Different mental health responses to the COVID-19 pandemic: latent class trajectory analysis using longitudinal UK data

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Background

The UK population's mental health declined at the pandemic onset. Convenience sample surveys indicate recovery began soon after. Using a probability sample, we tracked average mental health during the pandemic, characterised distinct mental health trajectories and identified predictors of deterioration.

Methods

Secondary analysis of five waves of UK Household Longitudinal Survey from late April-early October 2020 and pre-pandemic data, 2018-2019. Mental health was assessed in 19,763 adults (≥16 years) using 12-item General Health Questionnaire. Latent class growth models identified discrete mental health trajectories and fixed-effects regression identified predictors of change in mental health.

Findings

Average population mental health deteriorated with onset of the pandemic and did not begin improving until July 2020. Latent class analysis identified six distinct mental health trajectories up to October 2020. Three-quarters had consistently good (46·2%) or very good (30·9%) mental health. Two 'recovery' groups (15·8%) initially experienced marked declines in mental health, improving to their pre-pandemic levels by October. For 4·8%, mental health steadily deteriorated and for 2·3% it was very poor throughout. These two groups were more likely to have pre-existing mental or physical ill-health, live in deprived neighbourhoods and be non-white. Infection with COVID-19, local lockdown and financial difficulties all predicted subsequent mental health deterioration.

Interpretation

Between April-October 2020, the mental health of most UK adults remained resilient or returned to pre-pandemic levels. One-in-fourteen experienced deteriorating or consistently poor mental health. People living in areas affected by lockdown, struggling financially, with pre-existing conditions or COVID infection might benefit most from early intervention.

Evidence before this study

We searched Embase, Psychinfo and Medline for articles published in English between Jan 1 2020 and Jan 31, 2021 that contained terms relating to mental illness (`psychiatr*' or 'mental' or `distress' or `depression' or `anxiety'), COVID, and longitudinal analysis ('trajector*' or `longitudinal' or `latent curve'). Of 496 studies retrieved only 13 conducted a trend analysis. Studies with a pre-pandemic baseline showed that population mental health deteriorated with the onset of the pandemic in the UK, US, China and other European countries. Most studies were drawn from convenience samples where participants are recruited according to ease of access. UK studies conducted on trends since the beginning of the pandemic indicated a pattern of immediate recovery in the population overall and in all subgroups (gender, age, employment status and other deprivation measures). However, studies that rely on follow-up from convenience samples might be biased towards a positive trend in mental health because study attrition is more likely among those with poor or deteriorating mental health.

Added value of this study

This study used a longitudinal, probability sample survey to map the overall mental health trajectory in the first five months of the pandemic and to distinguish the different mental health trajectories individuals tended to follow. Overall, we found the elevated rates of poor mental health were sustained, with significant improvements occurring only after June 2020 (when UK schools reopened, infection rates fell and significant relaxation of lockdown measures occurred). This study revealed that, while most of the population either remained resilient, or reacted and recovered within the first six months of the pandemic, there are two groups of continuing concern. In one, individuals' mental health deteriorated rapidly at the onset of the pandemic and showed no sign of recovery; the other group comprised people whose mental health progressively worsened month on month during the pandemic. COVID-19 infection, prior poor physical and/or mental health and financial difficulties predicted subsequent deterioration in mental health during the pandemic.

Implications of all the available evidence

While the mental health of the population as a whole improved after the initial reaction to the pandemic, this recovery took some months and the overall trend masks sustained and dynamic distinct patterns of change. Two groups showed no signs of recovery and manifested symptom severity potentially warranting clinical intervention. Socioeconomic pressure - both area-level deprivation and individual financial struggles - emerged as a risk for deteriorating mental health

during the pandemic, highlighting the need for policies aimed at socio-economic inequalities in the recovery response. COVID infection also strongly predicted subsequent decline in mental health. These findings provide valuable information for policymakers and planners about rising demand for mental health services.

Introduction

Around the world, the onset of the COVID-19 pandemic has resulted in a marked decline in population mental health. In eight countries, relatively high rates of anxiety disorder, depression, post-traumatic stress disorder, psychological distress and stress have been reported[1]. Using a random sample with pre-pandemic data, we previously reported that, in April 2020, one month after lockdown measures were introduced in the UK, the prevalence of clinically significant levels of mental distress was 50% higher than before the pandemic[2].

