



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Mental health and wellbeing during the COVID-19 pandemic

longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study

Citation for published version:

O'Connor, RC, Wetherall, K, Cleare, S, McClelland, H, Melson, AJ, Niedzwiedz, CL, O'Carroll, RE, O'Connor, DB, Platt, S, Scowcroft, E, Watson, B, Zortea, T, Ferguson, E & Robb, KA 2020, 'Mental health and wellbeing during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study', *The British Journal of Psychiatry*, pp. 1-17. <https://doi.org/10.1192/bjp.2020.212>

Digital Object Identifier (DOI):

[10.1192/bjp.2020.212](https://doi.org/10.1192/bjp.2020.212)

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Published In:

The British Journal of Psychiatry

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.



Mental health and wellbeing during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study

Rory C O'Connor, Karen Wetherall, Seonaid Cleare, Heather McClelland, Ambrose J Melson, Claire L Niedzwiedz, Ronan E O'Carroll, Daryl B O'Connor, Steve Platt, Elizabeth Scowcroft, Billy Watson, Tiago Zortea, Eamonn Ferguson, & Kathryn A Robb

Mental health and wellbeing during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study

Abstract

Background: The effects of COVID-19 on the population's mental health and wellbeing are likely to be profound and long-lasting.

Aims: To investigate the trajectory of mental health and wellbeing during the first six weeks of lockdown in adults in the UK.

Method: A quota survey design and a sampling frame that permitted recruitment of a national sample was employed. Findings for waves 1 (31st March to 9th April 2020), 2 (10th April to 27th April 2020) and 3 (28th April to 11th May 2020) are reported here. A range of mental health factors was assessed: pre-existing mental health problems, suicide attempts and self-harm, suicidal ideation, depression, anxiety, defeat, entrapment, mental well-being, and loneliness.

Results: A total of 3077 adults in the UK completed the survey at wave 1. Suicidal ideation increased over time. Symptoms of anxiety, levels of defeat and entrapment decreased across waves whereas levels of depressive symptoms did not change significantly. Positive wellbeing also increased. Levels of loneliness did not change significantly over waves. Sub-group analyses showed that females, young people (18-29 years), those from more socially disadvantaged backgrounds, and those with pre-existing mental health problems have worse mental health outcomes during the pandemic across most factors.

Conclusions: The mental health and wellbeing of the UK adult population appears to have been affected in the initial phase of the COVID-19 pandemic. The increasing rates of suicidal thoughts across waves, especially among young adults, are concerning.

Funding: University of Glasgow, Samaritans, Scottish Association for Mental Health and the Mindstep Foundation

Mental health and wellbeing during the COVID-19 pandemic: longitudinal analyses of adults in the UK COVID-19 Mental Health & Wellbeing study

Background

The effects of COVID-19 on mental health and wellbeing are likely to be profound and long-lasting (1) and will extend beyond those who have been directly affected by the virus. However, it is unclear who will be affected and to what extent such effects will generalise across all aspects of mental health. Evidence from previous public health epidemics (e.g., SARS) illustrated that the adverse effects are more common in some groups and that the detrimental effects are more pronounced among certain aspects of mental health than others (2-6). Increased risk of suicide was evident following SARS in older adults (3). Cross-sectional (7-9) and longitudinal evidence (over 4 weeks)(10) from China during the early stages of the outbreak of COVID-19 found high levels of mental health problems and distress in the general population. A study from Spain reported that distress during lockdown was associated with younger age and being female (11). Data from the UCL COVID-19 Social Study, which started post-pandemic, suggests self-harm and thoughts of suicide/self-harm were higher among women, Black, Asian and minority ethnic (BAME) groups, people experiencing socioeconomic disadvantage and those with mental disorders (12). Repeated cross-sectional and longitudinal analysis of individual responses to the UK Household Longitudinal Study (UKHLS) panel, including pre-pandemic data, have also demonstrated that mental health deteriorated in the early stages of the pandemic (13). All of these studies point to elevated rates of anxiety, depression, stress, suicide risk, and post-traumatic stress in the initial stages of the pandemic.

On the 23rd March 2020, a nationwide lockdown was announced by the UK government with the public instructed to stay at home, socially distance, and self-isolate with strict guidance about movement outside of one's household. Public health measures are important to protect physical health, but it is essential that we gain a clearer understanding of the mental health and wellbeing of the UK population during the COVID-19 pandemic (14). Such understanding is vital to ensure that those affected receive the support that they require and to enable us to be better prepared for a potential second wave of the pandemic and for future outbreaks. Lockdown and the social and economic consequences of COVID-19 are likely to be associated with loneliness, social isolation and entrapment (1). To track their effects longitudinally, we assessed a wide range of mental health and wellbeing outcomes including: symptoms of depression and anxiety; wellbeing; defeat; entrapment; suicidal thoughts and behaviours; and loneliness.

Aims

The current study investigates the mental health and wellbeing of adults in the UK in the early weeks of the COVID-19 pandemic. Using a quota survey design and a sampling frame that permitted recruitment of a national sample, we report the mental health and wellbeing of adults in the UK at three time-points across six weeks following the COVID-19 lockdown in the UK. We also investigated whether outcomes varied by sociodemographic characteristics and those with pre-existing mental health problems, given their established vulnerability (1, 15, 16).

Methods

Study design, setting and participant recruitment

Participant recruitment was conducted by Taylor McKenzie, a social research company. We recruited a non-probability sample of adults (aged 18 years or older) from across the UK to the UK COVID-19 Mental Health & Wellbeing study (UK COVID-MH), with a longitudinal

study design. We employed a quota sampling methodology, with quotas based on age (18-24:12%, 25-34:17%, 35-44:18%, 45-54:18%, 55-64:15%, 65+:20%), gender (female: 51%, male:49%), socio-economic grouping (SEG; AB:27%, C1:28%, C2:20%, DE:25%) and region of the UK (12 regions). The weighted and unweighted sample characteristics are presented in Table 1. Weights are based on National Readership Survey and ONS data for SEG and UK region, respectively and Census data for age and gender (17, 18). Given the time sensitive nature of the study, a quota methodology was selected over probability sampling because it facilitated the recruitment of a well-stratified UK sample at the early phase of lockdown. Moreover, given the constraints of lockdown, online recruitment was the only feasible design.

