sample size also enables us to examine differences by child and adolescent age. We also examine whether this relation changes over time. Taking a social contextual approach to risk, we focus on family, wider social network, and community level stressors.

## Results

Table 1 presents descriptive statistics about the sample from each of the two waves utilized in the current analysis. The mean age of young people in the analytical sample was 14, and 43% were female. The adult respondent who reported on youth mental health was likely to be female (84%), with a mean age of 42. About a third of respondents live in highly educated households, compared with 37% and 30% with low and moderate education, respectively. The mean size of households was 5, ranging from 2 to 15. These characteristics were not significantly different across the two waves.

Internalizing symptoms were lower in October 2022 compared to February 2022. The overall Pediatric Symptoms Checklist (PSC) internalizing score declined from 2.68 to 2.43, and this decline was twice as large among 5- to 7-year-olds (by 0.48 points from 2.68 to 2.20) vs. the 13- to 19-year-olds (by 0.22 points from 2.70 to 2.48). The pre-school Spence Children's Anxiety Scale (SCAS) score declined the most (by 0.61 points from 2.69 to 2.08). Most of the study sample utilized the school-aged version of the SCAS, which declined by 0.27 points.

Specific to pandemic-related stressors, in 28% of households, a relative or friend had been either severely ill or died from COVID-19 with an additional 10–12% reporting knowing a member of their wider community (neighbors, others) who was seriously ill or died from COVID-19. Roughly a third of households reported not knowing of anyone who either had been ill or died from COVID-19. The lockdown stringency index declined from 3.76 in February to 1.38 in October. Finally, about 30% of households had lost significant income during the pandemic as of February 2022, compared to income before the pandemic. This percentage declined to 23% of households by October 2022, indicating that families were recovering financially over the course of 2022.

### Associations between pandemic stressors and outcomes

Tables 2 and 3 present regression results of the three pandemic-related stressors (i.e., COVID illness or death in the social network, income change, and lockdown stringency) on internalizing symptoms measured by the PSC and SCAS in February and October 2022. These associations are also plotted in Figs. 1 and 2.

In February 2022, knowing people who have become ill or died from COVID-19 was overall associated with higher child and adolescent internalizing symptoms assessed by the PSC (Fig. 1). For example, young people in families where there were severe cases in the community had 0.10 standard deviation (SD) higher internalizing PSC score (95% CI: 0.04–0.14) when compared with youth in households with no COVID illness or death exposure. The magnitude of association with the PSC was similar among those who reported only mild cases in the community (0.10 with 95% CI: 0.04–0.15). While the estimates for the mild-close and severe-close levels of exposures were also in the same direction, the confidence intervals of these estimates crossed the null. Additionally, the confidence intervals are similar and overlap when comparing across exposure levels, so no inference can be made about PSC correlates of different exposures levels. The results from the October 2022 models are weaker and less likely to be statistically significant. Age stratified models in Table 2 show that this

| | February 2022 $N = 25,683$ | October 2022 $N = 22,356$ |
|---|---|---|
| **Mental Health Variables** | | |
| PSC (0–15) | 2.68 (2.64) | 2.43 (2.53) |
| SCAS: Pre-school (0–13) | 2.69 (2.81) | 2.08 (2.64) |
| SCAS: School-aged (0–18) | 3.09 (3.23) | 2.82 (3.15) |
| **COVID Variables** | | |
| *COVID-19 Exposure* | | |
| No one ill or died | 8030 (31.3%) | 8243 (36.9%) |
| Mild community, none close | 1938 (7.5%) | 1370 (6.1%) |
| Severe community, none close | 3082 (12.0%) | 2268 (10.1%) |
| Mild close | 5461 (21.3%) | 4224 (18.9%) |
| Severe close | 7172 (27.9%) | 6251 (28.0%) |
| Lockdown stringency index (0-100) | 37.60 (16.89) | 13.84 (0.57) |
| *Income* | | |
| Decreased | 7597 (29.6%) | 5155 (23.1%) |
| Stayed the same | 11,608 (45.2%) | 9330 (41.7%) |
| Increased | 6478 (25.2%) | 7871 (35.2%) |
| **Control Variables** | | |
| Age (5–19) | 14.01 (3.79) | 14.19 (3.69) |
| Female | 11,009 (42.9%) | 9494 (42.5%) |
| Urban | 16,995 (66.2%) | 15,307 (68.5%) |
| *Caste* | | |
| Scheduled caste/scheduled tribes | 6969 (27.1%) | 6309 (28.2%) |
| Other backward classes | 10,580 (41.2%) | 8859 (39.6%) |
| Intermediate | 1875 (7.3%) | 1696 (7.6%) |
| Upper | 6259 (24.4%) | 5492 (24.6%) |
| *Household education* | | |
| Low | 9551 (37.2%) | 8188 (36.6%) |
| Moderate | 7751 (30.2%) | 6674 (29.9%) |
| High | 8381 (32.6%) | 7494 (33.5%) |
| Household size (2–15) | 4.80 (1.35) | 4.69 (1.32) |
| Pre-COVID average income | 21,667.46 (15932.75) | 21,861.59 (16428.20) |
| Adult reporter female | 21,722 (84.6%) | 18,471 (82.6%) |
| Adult reporter age (18–90) | 42.15 (10.23) | 42.45 (9.84) |
| New in wave | - | 3507 (15.7%) |

