**Differing impact of the COVID-19 pandemic on youth’s mental health: combined population and clinical study**

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**Abstract**

**Background:** Identifying youths most at risk to COVID19-related mental illness will be essential to develop effective targeted interventions.

**Aims:** To compare trajectories of mental health throughout the pandemic, in youths with and without prior mental illness, and identify youths most at risk to COVID-19-related mental illness.

**Methods:** Data was collected from youths aged 18-26 years (N=669) from two existing cohorts: IMAGEN, a population-based cohort, and ESTRA/STRATIFY, clinical cohorts with pre-existing diagnoses of mental disorders. Repeated COVID-19 surveys and standardized mental health assessments were used to compare trajectories of mental health symptoms from prior to the pandemic through to the second lockdown.

**Results:** Mental health trajectories differed significantly between cohorts. In the population cohort, depression and ED symptoms increased by 33.9% [95% CI, 31.78-36.57] and 15.6%, [95% CI, 15.39-15.68] during the pandemic, respectively. In contrast, these remained high over time in the clinical cohort. Conversely, trajectories of alcohol abuse were similar in both cohorts, decreasing continuously (15.2% decrease) during the pandemic. Pre-pandemic symptoms severity predicted the observed mental health trajectories in the population cohort. Surprisingly, being relatively healthy predicted the increases in depression and ED symptoms, and BMI. In contrast, youths initially at higher risks for depression or ED reported a lasting decrease.

**Conclusions:** Healthier youths may be at greater risk of developing depressive or ED symptoms during the COVID-19 pandemic. Targeted mental health interventions considering prior diagnostic risk may be warranted to help youths cope with the challenges of psychosocial stress and reduce the associated health care burden.

**Background**

COVID-19 had detrimental effects on mental health, most reportedly with worldwide rates in major depression and anxiety disorders rising to 27.5% and 25.6%, respectively (1). Fear of the virus itself and lockdowns implemented by governments around the globe have caused higher mental distress and lower life quality in the general population (2-5). Particularly, youth, known to experience major social role transitions (6), experienced higher levels of depressive and anxiety symptoms than older age groups (1, 4, 5). The pandemic has also been reported to worsen symptoms of patients with pre-existing mental illness (7, 8), although contradictory findings have been reported (9-12). These contradictions and the limitations of current studies highlight the need for further research that is both longitudinal and focuses on youth (13).

The psychosocial stress caused by this pandemic has been detrimental to youth around the world, who have experienced adverse lifestyle changes (14, 15). Confinement measures during lockdowns and the associated personal, educational and economic disruptions created pervasive social isolation, increased stress, and decreased peer interactions, which might have triggered psychological distress and mental health difficulties in this age group. Indeed, meta-analyses of studies of children and adolescents indicate an increased prevalence of clinically elevated depression and anxiety symptoms compared to pre-pandemic estimates, especially in adolescent females (16, 17). However, most studies investigated the effects of the pandemic on mental health changes only at the beginning of the pandemic. While enormously instructive, these studies do not address the longer-term effects of the pandemic. Other limitations are the considerable heterogeneity of studies, largely due to differences in assessments and diagnostic criteria (18). The focus of most studies on anxiety and depression has also called for more research to consider the effects of the pandemic on other youth’s mental health conditions that may have been negatively affected by the COVID-19 pandemic, in particular eating disorders (EDs) and addiction (19). More limited evidence available suggests that pre-pandemic disordered eating is a risk factor for poorer mental health during the pandemic (8, 20). However, interpretations of these findings are limited as, here again, assessment of mental health was restricted to the period of eased restrictions following the first lockdown. As for addiction, a decline in substance use has been reported, especially among adolescents initially at higher risk for substance use disorder (21, 22). It is clear from these limitations that longitudinal trajectory research with comprehensive mental health assessments, spanning the pre-pandemic period, and across multiple lockdown and release phases, is needed to understand the long-term impact of the COVID-19 pandemic on youth’s mental health (13). Research comparing data from the general population and from patient groups is also needed. Crucially, identifying the most vulnerable and resilient groups will be important to design and deliver the most appropriate targeted interventions.