Between 31st March and 9th April 2020, members of an existing online UK panel (Panelbase.net) were invited by email to take part in an online survey on health and wellbeing (wave 1). The panel has approximately 300,000 registered adult members. In total, 7,471 panel members were invited to take part, 3077 were included in the final sample (target sample was n=3,000) and 4394 did not take part in the survey. The majority were screened out as a particular quota was full (n=3527) and the remainder dropped out (n=867; see supplementary material). Respondents were asked demographic questions to determine whether they qualified for the study and if they did, they were re-directed to the survey. After providing informed consent online, participants completed a wide range of psychological and social measures including questions about COVID-19. Only findings related to depression, anxiety, suicidal and self-harm history, defeat, entrapment, loneliness, and wellbeing are reported here. Participants were informed that they would have the opportunity to participate in a minimum of six waves of the survey that will track the health and wellbeing of the UK during the current COVID-19 outbreak. All those who took part in wave 1 were invited to take part in the follow-up waves, and missing wave 2 did not exclude participation in wave 3. The follow-up surveys were scheduled to ensure a minimum of 1 week (wave 2) and 3 weeks (wave 3) between each participant completing a wave. Three additional waves were scheduled between end of May and autumn 2020, with longer-term follow-ups also anticipated. This data collection schedule was decided to minimise fatigue effects and to maximise follow-up over time. In addition, we anticipated that after the initial shock of lockdown, changes in participants' wellbeing may be less marked over time thereby not requiring weekly data collection. Findings for waves 1 (31st March to 9th April 2020), 2 (10th April to 27th April 2020) and 3 (28th April to 11th May 2020) are reported here. At wave 2 89% (n=2742) completed the survey while at wave 3 the survey was completed by 85.0% (n=2604; see Figure 1 for flowchart of sample participants across the waves).

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 the University of Glasgow's Medical, Veterinary & Life Sciences Ethics Committee (approval number: 200190146). The study was pre-registered at aspredicted.org (#41910). Participants received £1.50 for the completion of the surveys and were entered into prize draws. A list of mental health support organisations was made available to participants online.

Measures

Suicidal history was assessed via two items adapted from the Adult Psychiatric Morbidity Survey (19), 'Have you ever made an attempt to take your life, e.g. by taking an overdose of tablets or in some other way?' (Yes/no) (suicide attempt history) and 'Have you ever

deliberately harmed yourself in any way but not with the intention of killing yourself?' (Yes/No) (self-harm history). If respondents answered yes to the suicide attempt or the self-harm history questions, they were asked "when was the last time you deliberately harmed yourself?" (past week, past month, past 6 months, more than 6 months, more than 12 months). We report self-harm and suicide attempts in the past week. Suicidal ideation in the last week was assessed by the question 'How often have you thought about taking your life in the last week?' ('one day', 'several days', 'more than half the days', 'nearly everyday', 'never', 'I would rather not answer'). 'One day' to 'nearly everyday' was coded as yes, 'never' as no. Depressive symptoms was assessed via the Patient Health Questionnaire (PHQ-9 (20)). The GAD-7 (21), a 7-item screening tool, was used to assess symptoms of generalized anxiety disorder. Both measures ask how often symptoms are bothering the respondents in the last 2 weeks. Scores of 10 and above on both measures are thought to indicate moderate levels of depression and anxiety and are used as cutoffs here (21, 22). Feelings of defeat (perceived failed struggle and loss of rank) were assessed using four items from Griffiths' short-form scale (23). The Entrapment Scale Short-form (24) was used to explore perceptions of entrapment (feeling trapped by thoughts and feelings or situation). Mental wellbeing was assessed via the 7-item Short Warwick Edinburgh Mental Well-Being Scale (SWEMWBS)(25). Loneliness was assessed using the UCLA 3-item scale (26). The National Readership Survey social grade (17) was used as an indicator of socioeconomic group (SEG): high (A+B+C1) versus low (C2+D+E). To assess pre-existing mental health conditions, participants were first asked if they had any long-standing physical or mental impairment, illness or disability. Participants were then asked to select their mental or physical impairment from a list of options, which included mental health conditions, neuro-divergent disorders and alcohol and drug problems, and these responses were used to create a dichotomous variable for presence or absence of a pre-existing mental health condition (see Supplementary materials).

Statistical Analysis

All analyses were conducted using Stata MP 16. Our analyses were conducted using an imputed dataset of the 3077 participants who completed the survey at wave 1 as there were significant differences in the mental health of those who did and did not complete all waves of the survey. We used multiple imputation (MI) to generate 50 datasets for each outcome variable. MI generalised estimating models (MI-GEE) were then constructed to test the changes in the variables across waves for the whole sample. This approach is suitable for longitudinal data (27). As a sensitivity check, we ran all analyses with and without MI and found a similar pattern for both analyses. The GEE results presented here are those using MI. GEE models use a multilevel approach and produce odds ratios. For the binary outcome variables (suicidal ideation, PHQ-9 and GAD-7 cut-off scores) binomial logit modelling was used, and for the continuous outcome variables (defeat, entrapment, loneliness, and positive wellbeing) linear Gaussian identity modelling was used. Region (South England, English Midlands, North England, Scotland, Wales and Northern Ireland) was controlled for in all analyses. We modelled the temporal covariation using an unstructured correlation matrix, as the pattern of associations was neither fully exchangeable nor had an AR(1) structure. Further GEE models were conducted to test for subgroup differences in the outcome variables; as a function of age (18-29, 30-59, 60+), gender (male, female), ethnicity (categorised into white and minority ethnic group due to small numbers), socio-economic grouping (SEG; higher, lower) and the presence of a pre-existing mental health problem (no, yes). Additionally, interactions between each of these subgroups and changes in each outcome over the waves was also tested, with only significant interactions reported in the results. As before, the binary variables were analysed using binomial logit GEE models and the continuous variables were explored using linear Gaussian identity GEE models. Given the