**Table 1**. Descriptives of the SEHAT analytic sample.

association tended to be stronger among older youth, with the exception of 5- to 7-year-olds and the 'severe community' exposure level (Table 2, model 2). The association was similar with internalizing symptoms assessed by the SCAS (Fig. 2), although somewhat weaker and with a less consistent reduction in magnitude between the February and October waves.

Examining lockdown stringency, we find that higher values on the lockdown stringency index were associated with lower levels of internalizing symptoms assessed by the PSC, an association that increased in magnitude between the February and October 2022 waves (Fig. 2). Table 2 shows that, unlike the COVID illness and death exposure, this association was similar across age groups. For example, a single point increase on the index was associated with a 0.01 SD decrease on the PSC score among each of the three age groups (Table 2 models 2, 3, and 4). This pattern was repeated with internalizing symptoms assessed by the SCAS, with a consistent protective association of the same magnitude with more strict lockdown policies, that only strengthened over time.

We examined the association between mental health and large (over 20%) decreases or increases in household income. In the February 2022 wave, increases in household incomes over 20% were associated with internalizing symptoms assessed by the SCAS (Fig. 2) (0.04; 95% CI: 0.01–0.06). Analysis for assessments by the PSC in February 2022 (Fig. 1) showed similar associations although the confidence interval did cross the null (0.02; 95% CI: -0.001–0.05). In contrast, increases in income in October 2022 waves showed no evidence of association with either the SCAS (0.01; 95% CI: -0.01–0.03) or PSC (-0.001; 95% CI: -0.02–0.02We further investigated whether results in February 2022 were driven by any subgroup and found that results were driven by older adolescents (13–19): in this group the 20% income increase was associated with a 0.04 SD higher SCAS score (95% CI: 0.01–0.07) when compared with youth in households with a smaller income change.

| | February 2022 | | | | October 2022 | | | |
|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| | Overall | Ages 5–7 | Ages 8–12 | Ages 13–19 | Overall | Ages 5–7 | Ages 8–12 | Ages 13–19 |
| VARIABLES | *N* = 25,683 | *N* = 1,827 | *N* = 6,522 | *N* = 17,334 | *N* = 22,356 | *N* = 1,465 | *N* = 5,306 | *N* = 15,585 |
| *COVID-19 Exposure (ref. = no one ill/died)* | | | | | | | | |
| Mild community, none close | 0.10*** | 0.15 | 0.05 | 0.11*** | -0.02 | -0.03 | -0.03 | -0.02 |
| | (0.04–0.15) | (-0.02–0.31) | (-0.04–0.15) | (0.05–0.18) | (-0.06–0.01) | (-0.15–0.10) | (-0.10–0.03) | (-0.06–0.03) |
| Severe community, none close | 0.10*** | 0.19* | 0.10* | 0.09*** | 0.05** | 0.03 | 0.05 | 0.05** |
| | (0.05–0.14) | (0.03–0.34) | (0.01–0.18) | (0.05–0.14) | (0.02–0.08) | (-0.08–0.13) | (-0.01–0.12) | (0.02–0.08) |
| Mild close | 0.04 | 0.04 | 0.03 | 0.06* | 0.01 | -0.00 | 0.01 | 0.01 |
| | (-0.00–0.09) | (-0.10–0.18) | (-0.05–0.11) | (0.00–0.11) | (-0.01–0.04) | (-0.09–0.08) | (-0.04–0.06) | (-0.02–0.04) |
| Severe close | 0.03 | 0.04 | 0.01 | 0.04 | 0.01 | 0.01 | 0.01 | 0.01 |
| | (-0.01–0.07) | (-0.10–0.19) | (-0.07–0.09) | (-0.00–0.09) | (-0.01–0.04) | (-0.08–0.09) | (-0.03–0.06) | (-0.01–0.04) |
| Lockdown stringency index | -0.01*** | -0.01*** | -0.01*** | -0.01*** | -0.06*** | -0.09 | -0.04 | -0.07*** |
| | (-0.01 - -0.01) | (-0.01 - -0.00) | (-0.01 - -0.01) | (-0.01 - -0.01) | (-0.09 - -0.03) | (-0.24–0.06) | (-0.10–0.01) | (-0.10 - -0.04) |
| *Household income change (ref. = stayed the same)* | | | | | | | | |
| Decreased by at least 20% | -0.00 | -0.04 | 0.00 | -0.00 | 0.00 | -0.05 | 0.01 | 0.01 |
| | (-0.03–0.03) | (-0.13–0.04) | (-0.04–0.05) | (-0.03–0.03) | (-0.02–0.02) | (-0.12–0.03) | (-0.04–0.05) | (-0.02–0.03) |
| Increased by at least 20% | 0.02 | 0.03 | 0.02 | 0.02 | 0.01 | -0.01 | 0.00 | 0.01 |
| | (-0.00–0.05) | (-0.05–0.11) | (-0.02–0.06) | (-0.01–0.04) | (-0.01–0.03) | (-0.08–0.06) | (-0.04–0.04) | (-0.01–0.04) |