As the pandemic develops, interest turns to how mental health changes with circumstances and whether or not early indicators herald persistently poor mental health and, therefore, clinical need. Studies assessing mental health trends since the beginning of the pandemic have reported symptoms of anxiety disorder, depression and loneliness steadily improving over the summer months of 2020[3–5]. However, these studies suffer from methodological problems. First, they use convenience samples which means they cannot adjust properly for sampling bias and are, thus, considered poor tools for estimating population statistics[6]. Second, many have considerable attrition over time; and those with poor mental health are more susceptible to drop-out[7], resulting in an overoptimistic assessment of mental health trends. Also, most studies lack comparable pre-pandemic data[8] so it remains unknown whether mental health returned to pre-pandemic levels. Furthermore, the average trajectory for the population as a whole may mask heterogeneous responses to the pandemic: it may be that some groups have remained or become increasingly vulnerable.

Critical questions for public mental health are whether new disparities have emerged in population mental health and whose mental health has deteriorated during the pandemic. Understanding these is key to anticipating additional demand on services, identifying where the unmet clinical need might lie and delivering preventive interventions for those at most risk. We and others reported common risk factors for mental health deterioration in the initial phase of the pandemic, including being a woman, younger age (≤40 years), presence of a chronic physical or mental illness, unemployment and frequent exposure to social media or news coverage of COVID-19[1]. Most of these were also associated with poor mental health before COVID-19. Compared with before, in the early phases of the crisis, young people, women and parents living with preschool children saw greater than average decreases in levels of mental health (measured by GHQ-12)[2]. Whether these groups and characteristics are associated with sustained distress as the pandemic has continued remains unclear. In addition, while some of the determinants of worsening mental health may have receded after the early 'shock' of pandemic onset and initial easing of national

lockdown, some effects may have persisted. For example, infection with COVID-19[9], localised containment measures and financial insecurity[10].

We used a large, longitudinal panel sample, representative of the adult UK general population to:

a) Describe population trends in mental health in the first six months of the pandemic, overall and by age and gender.
b) Identify distinct trajectories in mental health over this period.
c) Describe the characteristics of individuals within each distinct mental health trajectory, and
d) Identify adversities that predict worsening mental health during the pandemic: COVID-19 infection, financial difficulties and local containment measures.

Methods

Study design and participants

Understanding Society: the UK Household Longitudinal Study is a large, national, probability-based survey that has been collecting data continuously since January 2009[11]. The sample is representative of the UK population, consisting of clustered, stratified samples of households in England, Scotland and Wales and an unclustered, systematic random sample in Northern Ireland. Areas with proportionately large migrant and ethnic minority populations were oversampled. The questionnaires were available in English and Welsh.

Prior to March 2020, around half of data collection was carried out face-to-face and collected annually. With the pandemic's onset, the survey transitioned online[12], with monthly, and then bi-monthly from July 2020. Panel members who took part in Waves 8 and/or 9 (between 2016 and 2019) were invited to complete a series of web-based data collections carried out in the last week of each month: 24th to 30th April, 27th May to 2nd June, 25th June to 1st July, 24th to 31st July, and 24th September to 1st October 2020.

All household members aged 16 or older were invited to participate, except for those unable to make an informed decision as a result of incapacity and those with unknown postal addresses or addresses abroad. Those aged 16 years in April 2020 were not eligible to complete the UKHLS at previous waves, but participated in the COVID-19 survey if they were from eligible households (i.e. those with at least one participant in the two most recent waves of the main survey).

Invitations were sent to 42,330 panel members. 17,761 participated in April (a 42·0% response rate), 14,811 (35·0%) in May, 14,123 (33·4%) in June, and 13,754 (32·5%) in July. For the September 2020

survey, only panel members who had completed at least one COVID web survey were invited (66·4% of the issued sample; 30·4% of the total eligible panel). Responses were linked to pre-pandemic data from Understanding Society's main survey Wave 10 (majority surveyed between January 2018 and December 2019). Analyses used longitudinal non-response weights as calculated by the data custodians[13] and provided with the September wave. Unweighted and weighted statistics for each wave are provided in the supplementary Table S1 and patterns of non-response to the COVID-19 web-surveys are provided in supplementary Table S2.

Procedures and outcomes

A composite score was calculated from summing items in the 12-item General Health Questionnaire (GHQ-12), which is validated as an unidimensional measure of mental distress in the past 2 weeks in non-clinical populations[14]. It was administered by self-completion in Wave 10 and in each of the five COVID-19 web-survey waves. The items refer to difficulties with sleep, concentration, problems in decision-making, strain, feeling overwhelmed and other indicators of distress. GHQ-12 items were scored as: 0, not at all; 1, no more than usual; 2, rather more than usual; or 3, much more than usual; a total score was derived for each wave (0–36).