large number of analyses, a false discovery rate (FDR) was applied to all the between, within and interaction p-values from all analyses. FDR is a method of understanding the rate of type I errors in null hypothesis testing when conducting multiple comparisons. FDR-controlling procedures are designed to control the expected proportion of "discoveries" that are false (29). There were few missing data at wave 1; a small number of participants indicated that they "would rather not say" for the suicidal ideation (n=93; 3% at wave 1, n=91; 3.3% at wave 2, n=71; 2.7% at wave 3), suicide attempts (n=71; 2.3% at wave 1, n=36; 1.3% at wave 2, n=32; 1.2% at wave 3) or self-harm (n=64; 2.1% at wave 1, n=39; 1.4% at wave 2, n=33; 1.3% at wave 3) questions; these were imputed via multiple imputation. As the rates of self-harm and suicide attempts in the past week were found to be low, no inferential statistics were applied to these data.

[Insert Table 1 and Figure 1 about here]

Results

Sample and participant characteristics

A total of 3077 adults completed the survey at wave 1 (see Table 1, Figure 1 and S1 and S2). In the unweighted data at wave 1, 55.1% of the sample were female, 90.5% were white, 27.5% were aged 18-29 years, 53.2% and 19.3% were aged 30-59 and 60+ years, respectively. 59.6% were married/living with partner and 92.0% self-identified as heterosexual. Over half (55.0%) reported occupations that were classified as higher SEG and 59.6% reported owning their own home (including with mortgage). Just over a quarter (27.2%) of the sample reported having a pre-existing mental health problem at wave 1 (see Supplementary materials).

[Insert Table 2]

Mental health outcomes across waves for all adults

Rates of suicidal ideation increased over time (see Table 2), with respondents at wave 2 (9.2%; OR=1.17 [1.01-1.34], p=0.031) and wave 3 (9.8%; OR=1.24 [1.07-1.44], p=0.005) reporting higher levels than at wave 1 (8.2%). The difference between waves 2 and 3 was not statistically significant. The rates of suicide attempt (0.1% at wave 1, 0.7% at wave 3) and self-harm (0.7% at wave 1 and 1.4% at wave 3) in the past week were low. Twenty one percent of the sample was above the cut-off for moderate or severe levels of symptoms of anxiety at wave 1. However, these symptoms decreased across waves, with wave 2 (18.6%; OR=0.89 [0.81-0.97], p<0.012) and wave 3 (16.8%; OR=0.74 [0.76-0.91], p<0.0001) being lower than wave 1 (21%); the differences between wave 2 and wave 3 was not significant. More than a quarter (26.1%) scored above the cut-off for moderate or severe levels of depression; there was no significant change across the waves.

Feelings of defeat decreased from wave 1 (M=4.11) to wave 2 (M=4.02; OR=0.84 [0.75-0.95], p=0.003) and from wave 1 to wave 3 (M=3.92; OR=0.80 [0.71-0.91], p=0.0001; Table 2). There was no difference between waves 2 and 3. Entrapment also decreased over time, from wave 1 (M=3.96) to wave 2 (M=3.78; OR=0.88 [0.72-1.00], p=0.04) and from wave 1 to wave 3 (M=3.60; OR=0.79 [0.69-0.91], p=0.001) but not between waves 2 and 3. Positive wellbeing increased from wave 1 (M=22.27) to wave 2 (M=22.64; OR=1.32 [1.09-1.58], p=0.005) and from wave 1 to wave 3 (M=22.92; OR=1.58 [1.19-1.93], p<0.0001), but not from wave 2 to wave 3. Levels of loneliness did not significantly change over waves (see Supplementary materials).

Mental health outcomes across wave by sociodemographic characteristics and pre-existing mental health condition

Suicidal ideation

Males and females reported similar levels of suicidal ideation (see Table S3). Compared to younger adults (18-29 year olds; wave 1=12.5%¹) those aged 30-59 years (8.4%; OR=0.65 [0.49-0.85], $p=0.002$) and 60+ (1.9%; OR=0.14 [0.08-0.27], $p<0.0001$) reported lower levels of suicidal ideation, and those aged 30-59 were more likely to report suicidal ideation than 60+ year olds (OR=4.51 [2.43-8.39], $p<0.0001$). There were no clear differences when comparing ethnic minorities to the white ethnic group (see Table S4). Those from the lower SEG were more likely to experience suicidal ideation (10.3%; OR=1.63 [1.24-2.10], $p<0.0001$) compared to those in the higher SEG (6.6%; see Table S5). Those with a pre-existing mental health condition were more likely to experience suicidal ideation (19.3%; OR=5.56 [4.23-7.31], $p<0.0001$) compared to those without (4.1%; see Table S6).

Depressive symptoms

Males reported lower levels of depressive symptoms (17.6%) than females (33%; OR=0.44 [0.37-0.52], $p<0.0001$; see Table S3). Those who were aged 30-59 years (26%; OR=0.55 [0.46-0.66], $p<0.0001$) and aged 60+ (8.2%; OR=0.14 [0.10-0.20], $p<0.0001$) reported lower levels of depressive symptoms than younger adults (38.8%; 18-29 years), and those aged 30-59 years reported higher rates of depressive symptoms than those 60+ (OR=3.85 [2.82-5.27], $p<0.0001$). There were no significant differences by ethnicity. The respondents in the lower SEG were more likely to report higher levels of depressive symptoms (30.4%; OR=1.47 [1.25-1.73], $p<0.0001$) than those in the higher SEG group (22.9%; see Table S5).

People with a pre-existing mental health condition were significantly more likely to report higher levels of depressive symptoms (54.2%; OR=6.50 [5.45-7.77], $p<0.0001$) compared to those without (15.3%). The interaction between pre-existing mental health condition and wave was statistically significant (OR=0.87 [0.79-0.96], $p=0.007$), with those who had a pre-existing mental health condition reporting reductions in depressive symptoms over time at both wave 2 (reduction=5.6%; OR=0.80 [0.67-0.96], $p=0.017$) and wave 3 (reduction=7.5%; OR=0.76 [0.63-0.94], $p=0.009$), but not from wave 2 to wave 3 (reduction=1.9%). Those with no pre-existing mental health conditions did not change over time.