**Table 2**. COVID-19 related stressors and internalizing symptoms (Pediatric Symptom Checklist, PSC). Robust 95% confidence intervals in parentheses. Models control for child age, child gender, urban/rural residence, caste, household education, household size, pre-COVID average income, and the adult respondent's gender and age. Additionally, the October 2022 wave includes a control for a new respondent in October 2022. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

| | February 2022 | | | | October 2022 | | | |
|---|---|---|---|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| | Overall | Ages 5–7 | Ages 8–12 | Ages 13–19 | Overall | Ages 5–7 | Ages 8–12 | Ages 13–19 |
| VARIABLES | *N* = 25,683 | *N* = 1,827 | *N* = 6,522 | *N* = 17,334 | *N* = 22,356 | *N* = 1,465 | *N* = 5,306 | *N* = 15,585 |
| *COVID-19 Exposure (ref. = no one ill/died)* | | | | | | | | |
| Mild community, none close | 0.06* | 0.09 | 0.02 | 0.07* | -0.03 | 0.00 | -0.04 | -0.02 |
| | (0.01–0.11) | (-0.07–0.25) | (-0.08–0.11) | (0.01–0.14) | (-0.06–0.01) | (-0.11–0.12) | (-0.10–0.02) | (-0.06–0.02) |
| Severe community, none close | 0.03 | 0.08 | 0.01 | 0.04 | 0.04** | 0.07 | 0.05 | 0.04* |
| | (-0.01–0.08) | (-0.06–0.23) | (-0.06–0.09) | (-0.01–0.09) | (0.01–0.08) | (-0.05–0.18) | (-0.01–0.11) | (0.01–0.08) |
| Mild close | 0.03 | -0.04 | 0.02 | 0.05 | 0.04** | 0.01 | 0.06* | 0.03 |
| | (-0.02–0.07) | (-0.18–0.10) | (-0.07–0.10) | (-0.00–0.10) | (0.01–0.06) | (-0.07–0.08) | (0.01–0.11) | (-0.00–0.06) |
| Severe close | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | -0.01 | 0.02 | 0.00 |
| | (-0.03–0.05) | (-0.14–0.14) | (-0.06–0.08) | (-0.03–0.07) | (-0.02–0.03) | (-0.10–0.08) | (-0.02–0.06) | (-0.02–0.03) |
| Lockdown stringency index | -0.01*** | -0.01*** | -0.01*** | -0.01*** | -0.06*** | -0.07 | -0.05 | -0.07*** |
| | (-0.01 - -0.01) | (-0.01 - -0.00) | (-0.01 - -0.00) | (-0.01 - -0.01) | (-0.09 - -0.03) | (-0.20–0.05) | (-0.10–0.01) | (-0.10 - -0.03) |
| *Household income change (ref. = stayed the same)* | | | | | | | | |
| Decreased by at least 20% | 0.01 | 0.03 | -0.02 | 0.01 | -0.00 | -0.02 | 0.00 | 0.00 |
| | (-0.02–0.03) | (-0.06–0.12) | (-0.06–0.03) | (-0.02–0.04) | (-0.02–0.02) | (-0.09–0.05) | (-0.04–0.04) | (-0.02–0.03) |
| Increased by at least 20% | 0.04** | 0.01 | 0.03 | 0.04** | -0.00 | -0.03 | -0.01 | 0.00 |
| | (0.01–0.06) | (-0.07–0.09) | (-0.01–0.07) | (0.01–0.07) | (-0.02–0.02) | (-0.09–0.04) | (-0.05–0.03) | (-0.02–0.02) |