**Aims**

Our study addresses these needs by using data collected before and throughout the COVID-19 pandemic in two pre-existing youths cohorts: IMAGEN, a longitudinal population-based adolescent cohort, and ESTRA/STRATIFY, a clinical cohort with diagnoses of major depression (MDD), alcohol use disorders (AUD) and eating disorders (EDs). Our repeated assessments, based on the CoRonavIruS Health Impact Survey (CRISIS)(23) and standardised mental health questionnaires, aimed at (i) establishing trajectories of behaviours and mental health symptoms throughout stages of the pandemic in these cohorts, (ii) comparing these trajectories to identify the most vulnerable groups, and (iii) identify pre-pandemic predictors of these mental health trajectories.

# Methods

# Study design

Participants were drawn from three existing cohorts located in the UK, France, and Germany: IMAGEN, STRATIFY and ESTRA. IMAGEN was a longitudinal population cohort, while STRATIFY and ESTRA were case-control cohorts. To be eligible for inclusion, participants needed to respond to our invitation and provide informed consent through an online form sent via email. Data collection was conducted through online questionnaires, with the initial round taking place during the first national lockdown in the UK and Europe (April/May 2020). Subsequent follow-up surveys were administered when the first lockdown was released (July 2020) and when the second lockdown was imposed (November 2020). The design and reporting of our study were conducted in accordance with the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

# Participants

Population cohort: These participants, with no known history of mental illness, were drawn from the IMAGEN study, a longitudinal cohort of over 2000 adolescents recruited at age 14 from eight study sites in Europe, with follow-up assessments at ages 16, 19 and 23. For detailed study protocols, please refer to Schumann et al (24). Our survey was sent to those who had completed the follow-up assessment at age 23 (N=1350). A total of 458 IMAGEN participants recruited from the UK, France, and Germany (London, Nottingham, Paris, Mannheim and Berlin) who completed the COVID-19 survey at baseline were included in our analyses.

Clinical cohort: This cohort was derived from two studies, STRATIFY and ESTRA, of participants aged 18-30 (N=628). STRATIFY participants included in this study comprised participants recruited in the UK and Germany (London, Southampton, and Berlin) who met diagnostic criteria for major depressive disorders (MDD) and alcohol use disorder (AUD). as assessed by self-report via online computerised screening. Included were participants scoring moderate to severe (≥ 15) in the Patient Health Questionnaire (PHQ-9) (25) and Alcohol Use Disorders Identification Test (AUDIT) (26) for MDD and AUD participants, respectively. ESTRA consisted of participants recruited in London and meeting the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (27) based diagnostic criteria for anorexia nervosa (AN) or bulimia nervosa (BN). All were female. Their eating disorder symptoms were assessed by the Eating Disorder Diagnostic Scale (EDDS, DSM-5 version) over a screening phone call by study researchers (28). A total of 211 STRATIFY/ESTRA participants (80 MDD, 51 AUD, 47 AN, and 33 BN) who completed the COVID-19 survey at baseline were included in our analyses.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by King's College London Research Ethics Committee (17/LO/0552) for IMAGEN; London Westminster Research Ethics Committee (PNM/10/11-126) for STRATIFY; North West -Greater Manchester South Research Ethics Committee (20/NW/0143) for ESTRA. All adult participants provided written/online signature informed consent to participate in this study.

---------------------------------------------------figure 1---------------------------------------------------

# Survey and assessments

*The COVID-19 survey:* We adapted The CoRonavIruS Health Impact Survey (CRISIS v0.1 <http://www.crisissurvey.org>) (23) to examine changes induced by the pandemic on individuals' mental health and behaviours. The survey encompassed data collection at various time points, specifically, pre-pandemic (3 months prior, pre-LD1), during the first lockdown (LD1), after the first lockdown (after-LD1), and during the second lockdown (LD2). This questionnaire assessed a range of data domains including COVID-19-related health status, and life changes, daily behaviours and emotions and worries due to the COVID-19 crisis (see Supplemental Information for details).