Anxiety symptoms

Across the three waves, those aged 30-59 years (21.5%; OR=0.63 [0.52-0.76], $p<0.0001$) and those aged 60+ (6.4%; OR=0.16 [0.11-0.23], $p<0.0001$) were less likely to score above the cut-off for anxiety symptoms compared to those aged 18-29 years (30.1%), and those age 30-59 years were more likely to be above the cut-off for anxiety symptoms than those 60+ (OR=3.95 [2.55-5.34], $p<0.0001$; Table S3). Males were also less likely to meet the cut-off threshold (13%) compared to females (27.5%; OR=0.40 [0.33-0.48], $p<0.0001$). Levels of anxiety did not vary by ethnicity. Those who were of a lower SEG were more likely to score above the cut-off for anxiety symptoms (24.9%; OR=1.49 [1.13-1.78], $p<0.0001$) compared to those in the higher SEG (18%). Participants with a pre-existing mental health condition were more likely to score above the cut off (44.6%; OR=5.97 [4.95-7.19], $p<0.0001$) than those with no mental health condition (11.9%; Table S6).

Defeat

¹ Percentages and means from wave 1 have been used to illustrate differences between subgroups, although data from all waves were used in this analysis and are included in the Supplementary material

Compared to those aged 18-29 years ($M=5.27$), participants aged 30-59 years ($M=4.38$; $OR=0.40$ [0.29-0.55], $p<0.0001$) and those aged 60+ years ($M=2.45$; $OR=0.06$ [0.04-0.09], $p<0.0001$) reported lower levels of defeat, and 30-59 year olds scored higher than those aged 60+ years ($OR=6.77$ [4.72-9.71], $p<0.0001$; Table S7). Males reported significantly lower levels of defeat than females ($OR=0.22$ [1.67-0.29], $p<0.0001$). No differences were found by ethnicity on levels of defeat. Participants from a lower SEG reported higher levels of defeat ($M=4.81$; $OR=2.69$ [2.03-3.56], $p<0.0001$) compared to those of a higher SEG ($M=3.83$; see Table S8). Participants who reported a pre-existing mental health condition reported higher levels of defeat ($M=7.06$; $OR=48.47$ [36.56-64.27], $p<0.0001$) compared to those without a mental health condition ($M=3.17$; see Table S8).

Entrapment

Males reported lower levels of entrapment ($M=3.14$) than females ($M=4.62$; $OR=0.23$ [0.17-0.31], $p<0.0001$). Levels of entrapment differed significantly by age group, with those aged 30-59 years ($M=4.1$; $OR=0.37$ [0.25-0.54], $p<0.0001$) and those aged 60+ ($M=1.93$; $OR=0.05$ [0.03-0.07], $p<0.0001$) reporting lower levels of entrapment than those aged 18-29 years ($M=5.07$), and those aged 30-59 years were higher than those aged 60+ ($OR=8.30$ [5.58-12.34], $p<0.0001$). No significant differences by ethnicity were found. Those from a lower SEG reported significantly higher levels of entrapment ($M=4.47$; $OR=2.48$ [1.82-3.38], $p<0.0001$) than those in the higher SEG group ($M=3.57$). Participants with a pre-existing mental health condition reported higher levels of entrapment ($M=7.0$; $OR=66.78$ [48.99-91.04], $p<0.0001$) than those without ($M=2.79$). The interaction between mental health condition and entrapment over the waves was significant (0.84 [0.72-0.98], $p=0.02$), with those who had a mental health condition experiencing a more pronounced reduction in the average entrapment score from wave 1 to wave 3 (reduction = 0.63; $OR=0.70$ [0.52-0.95], $p=0.02$) compared to those with no mental health condition (reduction=0.2).

Loneliness

Males reported significantly lower levels of loneliness ($M=4.89$) than females ($M=5.52$; $OR=0.54$ [0.47-0.62], $p<0.0001$). There were significant differences between the age groups on levels of loneliness, with those aged 30-59 years ($M=5.28$; $OR=0.54$ [0.46-0.63], $p<0.0001$) and those aged 60+ ($M=4.31$; $OR=0.21$ [0.17-0.26], $p<0.0001$) reporting lower levels of loneliness than those aged 18-29 years ($M=5.87$), and those aged 30-59 years reporting higher loneliness than the 60+ group ($OR=2.54$ [2.13-3.02], $p<0.0001$). Additionally, the interaction between age and loneliness over the waves was significant ($OR=1.06$ [1.01-1.11], $p=0.016$), as levels of loneliness reduced significantly for those aged 18-29 years from wave 1 to wave 2 (reduction=0.17; $OR=0.78$ [0.65-0.92], $p=0.004$) and wave 1 to wave 3 (reduction=0.21; $OR=0.81$ [0.67-0.97], $p=0.004$) compared to those aged 60+, whose self-reported loneliness increased (wave 1 to wave 2 increase=0.11).. Levels of loneliness did not differ by ethnic group. Those from the lower SEG ($M=5.39$; $OR=1.31$ [1.14-1.50], $p<0.0001$) reported significantly higher levels of loneliness compared to those from the higher SEG ($M=5.12$). Participants with a pre-existing mental health condition reported significantly higher levels of loneliness than ($M=6.28$; $OR=4.19$ [3.63-4.85], $p<0.0001$) those without ($M=4.24$; see Table S8). There was evidence of a wave by mental health problem interaction ($OR=0.89$ [0.83-0.96], $p=0.002$), with a significant decrease in loneliness in those who had a pre-existing mental health problem from wave 1 to wave 3 (reduction=0.26; $OR=0.80$ [0.70-0.92], $p=0.002$), but no significant changes for those with no mental health condition.