Sociodemographic variables included gender (women, men), age (16–24, 25–34, 35–44, 45–54, 55–69, 70 years and older) and ethnicity (White British, White non-British, Mixed, Asian, Black, Other). Household structure captured indicators of whether or not the participant lived with a partner (yes, no) and the age of the youngest child living there (none; 0-5; 6-15 years). Area-level context was captured with geography (Wales, Scotland, Northern Ireland, and English region) and quintiles based on ranked Index of Multiple Deprivation (IMD) scores - an area-level deprivation measure that was only available for England. Thus, analyses by IMD quintile were conducted in the sample of residents in England only.

Presence of a pre-existing mental condition was identified using prior UKHLS waves using the question: "has a doctor or other health professional diagnosed you with a psychiatric illness?". Indicator variables were also constructed to identify individuals who had been asked by the NHS to shield during the pandemic because they had an underlying physical illness or health condition and those who identified as keyworkers, who were obliged to continue working in certain sectors during lockdowns. COVID-related adversities were captured with three indicators. The first was COVID-19 infection status, categorised into: no suspected symptoms, suspected but unconfirmed case, and confirmed case. Second, a binary variable was created to indicate whether participants had experienced particular problems with paying bills during the pandemic. This was only available from 3 of the 5 COVID related waves. Last, whether the participant was in an area with

local lockdown measures was determined (for England only) using local authority code. This was mapped to dates where they had been mandated to be under partial or full re-imposition of measures to control the spread of the coronavirus, or the deferring of planned easing of restrictions, in response to a localised spike in infections[15]. A list of local authorities that had local lockdown restrictions, their implementation dates and a description of lockdown measures in the UK are provided in supplementary Table S3.

Statistical analyses

Population-level changes in mean GHQ-12 and the proportion with significant levels of mental distress across the pandemic were examined graphically and compared with averages from wave 10 (2018 to 2019). Latent class growth models were constructed to identify typical distinct trajectories of mental health over the course of the pandemic. Models with two to seven latent classes were fitted using the Stata package traj[16]. This procedure estimated discrete mixture models with GHQ-12 as the outcome, time as a covariate and class-specific fixed-effects. The time variable was median date of data collection for each wave and parameterised as time (in years) since the first COVID-19 wave. Each model included a linear and squared term for time to account for non-linear trajectories. Model fit was determined using the Bayesian Information Criterion (BIC) and the model with the lowest BIC value was considered the best fit to the data. 7.3% had missing GHQ-12 data for all their COVID-19 waves and these were excluded. Sociodemographic variables were cross-tabulated with group membership. Each covariate had less than 5% of missing data and these were excluded from cross-tabulations.

Univariable fixed-effect models were fitted to individual's repeated GHQ-12 scores to ascertained which COVID-19 adversity variables predicted subject-specific change in mean GHQ-12. The variables were: confirmed or suspected COVID-19 infection, local lockdown measures and reported problems paying bills. These models adjusted for date of data collection (as a continuous variable and its square) and all person-specific, time-invariant effects. All analyses accounted for sampling probability weights. Cross-tabulations and calculations of means also accounted for the clustered and stratified sampling using the svy suite of commands in Stata. Analyses were carried out using Stata (Version 14) and graphs were produced using R package ggplot2.

In a sensitivity analysis, the GHQ-12 total for each participant was recalculated removing the question "Have you recently been able to enjoy your normal day-to-day activities?" which were considered to potentially be indicative of pandemic-related restrictions rather than mental health. Population trends and fixed-effects models were then refitted on this adapted version of the GHQ.

Role of the funding source

This study was unfunded. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Results

19,763 participants contributed data to at least one of the COVID-19 web surveys (58% female). Half (53%) of these completed all COVID-19 web survey's and 19% completed only one (most commonly -14% - just the first). A detailed description of respondents to each web-survey and the pre-pandemic survey are available in supplementary Table S1 and patterns of web-survey non-response are provided in supplementary Table S2.

Population trends

Over the first five waves of the COVID-19 web survey, mean GHQ-12 score for the total population peaked at 12·9 at the end of June, before improving, although not to pre-pandemic levels (Figure 1). The temporal trend varied by sex and age group (Figure 2), with the initial peak most pronounced at ages 16-24-years. Those aged 45 and older had relatively little variation in GHQ-12 score over time up to October 2020. A similar pattern was evident for temporal trends in prevalence of clinically significant levels of mental distress (see Figure S1 in the Supplementary Materials).

By examining temporal trends for individual GHQ-12 items it emerged that there was greater temporal variation for some items than others (Figure S2 in supplementary table). Enjoyment in day-to-day activities showed the strongest pandemic effect, at least initially. Other items indicative of a sustained pandemic effect were loss of sleep, feeling under strain, and feeling unhappy and depressed. Sensitivity analysis revealed that these trends persisted when the question "Have you recently been able to enjoy your day-to-day activities" was removed from the GHQ-12 total (Figure S3 in supplementary material).