**Table 3**. COVID-19 related stressors and internalizing symptoms (Spence Children's anxiety scale, SCAS). Note: Robust 95% confidence intervals in parentheses. Models control for child age, child gender, urban/rural residence, caste, household education, household size, pre-COVID average income, and the adult respondent's gender and age. Additionally, the October 2022 wave includes a control for a new respondent in October 2022. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

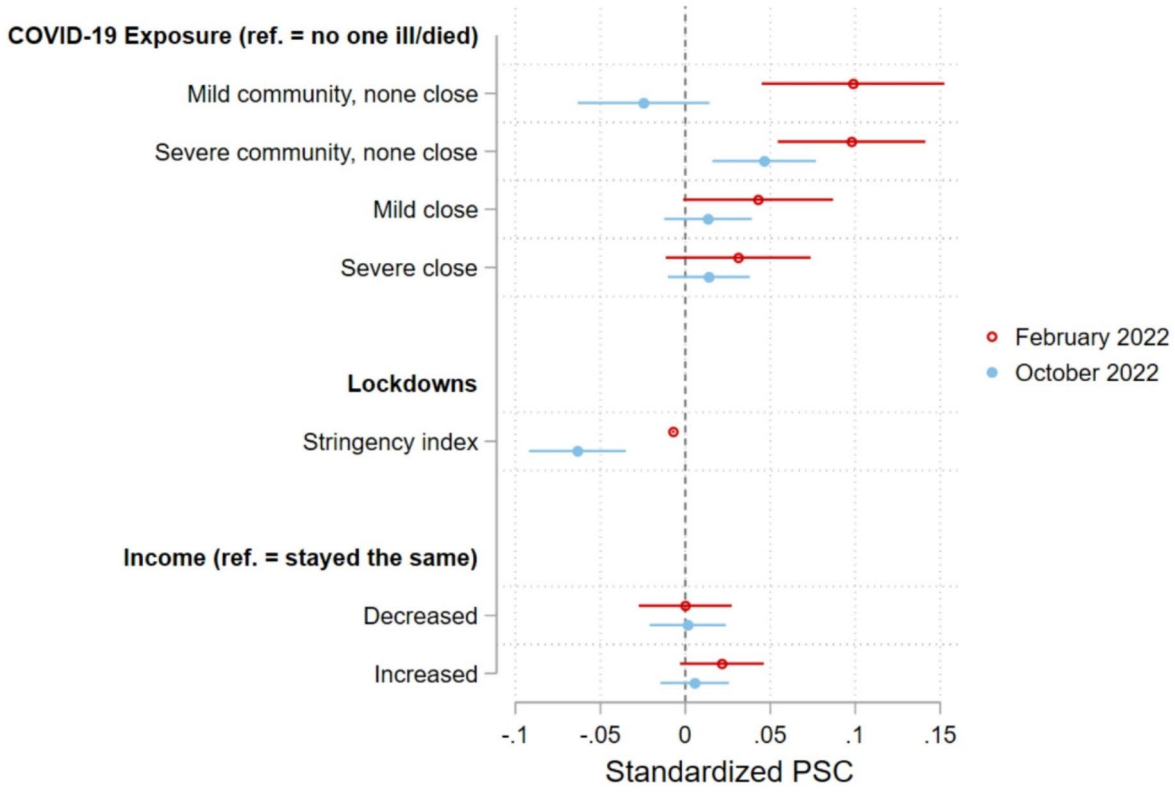


**Fig. 1**. Association between COVID-19 stressors and internalizing symptoms assessed by the PSC.

## Discussion

In our analysis of a large sample of households in India, we found that child and adolescent mental health symptoms were generally better in October 2022 than in February 2022, a period of over 8 months. By this waning phase of the pandemic, almost half of families report to know someone close who had either been ill with, or died from, COVID-19. Furthermore, almost a third experienced a significant drop in household income compared to prior to the start of the pandemic. Knowing people who had become ill or died from COVID-19 was generally associated with higher levels of child and adolescent internalizing symptoms, although the 95% Confidence Intervals of some estimates crossed the null. However, living in an area with higher lockdown stringency policies in place was associated with better mental health. Furthermore, an increase in household income, when compared to before the pandemic, was associated with worse mental health. Finally, most associations tended to be driven by older adolescents and were stronger during the earlier (February 2022) than later (October 2022) data collection time point.