*Mental health assessments:* The severity of mental disorder symptoms was assessed with validated questionnaires, including the Patient Health Questionnaire-9 (PHQ-9) for depressive symptoms, the Eating Disorder Examination Questionnaire (EDE-Q) (29) for eating disorder (ED) symptoms and the Alcohol Use Disorders Identification Test Consumption (AUDIT-C) (26) for alcohol abuse (see Supplemental Methods for details). Questionnaires were administered at three time points: a) at the previous recruitment wave, ~3 years prior to the pandemic (pre-PD), b)during the first lockdown (LD1); and c)during the second lockdown (LD2). The exception being for the EDE-Q, that was administered only at 2 time points (i.e., LD1 and LD2) in the clinical cohort.

*Pre-pandemic mental health*: Pre-PD symptom severity scores were used to classify participants from the population cohort, based on the following criteria. Depression: PHQ-9 scores between 0-4, 5-9, and 10+ were used to indicate minimal, mild, and moderate to severe depression, respectively (25). Alcohol abuse: AUDIT scores of 0-7, and 8+ were used to indicate low and high risks, respectively (30). Eating disorders: EDE-Q global scores <2.8 (for females) or 1.68 (for males) indicate low risk; higher scores were considered as probable EDs (31, 32). Body mass index (BMI): underweight or normal weight, BMI < 25; overweight or obese: BMI > 25.

# Statistical analyses

Data were analysed in SPSS version 27 using mixed-effects ANOVA, with within-subject effect (time) adjusted by country, and between-subject effects (cohort and sex) adjusted by country and age. For each analysis, participants were included if they didn’t have missing data for any variable needed. Separate analyses were conducted, as detailed in the Supplemental Methods, on the whole sample or in each cohort separately. Statistical significance was set at *p* < 0.05.

*Trajectories of lifestyle changes,* *worries and mental health symptoms during the pandemic*: Scores from the COVID survey and mental health questionnaires were analysed across time points. In addition to time effects, we investigated cohort and sex effects, along with interaction effects (i.e., time x cohort, time x sex) in the whole sample. Given the strong cohort effects, we also investigated these trajectories in the population and clinical cohorts separately.

*Trajectories of mental health symptoms based on pre-pandemic symptom severity*: These analyses were performed in the population cohort only. Sub-groups based on the severity of pre-pandemic (pre-PD) symptoms (see above) were included in mixed-effects ANOVAs. Three analyses were run to investigate interactions between time and pre-PD symptoms severity on mental health symptoms (i.e., depression, alcohol abuse or ED) during the pandemic.

# Results

**Sample descriptive and participants characteristics**

In total, 669 youth (31.5% clinical cohort; 69.4% females) completed the COVID survey at pre-LD1, 471 (29.9% clinical cohort) at LD1, and 429 (27.0% clinical cohort) at LD2 (Supplemental Table 1). As expected, immediately prior to the pandemic, symptoms of depression (F(1,615) = 156.26, *p* < .001, ηp2 = 0.203) and alcohol abuse (F(1,630) = 30.11, *p* < .001, ηp2 = 0.046) were higher in the clinical cohort. BMI was higher in the population sample (F(1,543) = 17.76, *p* < .001, ηp2 = 0.032). Females reported higher levels of depressive (F(1,615) = 13.95, *p* < .001, ηp2 = 0.022) and ED symptoms (F(1,411) = 45.92, *p* < .001, ηp2 = 0.100), and males higher levels of alcohol abuse (F(1,630) = 23.38, *p* < .001, ηp2 = 0.036).