Latent class trajectories

After fitting latent class growth models with two to seven latent classes, the six-class model was associated with the lowest BIC and therefore considered the best fit (Supplementary Table S4). From this model, six distinct mental health trajectories emerged (Figure 3). Most individuals in the population had either consistently good (46·2%, n=9,103) or consistently very good (30.6%, n=621)

mental health across the pandemic, with little divergence from their pre-pandemic scores. Two 'recovering' groups (recovery 13·0% n=2,283 and marked recovery 2·8% n=496) worsened during the initial 'shock' of the pandemic and then returned to around pre-pandemic levels of mental health by October. The two remaining groups were characterised by poor mental health over the course of the pandemic: for one group, (2·3%, n=375) there was an initial worsening in mental health which was sustained with highly elevated scores. The other group (4·8%, n=885) experienced no initial acute deterioration in their mental health, but rather reported a steady sustained decline in mental health over time.

Characteristics of people following the six trajectories are shown in Table 1. People with consistently very good mental health were more likely than the rest of the population to be male, older, partnered, without prior health conditions and to live in the most affluent neighbourhoods. In contrast, those in the deteriorating mental health group were more likely to be women, without a partner and keyworkers. Those in the consistently very poor group were more likely than the general population to be mixed ethnicity, women, shielding, living in deprived neighbourhoods, without a partner and having prior mental illness. People in the two 'recovering' categories, characterised by initial reaction followed by recovery, were more likely to be women, young adults, or have children living in the household.

Fixed-effect regression

Results from the fixed-effects regression (Table 2) showed that having confirmed or suspected COVID infection was associated with a subsequent increase in GHQ-12 score, which was more pronounced among confirmed cases (2·08, 1·06 to 3·10) than for suspected cases (0·24, 0·01 to 0·46). Living in an area under local lockdown measures (0·24, 0·01 to 0·46) and having problems paying bills (0·59, 0·12 to 1·06) were also linked to subsequent worsening in mental health. In sensitivity analysis, these inferences were consistent when an adapted version of the GHQ-12 was used (Supplementary table S5).

Discussion

Key findings

This study followed mental health in a random probability sample of the UK across a 6-month period of the pandemic. Overall, we report that, in the UK, mental health only started to recover by July 2020 (later than previously reported); and that it continued to improve through to October

2020, although not to pre-pandemic levels. This overall view masks the very different experiences encountered by people as the pandemic progressed, which we identified using latent class analysis. Six distinct trajectories emerged: three quarters had either consistently very good or good mental health throughout the pandemic (77%); a significant minority (around 7%) reported a very different experience, with very poor or steadily worsening mental health and, by October 2020, this group was experiencing far more mental health symptoms than they had before the pandemic. These trajectories were not equally distributed in the population; living in a deprived neighbourhood, shielding for health reasons, and self-reporting a prior mental illness diagnosis were all significantly more common in individuals whose mental health worsened between April and October 2020. Whilst men, older age-groups and those living in affluent areas were most likely to have maintained good mental health throughout.

For women, the picture was complex; they were more likely than men to have deteriorating or very poor mental health trajectories. However, compared to our last report where women stood out as being worse affected than men at the start of the pandemic[2], in this update, they were over-represented in the 'recovered' groups. Of note, this is also the case for parents of young children and for young people: many parents and young people who suffered precipitous decline in their mental health at the beginning of the pandemic[2] appear to have improved by October 2020. Several factors may play a role in their improving mental health over this period. For example, easing of national containment measures, school re-openings, summer holidays, and falling infection and death rates. The change in keyworkers' mental health is also notable. In our first report, at the start of the pandemic, they did not show a decline in mental health; but many are reporting worsening mental health at subsequent time points.

Results from fixed-effects regression reveal pandemic-specific effects. We corroborate findings from registry studies that confirmed diagnosis of COVID-19 is associated with a subsequent steep decline in mental health[9]. Longer-term follow-up of COVID patients is required to assess who is most affected and whether this translates into long-term clinical need for mental health services. Also, for the first time, we reveal that local lockdown measures were negatively affecting mental health.

