



## Research paper

# The prevalence of common mental disorders across 18 ethnic groups in Britain during the COVID-19 pandemic: Evidence for Equality National Survey (EVENS)

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## ABSTRACT

**Background:** The COVID-19 pandemic negatively impacted mental health in the general population in Britain. Ethnic minority people suffered disproportionately, in terms of health and economic outcomes, which may contribute to poorer mental health. We compare the prevalence of depression and anxiety across 18 ethnic groups in Britain during the COVID-19 pandemic.

**Methods:** Secondary analysis of cross-sectional data (February–November 2021) from 12,161 participants aged 18–60 years old ( $N$  with data on outcomes = 11,540 for depression & 11,825 for anxiety), obtained from the Evidence for Equality National Survey (EVENS). Data were weighted to account for selection bias and coverage bias. Weighted regression models examined ethnic differences in depression (Centre for Epidemiologic Studies Depression Scale) and anxiety (Generalised Anxiety Disorder-7). Effect modification analyses explored whether ethnic differences in outcomes were consistent within age and sex sub-groups.

**Results:** Compared to White British people, greater odds of anxiety caseness (and greater anxiety symptoms) were observed for Arab ( $OR = 2.57$ ; 95 %  $CI = 1.35–4.91$ ), Mixed White and Black Caribbean ( $1.57$ ;  $1.07–2.30$ ), any other Black ( $2.22$ ,  $1.28–3.87$ ) and any other Mixed ( $1.58$ ;  $1.08–2.31$ ) ethnic groups. Lower odds of depression caseness (and lower depressive symptoms) were identified for Chinese ( $0.63$ ;  $0.46–0.85$ ), Black African ( $0.60$ ;  $0.46–0.79$ ), and any other Asian ( $0.55$ ;  $0.42–0.72$ ) ethnic groups.

**Limitations:** Cross-sectional data limits the opportunity to identify changes in ethnic inequalities in mental health over time.

**Conclusions:** We have identified certain ethnic groups who may require more targeted mental health support to ensure equitable recovery post-pandemic. Despite finding lower levels of depression for some ethnic groups, approximately one third of people within each ethnic group met criteria for depression.

## 1. Introduction

### 1.1. Disproportionate impact of COVID-19 for ethnic minority people

The COVID-19 pandemic disproportionately impacted ethnic minority people, in relation to both physical health and economic outcomes (Hu, 2020; Irizar et al., 2023; Pan et al., 2020; Platt and Warwick, 2020; Sze et al., 2020). Rates of infection, severe disease and death due

to COVID-19 were higher among certain ethnic minority groups (Mathur et al., 2021). People from ethnic minority groups, particularly migrants, were more likely to experience income and job loss during the COVID-19 lockdown, and were less likely to receive employment protection, e.g., furlough (Hu, 2020). COVID-19 exposed and amplified existing socioeconomic and health inequalities affecting ethnic minority groups. These experiences may increase the likelihood of poor mental health among ethnic minority people during the pandemic. An exploratory

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qualitative study of adults from ethnic minority groups found varied experiences of mental health during the pandemic, with some people sharing positive experiences and coping strategies (e.g., spending more time with family, community cohesion), whereas others expressed negative experiences, particularly feelings of isolation and increases in racism (Van Bortel et al., 2022). The latter finding has also been confirmed through a small UK quantitative survey, with Black and South Asian people reporting more frequent discrimination, and this had a direct impact on fear of COVID-19, which was in turn associated with increased depression and anxiety (Jaspal and Lopes, 2021).

### 1.2. Mental health during the COVID-19 pandemic

The extent of the impact of the pandemic on mental health in the British general population is unclear, with many studies showing a detrimental effect, particularly at the beginning of the pandemic (Daly et al., 2020; Niedzwiedz et al., 2020; Patel et al., 2022; Pierce et al., 2020; Pierce et al., 2021), but some show a minimal longstanding impact (Daly and Robinson, 2021; Pierce et al., 2021; Sun et al., 2023). Longitudinal data from the UK Household Longitudinal Study (UKHLS) identified that the prevalence of psychological distress (measured using the General Health Questionnaire, GHQ-12, (Goldberg and Williams, 1988)) increased from 19 % (pre-pandemic: 2017–2019) to 27 % during the first lockdown (April 2020) (Pierce et al., 2020). There is some evidence to suggest that population mental health began improving after restrictions eased, following the first wave (July–September 2020) (Daly and Robinson, 2021; Pierce et al., 2021). However, Daly and Robinson (2021) detected a further rise in the prevalence of psychological distress during the second wave of the pandemic (January/February 2021). Further, evidence from 11 British longitudinal studies indicated that mental health deteriorated at the start of the pandemic and this was sustained across the first year of the pandemic (Patel et al., 2022).