Positive wellbeing

Levels of wellbeing differed by age groups, with those aged 30-59 years ($M=22.01$; $OR=5.78$ [3.52-9.49], $p<0.0001$) and those aged 60+ ($M=26.01$; $OR=255.59$ [139.39-479.44], $p<0.0001$) reporting higher levels of wellbeing than the 18-29 year olds ($M=20.28$). Males reported significantly higher wellbeing ($M=21.45$) compared to females ($M=23.29$; $OR=6.17$ [3.97-9.7], $p<0.0001$). Levels of wellbeing were not significantly different by ethnic group. Those of a lower SEG reported lower levels of wellbeing ($M=21.75$; $OR=0.41$ [0.26-0.64], $p<0.0001$) compared to those of a higher SEG ($M=22.66$). Participants with a pre-existing mental health condition were more likely to report lower wellbeing scores ($M=18.64$; $OR=0.007$ [0.004-0.01], $p<0.0001$) compared to those with none ($M=23.66$; see Table S8).

Discussion

This study offers a detailed examination of the mental health and wellbeing of the UK adult population during the first six weeks of the COVID-19 pandemic. Across every indicator, individuals from more socially disadvantaged backgrounds and those with pre-existing mental health problems report the worst mental health outcomes. The rates of suicidal ideation increased during the initial weeks of lockdown, with one in seven (14%) young adults reporting suicidal thoughts in the last week at wave 3. It is not possible to make direct comparisons with pre-COVID-19 rates, but the rate of suicidal ideation among young adults reported here (between 12.5% to 14.4% across waves) is higher than the 11% *past year* suicidal ideation rate reported by young adults in another pre-COVID-19 study (30). The weekly suicidal ideation rates for the whole sample (9.8% at wave 3) are also higher than those reported elsewhere, with 2.8% reporting suicidal thoughts in one national study of adults (31).

Across all three waves, approximately one in four respondents (26.1%) experienced moderate to severe levels of depressive symptoms on the PHQ-9. This finding is concerning when compared to other pre-COVID-19 general population studies where, for example, 5.6% scored above the standard 10+ cut-off (32). However, we urge caution when extrapolating from the PHQ-9 data to general population lockdown estimates, as a recent meta-analysis concluded that the PHQ-9 may more than double the estimate of depression compared to a structured clinical interview (SCID)(33). Also, although we have recruited a well stratified national sample from across the UK, quota sampling does not guarantee the same level of representativeness as probability sampling and therefore prevalence estimates need to be interpreted accordingly. However, it is also worth noting that our depressive symptoms findings are quite similar to the latest ONS data for the UK adult population collected in June 2020 (34), where 19.2% of adults reported moderate to severe levels of depression, compared to 23.7% at wave 3 in our study at the end of April/start of May 2020. For anxiety, one in five (21%) respondents in the present sample scored above the cut-off on the GAD-7, corresponding to moderate to severe levels of anxiety at wave 1, with this rate decreasing to 16.8% by wave 3. We do not have pre-COVID-19 figures to make like-for-like comparisons; nonetheless, these rates were much higher than the established general population norms (of approximately 5%)(35). Levels of mental wellbeing among females across all waves were lower than the general population norms for the SWEMWBS, but levels for males were similar (25).

As already noted, the mental health of females, of young people (18-29 years), of those from more socially disadvantaged backgrounds, and of those with pre-existing mental health problems has been particularly affected during the pandemic. These groups need to be prioritised to ensure that they receive the support they require (15) and accessible and remote clinical services tailored, as necessary, to meet this need. The trajectories across the three waves illustrate the importance of assessing different indicators of mental health and

wellbeing. Whereas symptoms of anxiety, levels of defeat and entrapment decreased across the three waves, depressive symptoms and loneliness remained stable but adversely affected. The findings also highlight that loneliness may become more of an issue for older adults as the pandemic unfolds, as well as for those from more socially disadvantaged backgrounds. Across all of the analyses the mental health outcomes for those from ethnic minority and white backgrounds were similar. Despite our sample being well stratified nationally, our sample size precludes a more fine-grained analysis of the mental health outcomes of people from specific ethnic minority communities. Such an analysis, that also takes account of intersectionality, is urgently required (1, 15, 16).

The trajectories of suicidal thoughts highlight that we need to be vigilant. Although an increase in suicide is not inevitable (36), the present data may be an early indicator of emerging risk, especially as the economic fallout of COVID-19 escalates. The proportions of respondents reporting at least one day in the previous week that they wanted to end their life increased across the 3 waves of the study, from 8.2%, to 9.2% and 9.8% at waves 1, 2 and 3, respectively. Given its well established relationship with suicide risk (37), it is surprising that levels of entrapment decreased while suicidal thoughts increased. This may reflect a lagged effect or it may be that the items assessing entrapment or depression focus on the past whereas the suicidal question is tapping uncertainty or concerns about the future. This may also explain why the positive wellbeing measure increased, as it also focuses on the past, and likely increased as levels of anxiety decreased. The focus on future orientation is potentially crucial as future thinking is a recognised cognitive factor associated with suicidal ideation independent of depression (37). Indeed, inspection of the items to assess depressive symptoms illustrates this point as they are tapping the extent to which respondents are 'bothered' by problems in the recent past; so after the initial shock of lockdown, one's appraisal of these problems is relatively stable in the short-term. By contrast, in the early weeks of the pandemic, the anticipated impact of the economic and social disruption to come may have exacerbated one's feelings of hopelessness and suicidal ideation and hence explain the increase in the latter. Survey-based research needs to be supplemented with qualitative interviews to determine whether our conjecture about the cause of increasing levels of suicidal ideation is supported. By way of post-hoc analyses, we also inspected the responses to the suicidal question in the PHQ-9 ("Thoughts that you would be better off dead, or of hurting yourself in some way?") and we find a similar pattern as above, of increasing suicidal thoughts. It is essential, therefore, that suicidal thoughts continue to be tracked as we emerge from lockdown and navigate national/local restrictions. These data are also consistent with the recent report from the National Child Mortality Database which points to a potential increase in child suicide deaths in the early stages of the pandemic (38). The defeat and entrapment levels are also of concern, especially among young adults at wave 1. At wave 1, more than one third (37%) of young people scored above the recommended cut-off (>5) for entrapment which indicates that further screening for suicide ideation is warranted (24).