# Behavioural, emotional, and mental health trajectories during the pandemic

We compared behavioural, emotional, and mental health trajectories during the pandemic in our two cohorts using mixed-effects ANOVA. Significant main effects of time on behaviours (i.e., positive lifestyle changes, frequency of media use, average daily food consumption and frequency of substance use; all, *p* < .001; Supplemental Table 2, Figure 2, A-E) were observed when analysing both samples together, but no significant time x cohort interactions. Similarly, there were significant main effects of time on emotional health, as assessed by the ‘emotions and worries’ and ‘worries about COVID’ sections of the survey (all, *p* < .001; Supplemental Table 2, Figure 3, A-E), but no significant time x cohort interactions (all detailed in Supplemental Material).

----------------------------------------------figure 2 and figure 3-----------------------------------------

Comparisons of mental health symptoms (i.e., depression, alcohol drinking and eating disorders) and BMI just prior to the pandemic and during both lockdowns revealed the differential impact of the COVID-19 crisis on the cohorts (Supplemental Table 3, Figure 4 A-D).

There was no significant main effect of time on depressive symptoms (F(2,836) = 0.43, *p* = .65, ηp2 = 0.001) in the whole sample. As expected, there were sex (F(1,417) = 11.84, *p* < .001, ηp2 = 0.028) and large cohort effects (F(1, 1417) = 213.05, *p* < .001, ηp2 = 0.338), depressive symptoms being higher in females and in the clinical cohort. Significant time x cohort interaction was also found (F(2,836) = 7.41, *p* < .001, ηp2 = 0.017), indicating that the trajectories of depressive symptoms significantly differed between the population and the clinical samples (Figure 4A). Analyses of these trajectories in the two cohorts separately revealed a significant main effect of time only in the population cohort (F(2,606) = 16.98, *p* < .001, ηp2 = 0.053). Depressive symptoms increased by 33.9% [95% CI, 31.78-36.57] during the lockdowns, their severity increasing to mild depression compared to minimal depression prior to the pandemic. In the clinical cohort, depressive symptoms remained high and constant across time (F(2,220) = 0.10, *p* = .91, ηp2 = 0.001).

A significant main effect of time in harmful alcohol drinking was found (F (2,838) = 14.06, *p* < .001, ηp2 = 0.032), symptoms decreasing during the pandemic to reach lowest levels (i.e., 15.2% decrease) during the second lockdown (pre-PD > LD1 > LD2, *p* < .05). Males drank more than females (F (1,418) = 41.90, *p* < .001, ηp2 = 0.091). There were no significant cohort or time x cohort interactions (Figure 4B). Nonetheless, a time x diagnosis interaction in the clinical cohort (F(6,220) = 4.25, *p* < .001, ηp2 = .104) revealed that the significant the decline in harmful drinking in the clinical cohort was driven by participants with AUD (i.e., 23.04% decrease).

For ED symptoms, as the EDE-Q was only administered at 2 time points in the clinical cohort, we analysed these 2 cohorts separately. In the population cohort, there was a significant main effect of time on ED behaviours and attitudes, as assessed by the EDE-Q global score (F(2,550) = 4.31, *p* = .01, ηp2 = 0.015). ED symptoms increased by 15.6% [95% CI, 15.39-15.68] during the 1st lockdown, returning to pre-pandemic levels during the second lockdown (Figure 4C). As expected, ED symptoms were significantly higher in females than males (F(1, 274) = 33.26, *p* = < .001, ηp2 = 0.108) but there were no significant time x sex interactions (F (2, 550) = 1.14, *p* = 0.32, ηp2 = 0.004). In contrast to the population cohort, ED symptoms did not significantly differ between the 2 lockdowns in the clinical cohort (F(1,110) = 0.09, *p* = .77, ηp2 = 0.001). Limiting analyses to the ED subgroups also revealed no significant time effects (F(1,30) = 2.35, *p* = .14, ηp2 = 0.073) and F(1,18) = 0.03, *p* = .87, ηp2 = 0.002), for AN and BN, respectively.