Comparison with literature

The overall positive message in the UK about the general population's mental health during the pandemic appears to mirror findings from earlier convenience surveys: these reported a rapid decline to the lowest level of mental health at the beginning of the pandemic, followed by a 'bounce

back' [3]. Our results are also consistent with most reports from the US[17] and across Europe[3,5] of an overall improvement in mental health in populations since the initial deterioration at the beginning of the pandemic. However, whereas these report improvements almost immediately after the start of the pandemic, we found that recovery in population mental health did not occur in the UK until July 2020, coinciding with the lifting of national lockdown measures. This divergence in findings could be because there was considerable attrition in other convenience surveys and those with poor or deteriorating mental health are more likely to drop out, resulting in assessment of trends biased towards better mental health[7]. In the Understanding Society sample, 7% of respondents completed only one survey while 51% completed all five COVID-19 waves (see Supplementary table S2). In addition, sophisticated weights were deployed to account for longitudinal non-response.

Unlike previous reports, our findings also provide important new signals of deteriorating mental health in particular groups as the pandemic developed through to the Autumn of 2020. Other studies defined groups by social or economic characteristics and described the mental health trajectory of these. In contrast, we identified the different mental health trajectories and then described the social and economic characteristics associated with each distinct trajectory. This approach led to a focus on those with deteriorating or consistently poor mental health, and allowed us not only to identify individuals of greatest clinical relevance but also to isolate predictors of deterioration. This may be especially relevant given Chandola et al's[10] recent report of deteriorating mental health in those experiencing financial stressors using the same COVID-19 Understanding Society dataset up to July 2020. However, these investigators did not find an effect of having problems paying bills, which might result from the lower statistical power of shorter follow-up and a dichotomised outcome measure. Our latent class model revealed six distinct trajectories of mental health across the Spring to early Autumn 2020 pandemic months. These trajectories are strikingly similar to those reported across six years of data collection in the UK, albeit using a different measure (SF12)[18]. We might conclude from this comparison that the pandemic has resulted in an acceleration of the rate of change of mental health among UK adults. The fact that those in the lowest income areas were more likely to experience declines suggests that existing mental health inequalities are being accentuated.

Strengths and limitations

This analysis has several important strengths. First, the sample was identified using random probability sampling. This is greatly preferable to surveys that use convenience sampling, which lack a theoretical basis for correcting sampling bias or for statistical inference[6]. Second, as well as including multiple post-pandemic time-points, unlike many other mental health surveys

following the pandemic, this sample includes pre-pandemic data. This allows us to consider whether individuals' mental health had recovered to where it was prior to the pandemic. Lastly, the large sample size and rich set of covariates provides sufficient statistical power to identify latent class trajectories and characteristics that were associated with them.

This study has some limitations. We lacked longitudinal data on some adversities that might have given a more complete picture of the determinants of mental health during the pandemic, such as exposure to violence and abuse, or health behaviours, like diet and exercise. This information would help inform interventions aimed at preserving or improving mental health during the pandemic. Also, whilst the GHQ-12 is a validated measure of mental health[19], it does not reveal clinical need directly. A prior mental illness diagnosis was ascertained from self-report and the estimated prevalence (6.5%) is far lower than expected, indicating substantial underreporting. These data might normally be ascertained from routinely collected clinical contacts; however, there has been a fall in visits to primary care for mental illness[20], even while people's mental health was apparently worsening. Finally, our study only includes data up to the beginning of October 2020, before the second and third waves of COVID-19 restrictions in the UK. National survey data reported that post-pandemic anxiety was at its lowest in July 2020 and has increased again up to January 2021[21].

Conclusions and Implications

Compared to previous rapid convenience surveys that suggested the UK's mental health adjusted quickly to the social changes surrounding the pandemic, our results imply that a more prolonged deterioration in mental health occurred with relatively little psychological adjustment or habituation, until lockdown measures were revoked. We also find an effect of localised lockdowns on people's levels of mental distress. We might anticipate similar effects to have occurred during subsequent national lockdowns in November 2020 and January 2021.

Our findings have important implications for mental health policymakers and service planners. Many individuals with deteriorating mental health may be existing service users whose symptoms have been worsening over time. These individuals' mental health may continue to deteriorate with the 'double dip' recession anticipated for the UK post-Brexit and post-pandemic[22]. Therefore, socioeconomic policies should be central to pandemic recovery programmes to take account of the mental health effects seen in deprived communities and the further likely effects of school closures, financial hardship, job insecurity and local restrictions.

Mental health services may also expect to see increased demand from approximately 10% of individuals recovering from COVID-19[23] who develop features of so-called 'long Covid' including psychiatric illness[9]. Preventive interventions might usefully be targeted at the vulnerable groups of people that we have identified, including keyworkers who were more likely to report deteriorating mental health. In advance of further lockdowns, public mental health should be a priority and areas of deprivation should be targeted.