### 1.3. Ethnic differences in mental health

Prior to the pandemic, evidence from the Adult Psychiatric Morbidity Survey (APMS) identified similar rates of common mental disorders (CMD), e.g., depression and anxiety, across ethnic groups (McManus et al., 2016), though there was a trend suggesting that CMDs were more common in Black women than White British women (McManus et al., 2009). However, APMS data are limited due to small sample sizes, with insufficient power to determine reliable differences across ethnic groups. The Ethnic Minority Psychiatric Illness Rates in the Community (EMPIRIC) study utilised disaggregated ethnic groups ( $N = 4281$ ), identifying higher levels of CMD among Irish and Pakistani men, aged 35–54 years, and among Indian and Pakistani women, aged 55–74 years, compared to their White British counterparts (Weich et al., 2004). Nevertheless, despite sufficient sample sizes for each ethnic group, the EMPIRIC study is limited as only five ethnic minority groups were included.

Longitudinal studies have explored changes in mental health across ethnic groups during the pandemic (Niedzwiedz et al., 2020; O'Connor et al., 2020; Proto and Quintana-Domeque, 2021; Quintana-Domeque and Proto, 2022). A latent class analysis of UKHLS data identified two classes characterised by sustained high levels of psychological distress and increasing levels of psychological distress across the first year of the pandemic, and people from Mixed and Asian ethnic groups were over-represented in these classes (Pierce et al., 2021). Similarly, another UKHLS analysis found greater increases in the prevalence of psychological distress in Asian groups (rising from 18.7 % to 34.9 % during the first lockdown), compared to White groups (19.2 % to 30.2 %) (Niedzwiedz et al., 2020). One UKHLS analysis aggregated Black, Asian, and other minority ethnic groups, finding that men from these groups experienced a higher average increase in the prevalence of psychological distress (from 2017 to 2019 to April 2020) than White British men (with women experiencing a higher average increase than men, regardless of

ethnicity) (Proto and Quintana-Domeque, 2021). When utilising more granular data for Asian ethnic groups, the authors identified that, among men, Bangladeshi, Indian, and Pakistani individuals were more likely to experience an increase in distress than White British men (Proto and Quintana-Domeque, 2021). A cross-sectional analysis of mothers recruited from ethnically diverse regions also identified greater odds of depression and anxiety symptoms among Bangladeshi mothers (but not Pakistani mothers), compared to White British mothers (McIvor et al., 2022). In contrast, longitudinal data from three waves (31 March – 9 April, 10–27 April, and 28 April – 11 May 2020) of the UK COVID-19 Mental Health & Wellbeing study showed no evidence of ethnic inequalities in changes in mental health (O'Connor et al., 2020), which may be due to ethnic minority groups being aggregated into one category due to small numbers.

Though existing literature provides insights into ethnic differences in mental health, and the impact of the pandemic on these differences, most surveys are limited. Ethnic groups are often aggregated in analyses, and this disguises potentially heterogeneous experiences across ethnic groups (e.g., between Mixed White and Asian and Mixed White and Black Caribbean). Further, the sampling methodology used in previous surveys may contribute to biased findings, as certain ethnic minority groups were not recruited or under-represented (e.g., Gypsy, Traveller, Roma), and participants were typically sampled from ethnically dense regions, and greater own group ethnic density (i.e., residential concentration of own ethnic group) is associated with better mental health (Bécares et al., 2018).

### 1.4. Sex and age differences in mental health

There is strong and consistent evidence that patterns of CMD differ between men and women, with women being more likely to report CMD than men (Piccinelli and Wilkinson, 2000; Salk et al., 2017), and gender differences also vary by ethnic group (McManus et al., 2016; Weich et al., 2004). Moreover, mental health deterioration during the COVID-19 pandemic was greater for women than men (Etheridge and Spantig, 2022; Niedzwiedz et al., 2020; Oreffice and Quintana-Domeque, 2021), relating to differences in caring responsibilities, financial situation, and social engagement (Etheridge and Spantig, 2022). Age differences in mental health are also apparent, with global evidence demonstrating a U-shaped relationship, with poorest mental health in midlife (ages 45–54) (Blanchflower, 2021; Deaton, 2008). However, few studies have explored age differences in mental health across ethnic groups. It is important to take an intersectional approach (Crenshaw, 1989) to understand the ways in which mental health is impacted by experiences associated with systems of structured inequity, particularly racism, patriarchy and capitalism, which converge to affect oppression, opportunities, and access to social and economic resources (Keith and Brown, 2018).