Analyses of BMI trajectories, revealed a significant main effect of time in the whole sample (F(2, 638) = 6.85, p < .001, ηp2 = 0.032), BMI being higher during the pandemic (pre-PD < LD1 and LD2, *p* < .01) (Figure 4D). Significant time x sex interaction (F(2,638) = 3.81, *p* < .05, ηp2 = 0.012) indicated that BMI significantly increased in females, not in males. No time x cohort interaction was found, but analyses of the two cohorts separately indicated that these findings were driven by the population cohort (F(2,428) = 9.61, *p* < .01, ηp2 = 0.043). While no main effect of time was found in the clinical cohort, analyses within each diagnostic group revealed time x sex interaction (F(2,50) = 5.48, *p* < .01, ηp2 = 0.180) in the AUD group, in which significant BMI increases were observed only in females (pre-PD < LD2, *p* < .05).

Re-running the analyses described above controlling for other potential confounders, generated in largely similar results (Supplemental Table 3).

---------------------------------------------------figure 4---------------------------------------------------

**Effects of pre-pandemic symptom severity on mental health trajectories during the pandemic**

The following analyses were performed to identify participants from the population cohort most vulnerable to COVID-induced mental illness. We categorised participants from this cohort based on their pre-pandemic symptom severity for depression, alcohol abuse, EDs and their BMI, and re-ran analyses with these categories as predictors (Figure 5 A-E; Supplemental Table 4).

 *Effects of pre-pandemic depression symptom severity on depressive symptom trajectories:* There were significant interactions between time and pre-pandemic symptoms severity on pandemic-related depressive symptoms (F(4,602) = 21.35, *p* < .001, ηp2 = 0.124). Post-hoc analyses revealed notable group differences in trajectories (Figure 5A, Supplemental Table 4). Participants with minimal pre-pandemic depression symptoms reported significant changes over time (F(2,300) = 41.73, *p* = < .001, ηp2 = 0.218), symptoms increasing during the first lockdown and remaining higher afterwards (pre-PD < LD1 or LD2, *p* < .001). In contrast, participants with moderate to severe depression reported the opposite trend (F(2,300) = 17.54, *p* = < .001, ηp2 = 0.105), symptoms being lower during the first and second lockdowns (pre-PD > LD1 or LD2, *p* < .001). Participants with mild depression did not report significant symptom changes with time (F(2,300) = 1.59, *p* = 0.21, ηp2 = 0.010).

*Effects of pre-pandemic risk for alcohol abuse on trajectories of alcohol abuse:* There were significant group differences on trajectories of harmful drinking during the pandemic (F(2,606) = 16.26; *p* = < .001, ηp2 = 0.051; Figure 5B, Supplemental Table 4). Participants initially more at risk of harmful drinking (i.e., prior to the pandemic), reported significant decrease in alcohol abuse at all time points during the pandemic (pre-PD > LD1 > LD2, all, *p* < .001). A decrease was also observed for participants at low risk, which became significant during the second lockdown (pre-PD > LD2, *p* < .001; LD1 > LD2, *p* < .05).

*Effects of pre-pandemic risk for ED on ED symptoms and BMI trajectories*: Similarly, significant group differences on trajectories of ED symptoms during the pandemic were observed (F(2, 548) = 18.07; *p* = < .001, ηp2 = 0.062; Figure 5C, Supplemental Table 4). Participants initially at low risk for ED, reported a increase in ED symptoms specifically during the first lockdown, symptoms decreasing during the second lockdown (pre-PD < LD1, *p* = < .001; LD1 > LD2, *p* < .01). Conversely, for participants initially scoring higher on ED symptoms (i.e., with probable ED), symptoms significantly decreased during the first lockdown ( *p* < .001), remaining lower during the second lockdown. Unsurprisingly, there were significant group differences in BMI (F(1,195) = 16.03; *p* < .001, ηp2 = 0.076), participants with probable ED having a BMI in the overweight range, and those at low risk in the normal range (Figure 5D). No significant group differences on BMI trajectories during the pandemic were observed (F(2,392) = 0.43; *p* = .65, ηp2 = 0.002), however, a nominally significant increase in BMI was observed in the participants at low risk for ED (pre-PD < LD2, *p* <.05), not in those with higher ED risk (Figure 5D).