Our findings fill a gap in the literature on young people's mental health in the waning phases of the pandemic, especially in the South Asian context. They also contribute to the growing body of literature showing dynamic patterns of mental health symptoms throughout the pandemic. Prior studies have reported both an improvement in symptoms over time[9] as well as initial improvements followed by worsening symptoms again in 2022[7] or a stabilization[8]. The dynamic nature of mental health over the course of the pandemic suggests that the overall population impact of the pandemic on child and adolescent mental health is time variant, in addition to being location and context specific.

Our analysis focused on three broad types of pandemic-related stressors. The first, death or illness in the family's social network, was meant to capture the most direct impact of the virus itself, and included both close family members as well as members of the wider community. Both illness and death in the family's network were associated with worse mental health, although not all associations were statistically significant. While only a few other studies have reported on the impacts of COVID illness or death in one's social network, among adults[16], our findings are consistent with an analysis of adults in India where depression scores were positively correlated with community infection rates[17]. In several of our models the association between illness and death in the family network and internalizing symptoms was weaker in the October 2022 wave. The time between the February and October waves was a time of decreasing COVID infections with commensurate increased vaccination rates[17]. This resulted in very few new deaths/illnesses reported between the two waves. It seems plausible that salience of these infections was receding, thus weakening their impact on mental health.