Limitations

Indicators of mental health were based on self-reports rather than clinical diagnoses, as a result, we can only comment on the trajectory of the symptoms of mental ill-health rather than psychiatric disorder. Despite successfully recruiting a quota-based national sample, similar to all studies that recruit via digital means, our sample is likely to under-estimate the mental health effects of COVID-19 as those who are digitally excluded may be under-represented. Also, those who did not complete all waves tended to have worse mental health at wave 1. Future research is required to understand what aspects of the pandemic and the pandemic response may have contributed to negative mental health outcomes as

well as those factors and activities that may be protective.

To conclude, the mental health and wellbeing of the UK adult population appears to have been affected in the initial phase of the COVID-19 pandemic, particularly females, young adults, the socially disadvantaged, and those with pre-existing mental health problems. The trajectory of increasing rates of suicidal thoughts, especially among young adults, is particularly concerning. These early data highlight that the detailed monitoring of the longer-term mental health outcomes and inequalities is essential.

Author contribution. RCOC, KAR, KW and SC had the idea for the study and RCOC secured funding for the study. All authors contributed to the study design. KW and EF led the statistical analyses alongside SC. RCOC led the drafting of the manuscript but all authors contributed to the drafting and approved the final manuscript for submission.

Declaration of interests. RCOC reports grants from Samaritans, grants from Scottish Association for Mental Health, grants from Mindstep Foundation, during the conduct of the study; grants from NIHR, grants from Medical Research Foundation, grants from Scottish Government, grants from NHS Health Scotland/Public Health Scotland, outside the submitted work; and he is co-chair of the Academic Advisory Group to the Scottish Government's National Suicide Prevention Leadership Group. He is also a member of the National Institute of Health and Care Excellence's guideline development group for the new NICE self-harm guidelines. CLM reports grants from Medical Research Council, during the conduct of the study. SP reports personal fees from Health Service Executive, Dublin, Ireland, personal fees from NHS Health Scotland, Edinburgh, Scotland, outside the submitted work. TZ reports being employed by the Scottish Government Scotland National Suicide Prevention Leadership Group, during the conduct of the study. Outside the submitted work, reports grants from NHS Scotland Endowment Funds; and is a co-chair of the Early Career Group of the International Association for Suicide Prevention. EF reports grants from Pfizer Limited and Versus Arthritis, grants from Versus Arthritis, grants from Football Association, grants from Medical Research Foundation, grants from U. S. Army Medical Research and Materiel Command, outside the submitted work. ES (Samaritans) and BW (Scottish Association for Mental Health) are employees of two of the funders of this research. KW, SC, HMcC, AJM, REOC, DBOC & KAR have nothing to disclose.

Data availability. The data that support the findings of this study are available from the corresponding author, [RCOC], upon reasonable request.

References

1. Holmes EA, O'Connor RC, Perry VH, Tracey I, Wessely S, Arseneault L, et al. Multidisciplinary research priorities for the COVID-19 pandemic: a call for action for mental health science. *Lancet Psychiatry*. 2020.
2. Cheung YT, Chau PH, Yip PSF. A revisit on older adults suicides and Severe Acute Respiratory Syndrome (SARS) epidemic in Hong Kong. *International Journal of Geriatric Psychiatry*. 2008;23(12):1231-8.
3. Yip PSF, Cheung YT, Chau PH, Law YW. The Impact of Epidemic Outbreak The Case of Severe Acute Respiratory Syndrome (SARS) and Suicide Among Older Adults in Hong Kong. *Crisis-the Journal of Crisis Intervention and Suicide Prevention*. 2010;31(2):86-92.

4. Lee SM, Kang WS, Cho A-R, Kim T, Park JK. Psychological impact of the 2015 MERS outbreak on hospital workers and quarantined hemodialysis patients. *Comprehensive psychiatry*. 2018;87:123-7.
5. Rogers JP, Chesney E, Oliver D, Pollak TA, McGuire P, Fusar-Poli P, et al. Psychiatric and neuropsychiatric presentations associated with severe coronavirus infections: a systematic review and meta-analysis with comparison to the COVID-19 pandemic. *The lancet Psychiatry*. 2020.
6. Mak IWC, Chu CM, Pan PC, Yiu MGC, Chan VL. Long-term psychiatric morbidities among SARS survivors. *General Hospital Psychiatry*. 2009;31(4):318-26.
7. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental health problems and social media exposure during COVID-19 outbreak. *PloS one*. 2020;15(4):e0231924-e.
8. Tian F, Li H, Tian S, Yang J, Shao J, Tian C. Psychological symptoms of ordinary Chinese citizens based on SCL-90 during the level I emergency response to COVID-19. *Psychiatry Research*. 2020;288.
9. Wang C, Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C.S., et al. . Immediate Psychological Responses and Associated Factors during the Initial Stage of the 2019 Coronavirus Disease (COVID-19) Epidemic among the General Population in China. *I. International Journal of Environ Res Public Health* . 2020;17(5)(1729.).
10. Wang C, Pan R, Wan X, Tan Y, Xu L, McIntyre RS, et al. A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, behavior, and immunity*. 2020.
11. Losada-Baltar A J-GL, Gallego-Alberto L, Pedroso-Chaparro MDS,, Fernandes-Pires J M-GM. "We're staying at home". Association of self-perceptions of aging, personal and family resources and loneliness with psychological distress during the lockdown period of COVID-19. *J Gerontol B Psychol Sci Soc Sci*. 2020.
12. Lob E, Steptoe, A., & Fancourt, D. Abuse, self-harm and suicidal ideation in the UK during the COVID-19 pandemic. *British Journal of Psychiatry*. 2020.
13. Pierce M, Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., McManus, S., Abel, K. Mental health before and during the COVID-19 pandemic: a longitudinal probability sample survey of the UK population. *Lancet Psychiatry*. 2020.
14. Douglas M, Katikireddi SV, Taulbut M, McKee M, McCartney G. Mitigating the wider health effects of covid-19 pandemic response. *Bmj-British Medical Journal*. 2020;369.
15. O'Connor RC, Hotopf, M., Worthman, C.M., Perry, V.H., Tracey, I., Wessley, S., Arseneault, L., Ballard, C., Christensen, H., Cohen Silver, R., Ford, T., John, A., Kabir, T., King, K., Simpson, A., Madan, I., Cowan, K., Bullmore, E., Holmes, E.A. . Multidisciplinary research priorities for the COVID-19 pandemic: authors' reply. *Lancet Psychiatry* 2020.
16. O'Connor DB, Aggleton, J.P., Chakarabarti, B... Armitage, C.J. . Research Priorities for the COVID-19 pandemic and beyond: A call to action for psychological science. . *British Journal of Psychology*. 2020.
17. NRS. National Readership Survey. Social Grade. 2016 [Available from: <http://www.nrs.co.uk/nrs-print/lifestyle-and-classification-data/social-grade/>].
18. Government U. Ethnicity facts and figures: gov.uk; 2018 [Available from: <https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/demographics/age-groups/latest-main-facts-and-figures>].
19. McManus S, Hassiotis, A., Jenkins, R., Dennis, M., Aznar, C., Appleby, L. Chapter 12: suicidal thoughts, suicide attempts and self-harm. In: McManus S, Bebbington, P., Jenkins, R., Brugha, T. (Eds), editor. *Mental health and wellbeing in England: Adult Psychiatric Morbidity Survey 2014*. Leeds: NHS Digital 2016.