*Effects of pre-pandemic BMI on BMI and ED symptoms trajectories*: Although no significant group differences on BMI trajectories were observed when comparing participants initially underweight/normal weight (BMI<25) and overweight/obese (BMI>25) (F(2,426) = 2.09; *p* = .13, ηp2 = 0.010), significant increases in BMI were observed in the underweight/normal weight group (pre-PD < LD1, *p* = .005; pre-PD < LD2, *p* < .001), not in the overweight/obese group, for which BMI remained constant during the pandemic (Figure 5E, Supplemental Table 4). Consistent with the analyses above, the increase in BMI in the underweight/normal weight group was paralleled by a significant increase in ED symptoms, specifically during the first lockdown (BMI<25; F(2,270) = 5.74, *p* = .004, ηp2 = 0.041; pre-PD < LD1, *p* = .003; LD1 > LD2, p = .045).

When re-running analyses controlling for other potential confounders, minor differences emerged in post-hoc tests, likely due to increased degrees of freedom and reduced sample size after adding numerous covariates. However, the overall pattern remained - participants with high pre-pandemic symptoms showed improvement during lockdowns, while those with minimal pre-pandemic depression symptoms reported significant increase over time.

--------------------------------------------------figure 5-----------------------------------------------------

**Discussion**

This comparative study following a population and clinical cohorts during the pandemic revealed the differing impact of the pandemic in youths with and without pre-existing mental illness. While symptoms of depression and ED increased during the pandemic in youths from the population, these symptoms remained high and stable in the clinical cohort. Pre-pandemic symptoms severity predicted mental health trajectories in the population cohort. Participants initially at higher risk for depression, alcohol abuse or ED reported a lasting decrease in their symptoms over the course of the pandemic. In contrast, being relatively healthy (i.e., lowest scores for depression or ED) was a significant risk for deterioration in mental health during the pandemic; this was associated with relative increases in depressive symptoms throughout the pandemic and in ED symptoms during the first lockdown, respectively. Being non-overweight or -obese predicted the observed rise in ED symptoms and was associated with weight gain (i.e., BMI increase).

Our findings corroborate previous research showing an increase in depression symptoms in all age groups (5, 15, 16, 33) from the population during the pandemic, but particularly in young and more physically active subjects (15). This observation may reflect greater changes in lifestyle habits in this group, or its reduced tolerance to uncertainty. They also highlight the contrasting effects of the pandemic on other mental health outcomes in youths, long-term negative impact on depressive symptoms lasting until the second lockdown, which contrasted to the transient increase in ED symptoms and continuous decrease in alcohol abuse.

Our findings also shed light on the contradictory debate concerning pre-existing mental illnesses (7-12, 34). Contrary to previous reports of worsening symptoms during the pandemic in patients with a history of mental illness (7) or pre-existing disordered eating (8), our findings indicated that while symptoms remained higher in the clinical sample, they did not worsen because of the pandemic. These discrepancies may be due to the lack of diagnostic measurement of mental illness and the lack of repeated assessments to measure symptom changes during the pandemic in these studies. Rather, our observed differences in mental health trajectories between youths from the general population and those with a clinical diagnosis suggested that pre-pandemic symptoms may be a protective factor, and that the general population was more likely to be affected by the lockdowns than patients, which our analyses confirmed. These showed that the clinical cohort seem to be resilient in the face of the pandemic, confirming previous reports for depression from the early stages of the pandemic (10, 11, 35), further indicating that this persists as the pandemic progressed. In contrast, and in agreement with previous assessments of depression in adults (9) and adolescents (12), youths without depressive, or ED symptoms showed an increase in these symptoms during the pandemic, whereas those with the highest pre-pandemic risk experienced a decrease. However, it should be noted that symptoms in the higher risk groups remained still much higher than those of individuals without prior symptoms, and that patients are more that vulnerable to some stressful situations due to the pandemic (34).