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Table 1: Proportion of membership in each latent class group according to key demographics

		Latent class group						
Characteristic	All	Consistently very good (n=6,621, 30·9%)	Consistently good (n=9,103, 46·2%)	Recovery (n=2,283, 13·0%)	Marked recovery (n = 496, 2·8%)	Deteriorating (n= 885, 4·8%)	Consistently very poor (n= 375, 2·3%)	p-value
All		100	100	100	100	100	100	
Gender								<0·001
Women	50·9	42·0	50·8	63·8	68·4	58·5	60·1	
Men	49·1	58·0	49·2	36·2	31·6	41·5	39·9	
Age-group								<0·001
16-24	13·1	6·5	16·3	13·7	19·9	16·8	16·4	
25-34	16·1	10·7	17·6	21·1	21·9	17·5	22·9	
35-44	15·3	12·5	16·0	18·3	20·4	16·2	15·8	
45-54	17·6	18·4	16·9	17·4	15·4	19·6	22·0	
55-69	23·0	29·0	20·9	19·2	15·6	21·1	19·7	
70+	14·8	23·0	12·3	10·3	6·8	8·8	3·1	
Ethnicity								<0·001
White British	86·0	88.5	85.6	84.4	88.1	85.5	69.5	
White non-British	3·6	3.1	4.4	2.4	5.3	2.5	2.1	
Mixed	2·1	1.4	1.9	2.5	1.3	2.4	14.9	
Asian	5·6	3.7	6.0	7.7	5.1	8.5	6.4	
Black	2·1	2.8	1.9	1.5	0.2	0.8	6.9	
Other	0·5	0.5	0.3	1.5	0.0	0.4	0.3	
Age of youngest child in household								<0·001
None	72·5	77·2	70·9	69·4	59·3	72·0	74·4	
<6 years	8·6	6·6	9·5	10·4	12·1	7·0	7·2	
6-15 years	19·0	16·3	19·7	20·1	28·6	21·1	18·4	
Lives with partner								<0·001
Yes	48·1	60·4	46·4	36·8	32·8	38·0	18·9	
No	51·9	39·6	53·6	63·2	67·2	62·0	81·1	
Keyworker								0·026
Yes	29·6	29·4	29·7	29·4	29·8	36·3	19·6	
No	70·4	70·6	70·3	70·6	70·2	63·7	80·4	
NHS shielding letter received								<0·001
Yes	7·2	6·3	6·2	9·6	5·7	10·3	21·3	
No	92·8	93·8	93·8	90·4	94·4	89·7	78·8	
Index of Multiple Deprivation quintile								<0·001
Most deprived	18·4	14·3	18·1	21·8	21·6	25·4	40·7	
2nd	19·5	18·3	19·7	20·3	23·9	22·5	18·0	
3rd	19·6	19·8	20·0	20·4	16·5	15·3	15·7	
4th	22·3	24·9	21·5	21·5	18·8	19·2	16·5	
Least deprived	20·3	22·7	20·8	16·0	19·2	17·7	9·1	
Prior mental illness								<0·001
Yes	6·6	2·3	6·2	12·2	14·3	12·6	16·1	
No	93·4	97·7	93·8	87·8	85·7	87·4	83·9	

p-values for test of association between variable and trajectory.

Wave-specific frequencies for each covariate are provided in supplementary Table S1

Table 2 Fixed effect model: effect of dynamic time-dependent variables on within-subject change in GHQ-12

Variable	Mean change in GHQ-12	95% Confidence Interval
Local lockdown	0·24	0·01, 0·46
COVID-19 infection status		
No suspected symptoms	REF	
Suspected COVID-19 symptoms	0·23	0·04, 0·41
Confirmed COVID-19	2·08	1·06, 3·10
Problems paying bills	0·59	0·12, 1.06