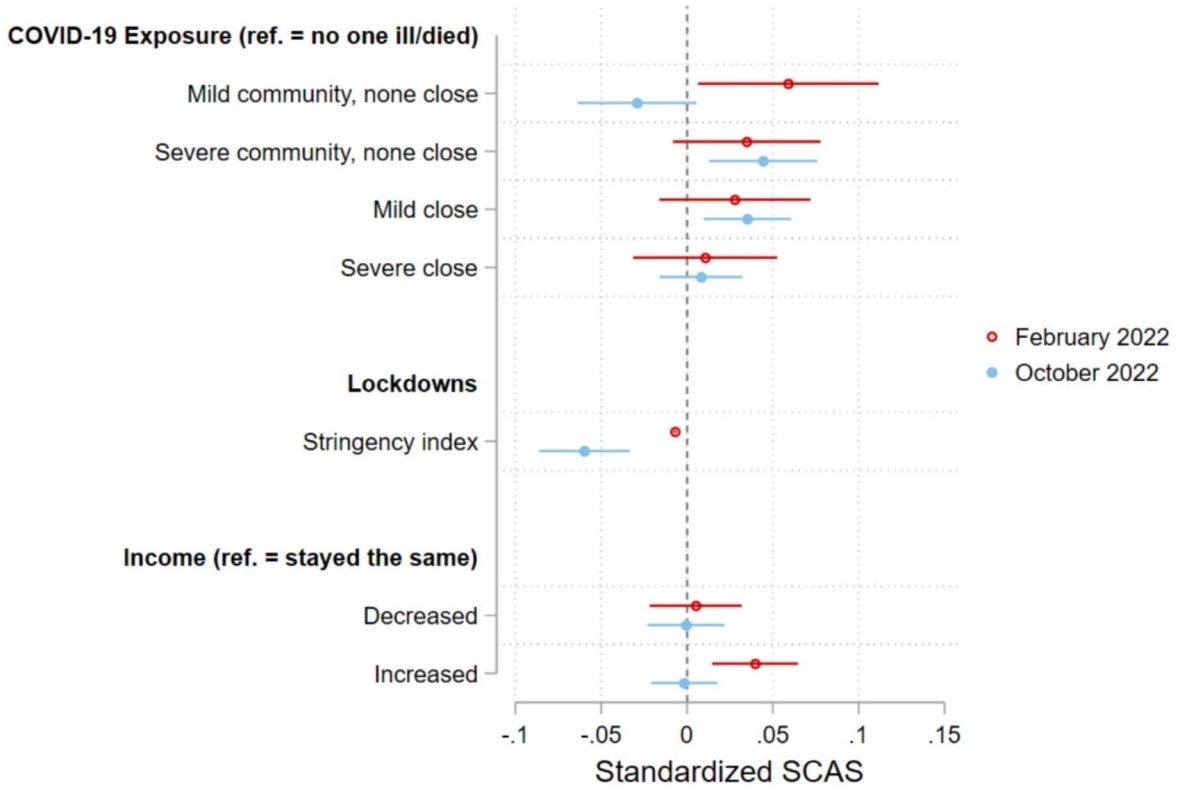


**Fig. 2**. Association between COVID-19 stressors and internalizing symptoms assessed by the SCAS.

The second stressor of interest was lockdown stringency which was measured with an index including factors such as state level school and workplace closings as well as restrictions on public gatherings. We found that, two years into the pandemic, living under higher restrictions was associated with better child and adolescent mental health. Although our effect estimates were small, we note that a single point on the stringency index similarly represents a very small change in actual lived experience. Previous research has presented conflicting evidence to the direction of the association between lockdowns and mental health. Some previous studies have reported lockdowns to be correlated with worse mental health symptoms[3,21,22]. Meanwhile other studies have reported a positive impact of lockdowns on mental health in China[23] and in certain circumstances in 22 European countries. Findings of a positive association between lockdowns and better mental health are consistent with studies that have reported improved family relationships and healthy habits among young people during the lockdowns[25]. For example, in a study of high school students in India, three-quarters reported developing new healthy lifestyle habits and over 90% reported more family time[26]. In another survey, 40% of students reported improved sleep habits since the lockdown started[14]. These improvements, especially in family relationships, can serve as important sources of resilience[27,28]. We also found that the positive impact of the lockdown stringency index on mental health strengthened over time. The changing association between lockdown policies and mental health has been reported previously, with some studies showing weakening impact over time with others showing a strengthening of association[22,29]. While, in a broad sense, lockdowns are a strategy to stem rising infection rates, in many places they were implemented in a very disorganized manner, especially at the beginning of the pandemic[17]. In the year prior to the SEHAT survey, during the Delta wave in 2021, the lockdown policies seemed especially chaotic. At that time, the government of India relaxed lockdowns in an effort to re-open the economy[17]. However, the relaxed lockdowns were in sharp contrast to people's lived experience of very high community illness rates, resulting in significant criticism of the government. By the time of the Omicron wave in 2022, the lockdown levels were more commensurate with infection rates, and this likely led to a growing confidence in the government and a sense of safety. Furthermore, in areas with higher stringency scores, children and adolescents were more likely to not be in school, potentially increasing their sense of safety and security.

Our third stressor of interest was a change in the financial wellbeing of the household, which we operationalized as either a decrease or increase of more than 20% in household income compared to prior to the start of the pandemic. We found weak evidence that increases in income were associated with worse internalizing symptoms, specifically for anxiety symptoms and among older adolescents. Although this finding might at first seem counterintuitive, we note that the implication of 'more income' during the pandemic is quite different from prior to the pandemic. Specifically, more income could potentially mean that a family member took a job as front-line or first responder worker. Multiple researchers have reported that work-related factors such

as overtime work during the pandemic or having a relative whose work was COVID-19 related, was associated with worse mental health[30–32]. It is therefore possible that, in households where income had increased, at least one family member was leaving the house to work in a high-risk environment. This heightened level of exposure could lead to anxiety, especially when community infection levels were higher during the February 2022 wave. This finding is also consistent with our findings of improved mental health during times of stricter lockdowns, when families were spending more time together. Our findings with income make an important contribution to understanding of how work and financial changes during the pandemic impact families. Especially in the face of major economic disruptions, social safety net policies are likely to serve an important stabilizing function in relation to families' standard of living and, thereby, mental health[34].

Our study has several strengths and limitations. We leveraged a large dataset that was constituted prior to the pandemic with households representing all states in India. Although a large dataset al.so has the risk of producing statistically significant yet very small estimates, we note that, at the population level, even small changes in mental health symptom values translate to meaningful differences[35,36]. Another strength is the availability of pre-pandemic data on factors such as income, which facilitated objective determination of household financial changes during the pandemic. One limitation is that due to the cross-sectional nature of both waves, we were not able to assess within person change in exposure or outcomes between February and October 2022. Additionally, information on COVID infection in a household's network was self-reported and therefore susceptible to bias. We were also not able to confirm whether the adult respondent was the young person's main caregiver. However, 84% of adult reporters were female with a mean age of 42, indicating that this person was likely the mother or an aunt. Prior research suggests that parent-reports are valid in assessing child mental health[37,38]. Nevertheless, internalizing symptoms are not necessarily directly observable to caregivers, and especially with older adolescents who may be more independent and spend less time with caregivers than younger children, caregivers may not be aware of young people's internalizing symptoms. Thus, the findings bear replication in future research using self-reports and other reporters whose relationships with young people are well specified. Finally, although mental health and COVID-related data were collected at two time points, the data are correlational so causal inference is limited.

## Conclusion

Our findings advance understanding of how the pandemic's impact on young people's mental health varied over time, especially in the waning phases of the pandemic. We find evidence that the deleterious associations with pandemic-related stressors weakened over time. We also illustrate the importance of anchoring results within the specific geographic context of the study as well as concurrent events during the study period. Importantly, findings that may initially seem counterintuitive ultimately illuminate the dynamic and complex processes underlying child and adolescent mental health. Specific to context, our findings contribute much needed data on child and adolescent mental health in India[17,39].