20. Löwe B, Kroenke, K., Herzog, W., Gräfe, K. Measuring depression outcome with a brief self-report instrument: sensitivity to change of the Patient Health Questionnaire (PHQ-9). *Journal of affective disorders*. 2004;81:61-6.
21. Spitzer RL, Kroenke, K., Williams, J.B., & Lowe, B. . A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine*. 2006;166:1092-7.
22. Kroenke K, & Spitzer, R.L. . The PHQ-9: A new depression diagnostic and severity measure. *Psychiatric Annals*. 2002;1:509-15.
23. Griffiths AW, Wood AM, Maltby J, Taylor PJ, Panagioti M, Tai S. The Development of the Short Defeat and Entrapment Scale (SDES). *Psychological assessment*. 2015;27(4):1182-94.
24. De Beurs D, Cleare S, Wetherall K, Eschle-Byrne S, Ferguson E, O'Connor DB, et al. Entrapment and suicide risk: The development of the 4-item Entrapment Scale Short-Form (E-SF). *Psychiatry Research*. 2020;284.
25. Fat LN, Scholes S, Boniface S, Mindell J, Stewart-Brown S. Evaluating and establishing national norms for mental wellbeing using the short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS): findings from the Health Survey for England. *Quality of Life Research*. 2017;26(5):1129-44.
26. Hughes ME, Waite LJ, Hawkey LC, Cacioppo JT. A short scale for measuring loneliness in large surveys - Results from two population-based studies. *Res Aging*. 2004;26(6):655-72.
27. Beunckens C, Sotto, C., & Molenberghs, G. A simulation study comparing weighted estimating equations with multiple imputation based estimating equations for longitudinal binary data. . *Computational Statistics & Data Analysis*. 2008;52:1533-48.
28. Ballinger GA. Using Generalized Estimating Equations for Longitudinal Data Analysis. *Organizational Research Methods*. 2004;7:127-50.
29. Benjamini YH, Y. Controlling the False Discovery Rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society Series B (Methodological)*. 1995;57:289-300.
30. O'Connor RC, Wetherall, K., Cleare, S., Eschle, S., Drummond, J., Ferguson, E., O'Connor, D.B., & O'Carroll, R.E. Suicide attempts and non-suicidal self-harm: national prevalence study of young adults. *British Journal of Psychiatry Open*. 2018;4:142-8.
31. Lee J-I, Lee M-B, Liao S-C, Chang C-M, Sung S-C, Chiang H-C, et al. Prevalence of Suicidal Ideation and Associated Risk Factors in the General Population. *Journal of the Formosan Medical Association*. 2010;109(2):138-47.
32. Kocalevent R-D, Hinz A, Braehler E. Standardization of the depression screener Patient Health Questionnaire (PHQ-9) in the general population. *General Hospital Psychiatry*. 2013;35(5):551-5.
33. Levis B, Benedetti A, Ioannidis JPA, Sun Y, Negeri Z, He C, et al. Patient Health Questionnaire-9 scores do not accurately estimate depression prevalence: individual participant data meta-analysis. *Journal of Clinical Epidemiology*. 2020;122:115-+.
34. ONS. Coronavirus and depression in adults, Great Britain: June 2020. London; 2020.
35. Lowe B, Decker, O., Müller, S., Brähler, E., Schellberg, D., Herzog, W., Yorck Herzberg, P. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Medical Care*. 2008;46:266-74.
36. Gunnell D, Appleby L, Arensman E, Hawton K, John A, Kapur N, et al. Suicide risk and prevention during the COVID-19 pandemic. *Lancet Psychiatry*. 2020.
37. O'Connor RC, & Kirtley, O.J. . The Integrated Motivational-Volitional Model of Suicidal Behaviour. *Philosophical Transactions of the Royal Society B*. 2018;373: 20170268.
38. Odd D, Sleaf, V., Appleby, L., Gunnell, D., Luyt, K. Child suicide rates during the COVID-19 pandemic in England: Real-time surveillance. Bristol: National Child Mortality Database; 2020.