Wave-specific frequencies for each covariate are in supplementary Table S1

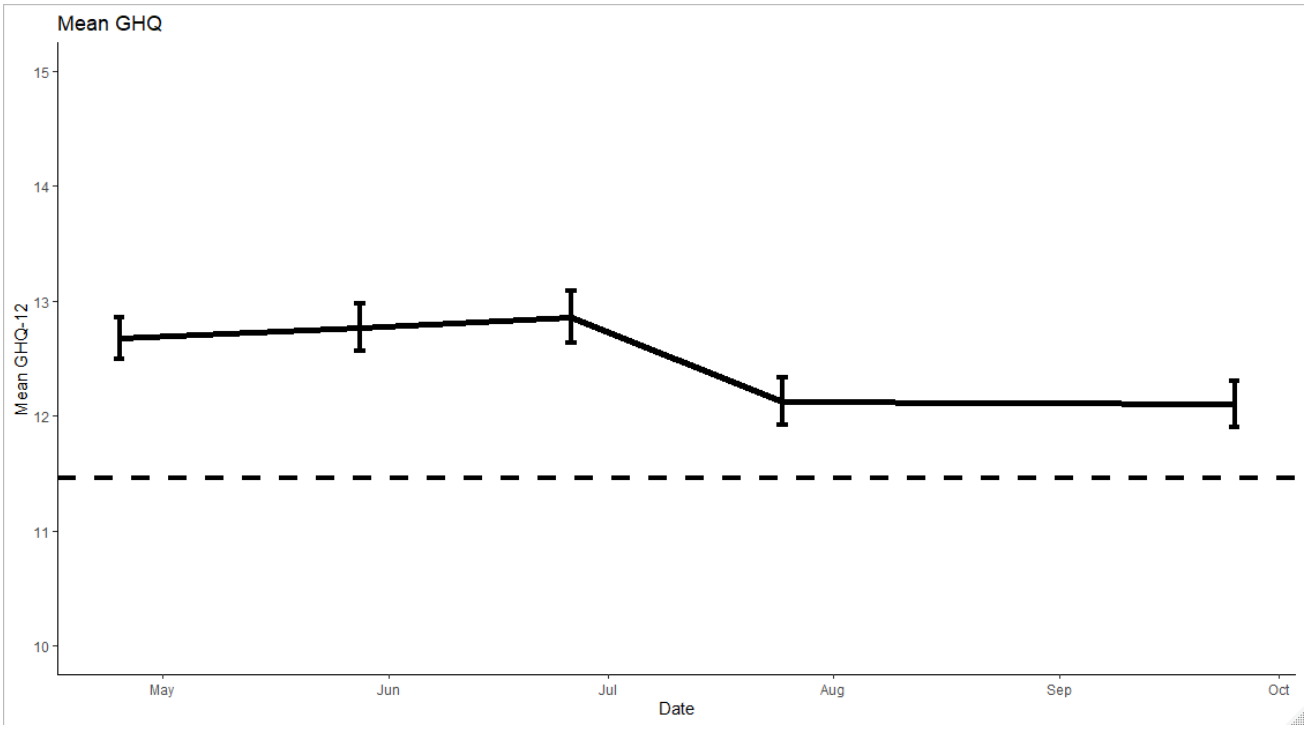

Figure 1: Overall mean GHQ-12 score by month of data collection. The dashed line represents the pre-pandemic average (from 2018-2019).