## Methods

### Study sample and participants

Our study uses data from the Indian Consumer Pyramids Household Survey (CPHS), combined with data on COVID stressors and health outcomes collected in the Survey of Health Trends (SEHAT) module among a subset of CPHS households. The CPHS is a longitudinal survey conducted three times a year among 175,000 households, and their approximately 675,000 members[40]. The survey, collected by Centre for Monitoring Indian Economy (CMIE), covers a wide range of topics related to household economic and social indicators. The sample, drawn based on geographic sampling, is spread across India's geography, and is representative of 98.5% of the country's population[40]. Each wave of the CPHS is conducted within a four-month period, with households re-interviewed four months later, and new households added to replace those lost to follow-up. The survey was first administered in January 2014 and data collection is ongoing.

SEHAT was developed as a module of the CPHS to assess the mental health impacts of COVID-related stressors. The sample for the SEHAT module included households interviewed in the first month of each wave of the CPHS (February, June, and October). Data for the current analysis are from the February 2022 and October 2022 waves. The SEHAT module was administered to approximately 32,000 households in both February 2022 and October 2022. Other data of interest from the main CPHS, either from an earlier wave or concurrent as appropriate, were combined with the SEHAT module for the analysis. Although a portion of households were re-interviewed across waves, the current analysis treats the data as two cross-sectional waves as over 20% of child level data was located in households that were dropped or added to the sample in later waves. At each interview, the main respondent, most commonly a female in her 40s, answered the child mental health module about a child (aged 5–19) living in their household.

Our analytic sample included children and adolescents 5 to 19 years old with non-missing covariates and with household income data from at least one wave before (May 2018-February 2020) and after (April 2020-October 2022) COVID to enable the calculation of the income change variable described below. Approximately 3% of the sample was excluded due to missing data on covariates and an additional 10% were excluded because of missing income data. This led to a sample size of 25,683 in February 2022 and 22,356 in October 2022.

### Measures

*Pandemic-related stressors*

Known COVID illness or death within one's social network  Participants were asked to indicate for each member in the household roster if each person had COVID, became severely ill due to COVID, or died of COVID. Additionally, participants were asked whether neighbors, friends / relatives, or others they knew had COVID,

became severely ill due to COVID, or died of COVID. During the February 2022 wave, the reference period was 'since the start of the COVID-19 pandemic in 2020'; during the October 2022 wave the reference period was 'since February' for those who participated in the February wave and 'since the start of the COVID-19 pandemic in 2020' for those who were not part of the February wave. For the October wave, a cumulative measure was created using the most severe COVID illness category, to create a similar reference period 'since the start of the COVID-19 pandemic in 2020' across waves and respondents.

Using these measures, we created a five-category variable to indicate COVID-19 illness and death in the household's social network. Categories were mutually exclusive and ordered from least (1) to most severe (5):

(1) *Completely unexposed*: Those who did not know anyone who became infected with (including themselves), or who were severely ill or died from, COVID-19;
(2) *Mild community*, *none close*: Those who only knew of neighbors or others who were infected with COVID-19. Among this group, neither the participant, nor their friends/relatives were infected with COVID-19; nor did they know anyone who became severely ill or died from COVID-19;
(3) *Severe community*, *none close*: Those who only knew of neighbors or others who were severely ill or died of COVID-19. Among this group, none of the participant's friends / relatives had COVID-19 or died from COVID-19;
(4) *Mild close*: Those who reported that they or a friend / relative had COVID-19 infection but were not severely ill and had not died from COVID-19; and.
(5) *Severe close*: Those who reported that a friend / relative was severely ill or died from COVID-19.

Lockdown stringency index We use data from the Oxford COVID-19 Government Response Tracker (OxCGRT)[41] to measure COVID lockdowns in the respondents' state during the date of the interview. In particular, we use the stringency index which comprises 9 measures including school closings, workplace closings, cancelling of public events, restrictions on gathering size, closing of public transportation, stay at home requirements, restrictions on internal movement, restrictions on international travel, and presence of public information campaigns. The index is a score of the underlying indicators that is normalized between 0 and 100.

Changes in income The change in income variable was meant to compare (a) average household income during waves prior to the pandemic with (b) average household income during data collection waves since the onset of the pandemic and the data collection wave (either February or October 2022). We compute average household income before the pandemic using the six waves of data between May 2018 and February 2020. For the February 2022 models, we compute average household income during the pandemic using the six waves collected between April 2020 and February 2022. For the October 2022 models, we compute average household income during the pandemic using the six waves collected between December 2020 to October 2022. We then created a ratio of pre-COVID income to COVID income, restricted to those with data from the wave just prior to COVID or the one before that, as well as with people from the data from the wave after COVID or the wave after that. The income ratio was then categorized into three groups: decreased, stayed the same, and increased. A threshold of 0.2 was used to indicate a 20% increase/decrease in income during COVID compared to pre-COVID income.