In contrast to depression and EDs, we observed a decline in alcohol and substance abuse during the pandemic, which supports existing evidence (22, 36). This decline during lockdown periods was similar in youths with and without mental health diagnoses. Among the general population, this decline was attributed to both youths at high risk and low risk for alcohol abuse, which may reflect closures of shops, bars, and pubs during lockdown.

Youths from the general population and patients differed in the intensity of their behavioural or emotional responses to the pandemic, but not by their trajectories. That youth are not equally at risk of the psychosocial stress brought about by COVID-19 was to be expected, however, counter-intuitively our findings indicate that healthier individuals tend to be the most vulnerable to the negative effects of the pandemic on mental health, not those with a higher burden. Possible explanations for this are that heightened fears and worries during periods of confinements, as highlighted in this study, and increased social isolation may have contributed to deterioration of mental health in healthier individuals. In contrast, those with depression and eating disorders might have felt relief with reduced exposure to psychosocial stressors (e.g., social interactions). Also, they may have felt less isolated given the global increase in fears and worries. As for alcohol and substance use, as noted above, their general reduction may reflect restriction policies such as closures of shops, bars, and pubs, which would have limited youth's access to those substances, as evidenced by a return to pre-pandemic levels after confinement measures were lifted. Also, the more time youths spend at home with their families, the less likely they were to gain access to these substances.

**Strengths and limitations**

Strengths of our study include the use of longitudinal data collected over up to 3 years prior to the pandemic and further assessments covering the two lockdowns, which allowed for a more comprehensive understanding of the impact of the pandemic. A clear strength is also the combination of data from youth from the population as well as patients with pre-existing mental illness, both groups assessed under the same study protocol. This enabled the investigation of vulnerability and resilience and improved our understanding of how distinct groups of people may respond to challenging circumstances. Some limitations should however be acknowledged. First, our study had a relatively low response rate and high attrition during the data collection phase. It did not include under-represented groups, such as participants from ethnic minorities that may have been disproportionately affected by the pandemic. Additionally, our clinical sample was relatively small, with the majority being females. All of this may limit the generalisability of our findings. In addition, although our study used validated instruments (PHQ-9, AUDIT and EDEQ) to measure psychiatric symptoms, they are not diagnostic tools but only measure a greater risk of the presence of clinical illness. Finally, psychiatric assessments were only conducted during periods of confinements, which precluded investigation of mental health changes once restrictions were lifted.

In summary, our study revealed the opposite impact of the pandemic on mental health in youths with and without mental illness. The improvements in depression, alcohol abuse or ED symptoms over the course of the pandemic observed youths carrying a higher pre-pandemic risk for these disorders suggest that the pandemic and lockdown measures have decreased the mental health burden specifically in this population group. In contrast, the increase in depressive and ED symptoms in youths with low prior risk suggest the detrimental effects of such measures on healthier youths. If confirmed by future studies in a more representative sample, our findings could support personalized mental health interventions to help young people better cope with the challenges of psychosocial stress and reduce the associated health care burden.

**Declaration of interests**

Tobias Banaschewski served in an advisory or consultancy role for eye level, Infectopharm, Lundbeck, Medice, Neurim Pharmaceuticals, Oberberg GmbH, Roche, and Takeda. He received conference support or speaker’s fee by Janssen, Medice and Takeda, and royalities from Hogrefe, Kohlhammer, CIP Medien, Oxford University Press; the present work is unrelated to these relationships. Dr. Barker received honoraria from General Electric Healthcare for teaching on scanner programming courses. Dr. Poustka served in an advisory or consultancy role for Roche and Viforpharm and received speaker’s fee by Shire. She received royalties from Hogrefe, Kohlhammer and Schattauer. The present work is unrelated to the above grants and relationships. The other authors report no biomedical financial interests or potential conflicts of interest.