### 1.5. Objectives

This analysis aims to determine the prevalence of CMD (depression and anxiety) across 18 ethnic groups in Britain during the COVID-19 pandemic, using data from the Evidence for Equality National Survey (EVENS), and to identify whether people from ethnic minority groups were more likely to report CMD, compared to White British people. This study explores whether ethnic differences in CMD remain if levels of previous SARS-CoV-2 infection, bereavement due to COVID-19, and existing clinical diagnosis of CMD, are consistent across ethnic groups. Although the cross-sectional nature of EVENS limits the opportunity to identify changes in ethnic inequalities in mental health over time, the rich data can be used to determine ethnic inequalities in the prevalence of CMD during the COVID-19 pandemic, with sufficient power to explore whether ethnic differences in CMD are consistent across sub-groups by age and sex.

## 2. Methods

### 2.1. Study population

The Evidence for Equality National Survey (EVENS) is a cross-sectional survey with the largest number of ethnic minority people in Britain (Finney et al., 2023), using a non-probability survey design to obtain larger samples of ethnic minority groups. EVENS (Finney et al., 2023) employed a responsive survey design, using targeted recruitment strategies, to achieve desired sample sizes for each ethnic group, by age, sex, and region (Shlomo et al., 2023). Responses to EVENS were monitored daily to ensure that the desired sample sizes were being met, or to identify specific groups which were in need of targeted recruitment. For example, few people from Roma and Gypsy Traveller groups were completing the online survey, and so, a community interview approach was implemented. Some ethnic minority groups that are typically under-represented or not included in previous probability-based surveys were oversampled to ensure a minimum target sample, to uniquely allow comparative analyses across disaggregated ethnic groups (Shlomo et al., 2023). Participants were eligible if they were 18 and over, and living in England, Scotland, or Wales. The analytical sample was restricted to those aged between 18 and 60 years old, as 67 % of people aged over 60 were White British (Fig. S1).

### 2.2. Data collection

Data were collected between February and November 2021. Recruitment methods are described in detail in the EVENS book (Finney et al., 2023; Shlomo et al., 2023). To summarise, the survey could be accessed through a dedicated website, which was advertised through several online events to promote the survey, including an online launch event. Partnerships with Voluntary, Community, and Social Enterprise (VCSE) organisations were central to the recruitment strategy and ensured a broad coverage of a full range of ethnic minority groups and sufficient geographical coverage. VCSE partners supported EVENS events, distributed recruitment materials, and worked with their networks to engage participants (Shlomo et al., 2023). Data collection was predominately online, with an open-link registration survey first being used to determine eligibility. If eligible, a unique link was provided to the main online survey. Snowball sampling was also used; those who completed the survey received four links that could be passed on to family and friends. Participants could choose to complete the survey via telephone or face-to-face interview. The latter was facilitated through partnership with VCSE organisations serving ethnic minority populations, who assisted with recruitment. Web panels from Ipsos and Prolific were also used for data collection. To increase sample sizes for under-represented groups, ethnic minority people were selected from Ipsos's 'Custom Panel' and 'Knowledge Panel', as well as Prolific's commercial panel. The survey covered demographics; identity; work; education; finances; racism; health; and social relationships (Finney et al., 2022). Participants received a £10 voucher after completing the survey.

### 2.3. Outcome measures

Symptoms of depression during the past week were self-reported using the eight-item Centre for Epidemiologic Studies Depression Scale (CES-D 8) (Radloff, 1977), with good internal reliability ( $\alpha = 0.83$ ). Yes/no responses were provided (scores range from 0 to 8; items 4 and 6 were reverse coded), with a score of four or more indicating caseness for probable depression, a threshold used in previous literature (McMunn et al., 2009; Turvey et al., 1999; White et al., 2016; Zaninotto et al., 2013). Symptoms of anxiety during the previous two weeks were self-reported using the seven-item Generalised Anxiety Disorder-7 (GAD-7) (Kroenke et al., 2007; Spitzer et al., 2006), with good internal reliability ( $\alpha = 0.92$ ). Responses were given on Likert-type scale,

ranging from 'not at all' (0) to 'nearly every day' (3). Scores range from 0 to 21, with a validated cut-off of 10 or more indicating caseness for moderate to severe anxiety (Kroenke et al., 2007; Spitzer et al., 2006). In addition, participants were asked if they currently have, or have ever had, a clinical diagnosis of depression and/or anxiety.