Authors

Rory C O'Connor PhD

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: rory.oconnor@glasgow.ac.uk

Karen Wetherall PhD

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: karen.wetherall@glasgow.ac.uk

Seonaid Cleare PhD

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: seonaid.cleare@glasgow.ac.uk

Heather McClelland MSc

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: heather.mcclelland@glasgow.ac.uk

Ambrose J Melson PhD

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: ambrose.melson@glasgow.ac.uk

Claire L Niedzwiedz PhD

Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: Claire.niedzwiedz@glasgow.ac.uk

Ronan E O'Carroll PhD

Division of Psychology, University of Stirling, Scotland. Email: ronan.ocarroll@stir.ac.uk

Daryl B O'Connor PhD

School of Psychology, University of Leeds, England. Email: d.b.oconnor@leeds.ac.uk

Steve Platt PhD

Emeritus Professor of Health Policy Research, Usher Institute, University of Edinburgh, Scotland. Email address: steve.platt@ed.ac.uk

Elizabeth Scowcroft, PhD

Samaritans, The Upper Mill, Ewell, Surrey, England. Email: e.scowcroft@samaritans.org

Billy Watson

Scottish Association for Mental Health, 51 Wilson Street, Glasgow. Email: samhchiefexecutive@samh.org.uk

Tiago Zortea PhD

Suicidal Behaviour Research Laboratory, Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: Tiago.Zortea@glasgow.ac.uk

Eamonn Ferguson PhD

School of Psychology, Nottingham University, England. Email: eamonn.ferguson@nottingham.ac.uk

Kathryn A Robb PhD

Institute of Health & Wellbeing, University of Glasgow, Scotland. Email: Katie.robbs@glasgow.ac.uk

Table 1. Demographic characteristics of the sample (n= 3077)

Characteristic	Total, N (%)	Total, N (%)
	Not weighted	Weighted
Gender at birth ^a		
Male	1381 (44.9)	1470 (49.1)
Female	1692 (55.1)	1526 (50.9)
Ethnicity		
White	2777 (90.5)	2691 (90.0)
Asian	162 (5.3)	169 (5.7)
Black	68 (2.2)	72 (2.4)
Mixed	52 (1.7)	48 (1.6)
Other	10 (0.3)	10 (0.3)
Relationship status		
Married/living with partner	1834 (59.6)	1790 (59.7)
Single	962 (31.3)	929 (31.0)
Separated/ divorced/widowed	248 (8.1)	247 (8.2)
Other/prefer not to say	33 (1.1)	32 (1.1)
Sexuality		
Heterosexual	2830 (92.0)	2762 (92.1)
Gay or bisexual	220 (7.1)	212 (7.1)
Other/prefer not to say	27 (0.9)	26 (0.9)
Employment status		
Employed	1838 (59.7)	1806 (60.2)
Unemployed	358 (11.6)	342 (11.4)
Other (retired, education, homemaker)	881 (28.6)	852 (28.4)
Socioeconomic grouping ^b		
High	1758 (57.1)	1651 (55.0)
Low	1319 (42.9)	1349 (45.0)
Tenure		
Own (including with mortgage)	1835 (59.6)	1792 (59.7)
Private rent	694 (22.6)	682 (22.7)
Council rent	463 (15.0)	446 (14.9)
Other	85 (2.8)	81 (2.7)
Preexisting mental health condition	836 (27.2)	780 (26.0)

Note: ^a n= 3073; ^b Categories A,B,C1= high socioeconomic group, categories C2, D, E= low socioeconomic group.

Table 2. Changes in primary outcome variables over waves 1 – 3 with odds ratio (OR) and 95% confidence interval (CIs)

	Wave 1 (n=3077)	Wave 2 (n=2742)	Wave 3 (n=2604)	OR [95% CI], p-value
	% [95% CI]	% [95% CI]	% [95% CI]	
Suicidal ideation last week	8.2 [7.2- 9.2]	9.2 [8.1- 10.3]	9.8 [8.7- 10.9]	W1-W2 ^a = 1.17 [1.01-1.34], 0.03 W1-W3 ^a = 1.24 [1.07-1.44], 0.005 W2-W3 ^b = 0.94 [0.81-1.09], 0.42
Suicide attempt last week	0.1 [-0.3 – 0.5]	0.8 [0.4- 1.2]	0.7 [0.3- 1.1]	N/A
Self- harm last week	0.7 [0.4- 1.1]	1.8 [1.3- 2.3]	1.4 [1.0- 1.9]	N/A
PHQ-9 (% ≥ 10)	26.1[24.6-27.7]	24.3[22.7-25.9]	23.7[22.1-25.3]	W1-W2 = 0.94 [0.87-1.02], 0.13 W1-W3 = 0.93 [0.86-1.02], 0.12 W2-W3 = 1.01 [0.93-1.10], 0.84
GAD-7 (% ≥ 10)	21[19.6-22.4]	18.6[17.1-20.1]	16.8[15.4-18.2]	W1-W2 = 0.89 [0.81-0.97], 0.012 W1-W3 = 0.82 [0.74-0.90], <0.0001 W2-W3 = 1.09 [0.78-1.21], 0.125
	M [95% CI]	M [95% CI]	M [95% CI]	

Defeat	4.11 [4.11-4.39]	4.02 [3.87-4.17]	3.92 [3.77-4.07]	W1-W2 = 0.84 [0.75-0.94], 0.003 W1-W3 = 0.80 [0.71-0.91], <0.0001 W2-W3 = 1.15 [0.92-1.19], 0.466
Entrapment	3.96 [3.81-4.11]	3.78 [3.62-3.94]	3.60 [3.44-3.76]	W1-W2 = 0.88 [0.78-1.00], 0.04 W1-W3 = 0.79 [0.69-0.91], 0.001 W2-W3 = 1.11 [0.97-1.28], 0.14
Loneliness	5.24 [5.17-5.31]	5.18 [5.11-5.25]	5.15 [5.08-5.22]	W1-W2 = 0.97 [0.92-1.03], 0.304 W1-W3 = 0.96 [0.90-1.02], 0.18 W2-W3 = 1.01 [0.95-1.08], 0.705
Wellbeing	22.27 [22.05-22.49]	22.64 [22.41-22.87]	22.92 [22.68-23.16]	W1-W2 = 1.30 [1.09-1.58], 0.005 W1-W3 = 1.58 [1.29-1.92], <0.0001 W2-W3 = 0.83 [0.68-1.2], 0.078

^aReference group: Wave 1, ^bReference group: Wave 3

Figure 1. Flow of participants across waves