*Internalizing symptoms*

Internalizing symptoms were assessed with two measures. The first measure included 5 items from the Pediatric Symptoms Checklist (PSC) parent report[42]. Adults were asked whether the child 'feels afraid', 'feels hopeless', 'is down on self', 'worries a lot', or 'seems to have less fun'. Each question was on a 4-point Likert scale (coded 0–3), with a total point range of 0–15. The internal consistency of the internalizing items in this sample was 0.84. For the regression analyses, this score was then standardized to a mean of zero and standard deviation of 1.

The second measure was the generalized anxiety subscale of the SCAS parent report[43,44]. For children aged 5 or 6, the preschool version, consisting of 5 items, was used: child 'has difficulty stopping him/herself from worrying', 'is tense, restless or irritable due to worrying', 'has trouble sleeping due to worrying', 'spends a large part of each day worrying about various things', 'asks for reassurance when does not seem necessary'. For children and adolescents aged 7 to 19, the 6-item school-aged version was used: 'my child worries about things', 'when my child has a problem, s/he complains of having a funny feeling in his/her stomach', 'my child complains of feeling afraid', 'when my child has a problem, s/he complains of his/her heart beating really fast', 'my child worries that something bad will happen to him/her', 'when my child has a problem, s/he feels shaky'. Questions in both the pre-school and school-aged versions were assessed using a 4-point Likert scale (never, sometimes, often, always). Responses were summed, resulting in a range of 0–15 for the pre-school version and 0–18 for the school-aged version. The internal consistency of the pre-school items was 0.87 and the school-aged version was 0.88. In order to model SCAS scores for all children simultaneously, both the pre-school and school-age children's scores were standardized with a mean of zero and standard deviation of 1.

*Other covariates*

Other covariates of interest that were used in the analysis include young person age in years, young person gender, urban/rural residence, caste, household education, number of people in the household, pre-COVID average income (see "changes in income" measure for details on measurement), and the adult respondent's gender and age. Additionally, in the October 2022 wave, a covariate denoted whether the household was newly added in that wave. Region types are based on the 2011 Census and defined by CMIE as rural if the household is located in a village and as urban if the household is located in a town. Caste was categorized into four groups: scheduled caste (SC)/scheduled tribes (ST), other backward classes (OBC), intermediate caste, and upper castes (UC). The household education variable was generated by CMIE by incorporating literacy and education information from

all adults in the household[45], categorized as low (no literate or educated adults), moderate (some literacy and education), and high (includes college graduates).

### Statistical analyses

We used ordinary least squares (OLS) regression to examine whether pandemic-related stressors were associated with children's and adolescent's mental health during February and October 2022. Models were run cross-sectionally for each of the two waves, as well as separately by outcome. Results are presented both for the full sample as well as age-stratified. The age groupings were chosen to best capture unique developmental periods of childhood (5–7), emerging adolescence (8–12), and adolescence (13–19). All models controlled for young person age, gender, urban/rural residence, caste, household education, household size, pre-COVID average income, and adult respondent's gender and age. Additionally, in the October 2022 wave, a control was added indicating whether the respondent was new to the sample since the February 2022 wave. Models also clustered by household ID to account for young people living in the same household, as well as include interviewer fixed effects. For ease of interpretation, coefficients and robust confidence intervals clustered at the primary sampling unit level were plotted.

## Data availability

The SEHAT module of the dataset used and/or analysed during the current study are available from the corresponding author on reasonable request. The CPHS dataset is available with subscription from the Centre for Monitoring Indian Economy Pvt. Ltd (www.cmie.com).

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## Author contributions

J.M. conceptualized the study, drafted the manuscript. K.S. analyzed and interpreted the data, contributed to drafting and editing manuscript. J.E.L. conceptualized the study, contributed to interpreting the data, drafting and editing manuscript. A.C. conducted background research to inform the study, contributed to drafting and editing manuscript. A.M. conceptualized the study, contributed to interpreting the data, drafting and editing manuscript. M.V.M. conceptualized the study, contributed to interpreting the data, drafting and editing manuscript. M.M. conceptualized the study, contributed to interpreting the data, drafting and editing manuscript. All authors have approved the final manuscript version.


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## Declarations

## Ethics approval and consent to participate

The research protocol was approved by Duke University IRB Protocol 2022 – 0113 as well as IRB approval from the Indian Institute of Management Bangalore.

## Consent for publication

Not applicable.

## Competing interests

The authors declare no competing interests.

## Additional information

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