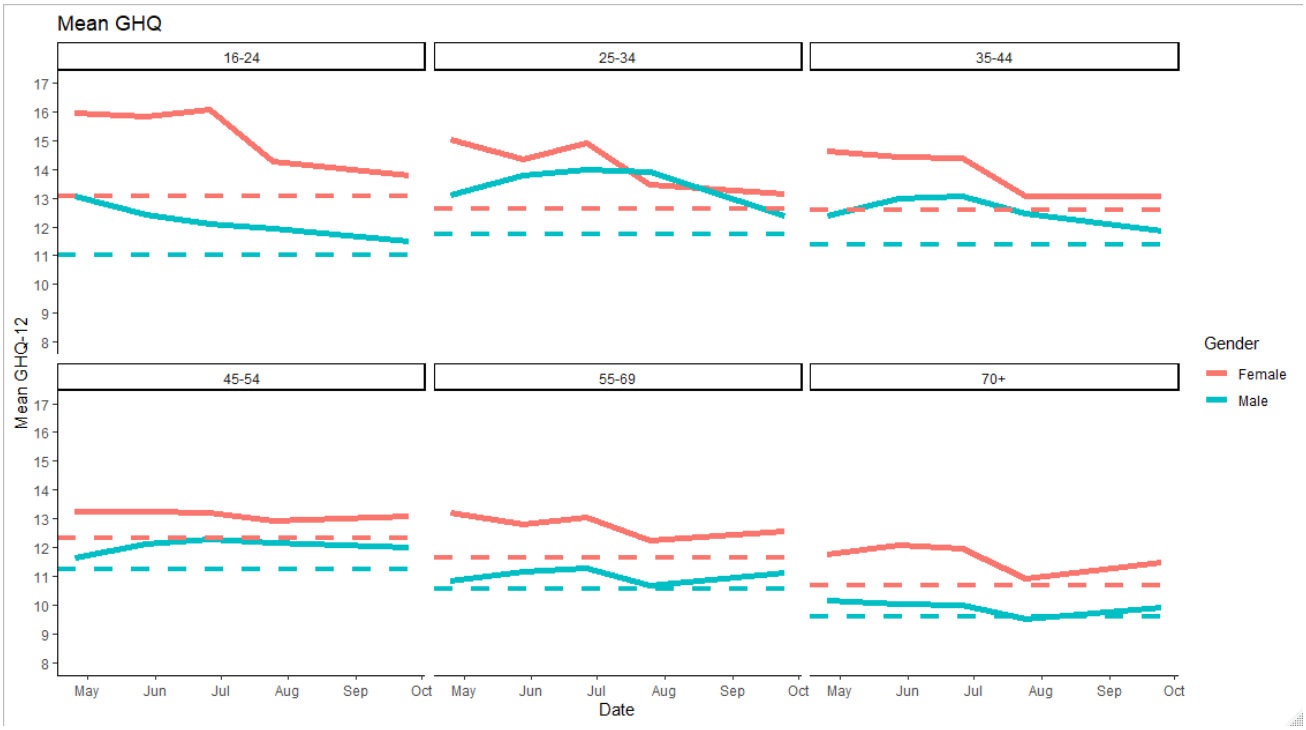

Figure 2: Mean GHQ-12 score by month of data collection, by age group and gender. The dashed lines represent the pre-pandemic average (from 2018-2019).

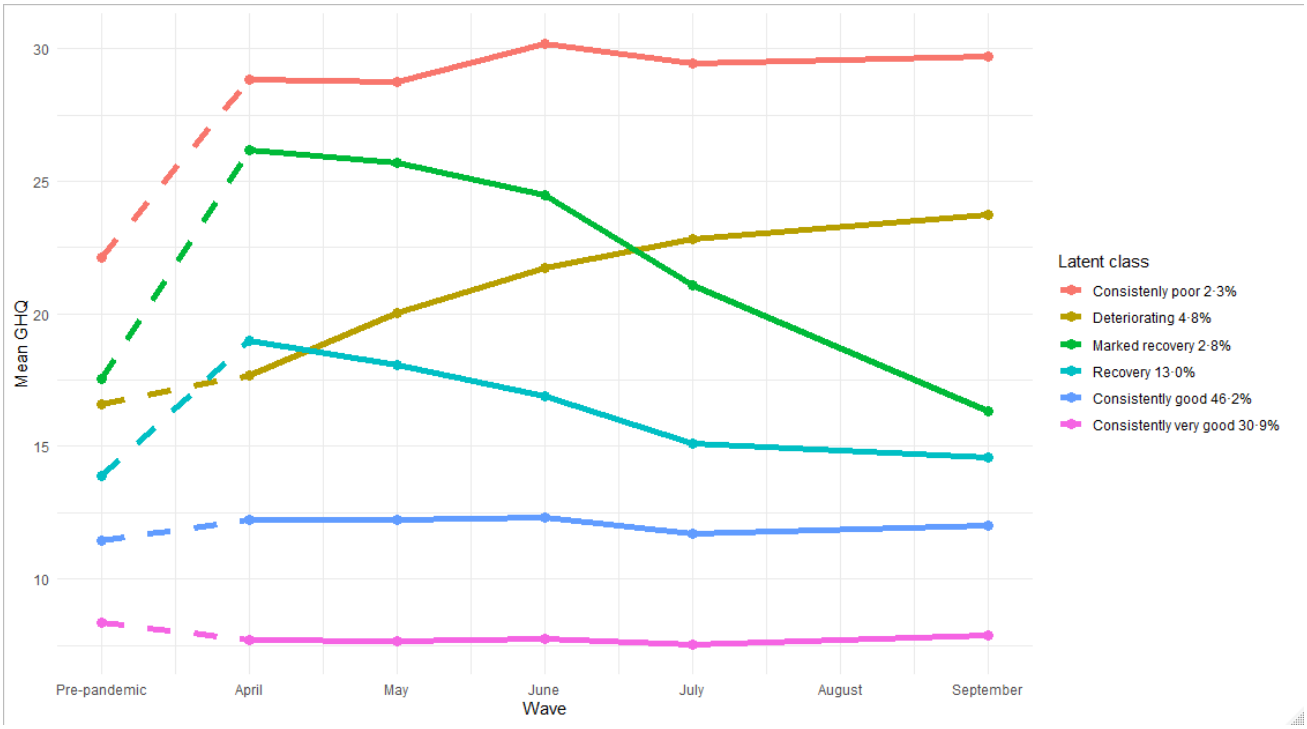

Figure 3: Observed mean GHQ-12 score from 6 class-specific trajectories across five waves of data collection during the pandemic. The dashed line indicates the change from their pre-pandemic score.