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**Author contributions**

S.D. conceived and designed the study. L.R., M.B., C. G., J. W., R. A., K. A., Y. Z., S. K., E. A., T. B., A.L.W.B., J. B., R. B., H. F., J.H.F., H. G., A. G., A. H., S. H., M-L. P.M., S. M., F. N., B.M.N., L.P., J.S., M.N.S, R.W., A. S., H. W., J-L. M., G.S., U.S. and S. D. collected the data. D.P.O. managed the data. L.Q. analysed the data and drafted the initial output. L.Q., Z.Z., and S.D. contributed to the interpretation of findings. S.D. will serve as a guarantor for the contents of the paper. All authors have read and approved the final version of the manuscript.

**Data availability**

The data that support the findings of this study are available from the corresponding author (S.D.), upon reasonable request.

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**Figure Legends**

Figure 1: Recruitment flowchart for study participants. Analysis 1 examined behavioural, emotional, and COVID-related worries trajectories during the pandemic. Analysis 2 investigated mental health trajectories during the pandemic. Analysis 3 explored the impact of pre-pandemic symptom severity on mental health trajectories during the pandemic. For each analysis, participants were excluded if they had missing data for any required variables. Abbreviations: ADHD, attention deficit hyperactivity disorder; RecAN, recovered from anorexia nervosa; RecBN, recovered from bulimia nervosa.

Figure 2: Behavioural trajectories during the pandemic, including (A) Positive life changes; (B) Frequency of exercising; (C) Frequency of media use; (D) Daily food consumption; (E) Frequency of substance use, in the whole sample and stratified by cohort. Data are expressed as mean and standard error. Time effects from mixed effect ANOVA in the whole sample were estimated by comparing data collected before the 1st lockdown to other time-points (\* p < .05, \*\* p < .01, \*\*\* p < .001), and by comparing data collected during the 1st lockdown to data collected afterwards (+ p < .05, ++ p < .01, +++ p < .001).

Figure 3: Emotional trajectories during the pandemic, including (A) Emotions and worries; (B) Worries about oneself being infected; (C) Worries about friends or family being infected; (D) Worries about own physical health; (E) Worries about own mental health, in the whole sample and stratified by cohort. Data are expressed as mean and standard error. Time effects from mixed effect ANOVA in the whole sample were estimated by comparing data collected before the 1st lockdown to other time-points (\* p < .05, \*\* p < .01, \*\*\* p < .001), and by comparing data collected during the 1st lockdown to data collected afterwards (+ p < .05, ++ p < .01, +++ p < .001).

Figure 4: Mental health trajectories during the pandemic. Trajectories of (A) Depressive symptoms; (B) Harmful Alcohol drinking; (C) Eating disorder symptoms (D) and Body mass index are indicated for the whole sample and for each cohort separately. Data are expressed as mean and standard error. Time effects from mixed effect ANOVA in the whole sample were estimated by comparing data collected before the pandemic to other time-points (\* p < .05, \*\* p < .01, \*\*\* p < .001), and by comparing data collected during the 1st lockdown to data collected afterwards (+ p < .05, ++ p < .01, +++ p < .001).

Figure 5: Effects of pre-pandemic symptoms severity on pandemic-induced mental health trajectories. (A) Effects of pre-pandemic severity for depression (minimal, mild, and moderate to severe) on trajectories of depressive symptoms; (B) Effects of pre-pandemic risk for alcohol abuse (low or high risk) on trajectories of harmful alcohol drinking; (C) Effects of pre-pandemic risk for eating disorders (low risk or probable ED) on trajectories of eating disorder symptoms, (D) Effects of pre-pandemic risk for eating disorders on BMI trajectories, and (E) Effects of pre-pandemic BMI (low or normal and overweight or obese) on BMI trajectories. Data are expressed as mean and standard error. Mixed effect ANOVA revealed significant time x group (i.e., pre-pandemic risks levels) interactions in all comparisons. Time effects in each group were estimated by comparing data collected before the pandemic to other time-points (\* p < .05, \*\* p < .01, \*\*\* p < .001), and by comparing data collected during the 1st lockdown to data collected afterwards (+ p < .05, ++ p < .01, +++ p < .001).