### 2.4. Explanatory measures

#### 2.4.1. Ethnicity

Participants were asked to self-report their ethnic group from the following responses: Arab; Black African; Black Caribbean; Bangladeshi; Chinese; Gypsy or Irish Traveller; Indian; Jewish; Mixed White and Asian; Mixed White and Black African; Mixed White and Black Caribbean; Pakistani; Roma; White British (English/Welsh/Scottish/Northern Irish); Irish; Eastern European; any other White background; any other Asian background; any other Black background; any other Mixed/Multiple ethnic background; and any other ethnic group not listed. Due to small sample sizes, Gypsy or Irish Traveller and Roma groups were combined as 'Gypsy/Traveller/Roma' and Eastern European and Irish groups were combined with 'any other White background', resulting in 18 ethnic groups.

#### 2.4.2. Age and sex

Participants reported their date of birth, to determine age. To identify age categories with meaningful group differences (to be formally tested through effect modification) and statistical power, frequencies and proportions of CMD caseness, by ethnic group and age group, were determined using three by three cross-tabulations, starting with 5-year age bands, and then broader age bands. For the effect modification analyses, age was categorised as 18–29 years old, 30–44 years old, and 45–60 years old. Sex at birth (male, female) was self-reported. Frequencies and proportions of CMD caseness, by ethnic group and sex (age-standardised to the 2013 WHO European Standard Population), were examined using three by three cross-tabulations, to identify whether there would be statistical power and meaningful differences to be formally investigated through effect modification.

#### 2.4.3. Pandemic factors

Participants were asked if they had ever had a test for COVID-19 and whether they had received a positive result, to determine previous infection. Participants were also asked if they had experienced a bereavement of someone close to them due to COVID-19, since February 2020. A variable was created to correspond with the month that the EVENS survey was completed, ranging from February 2021 (coded as 1) to November 2021 (coded as 10), given that levels of infection and restrictions to mitigate the spread of COVID-19 varied during this time period.

### 2.5. Sampling weights

Statistical adjustment weights were created to compensate for selection bias and coverage biases, due to the non-probability nature of the sample (Shlomo et al., 2023). First, propensity scores were estimated through a statistical model on an integrated dataset, containing both the non-probability sample and a probability reference sample, which drew upon data from the Annual Population Survey 2019 and 2020 (Office for National Statistics, 2021) and the European Social Survey, rounds 8 and 9 (European Social Survey, 2016; 2018). The predicted probabilities of participation were used to calculate pseudo-design weights. This step was then followed by post-stratification, to calibrate the pseudo-design weights to population benchmarks, to further reduce the impact of coverage biases. The calibrated adjustment weights were calculated to scale the obtained sample to match the characteristics of the population, in terms of age, sex, region, and ethnic group (Shlomo et al., 2023). The population benchmarks were obtained from the 2021 Census for England and Wales (Office for National Statistics, 2021) and the ETHPOP

Database for Scotland (extracted for the year 2020) (Wohland et al., 2018).

## 2.6. Missing data

EVENS obtained responses from 14,221 participants. Prior to the dataset being made available via the UK Data Service, data custodians conducted an in-depth analysis of 121 individuals (0.8 %) who abandoned the online questionnaire after completing more than two-thirds (data were imputed for 115 cases and 6 were dropped as they did not complete the minimum number of questions required for imputation) (Shlomo et al., 2023). Where possible, data custodians obtained missing data from the registration survey and from data held by Prolific or Ipsos Mori (these data are not publicly available). A nearest-neighbour random hot deck imputation approach (Kalton, 1986) was used to impute remaining missing data for these 115 cases by forming strata (cross-classifying age-group, sex, ethnic groups, region, education, and employment) and pairing each abandoned case with a ‘nearest neighbour’ complete case (donor) within the strata, calculated using Gower’s distance (Gower, 1971). Missing data for the weighting variables, ethnicity (0.2 %), sex (0.3 %), and age-group (1.8 %), were also imputed using a nearest neighbour algorithm (Shlomo et al., 2023). The data custodians avoided using the same donors to ensure minimal impact on variance estimation. The small number of missing data can be handled using the nearest-neighbour random hot deck imputation approach and this approach minimises the chance of bias arising from mis-specified models for multiple imputation (Andridge and Little, 2010). Approximately 9.8 % of the integer age values were missing and these values were imputed based on age group, employment type, marital status, blood pressure, whether the respondent lives with children, and how many generations are in respondent’s household (this imputation was conducted by the data custodians prior to releasing the data a’ the age group data provided by Ipsos Mori and Prolific are not available in the dataset). The distribution of age with and without the imputed values is very similar. Further detail is available elsewhere (Ipsos and Centre on the Dynamics of Ethnicity, 2023).

The analytical sample was restricted to those aged 18–60 years old, including 12,161 participants. There were no missing data for the pandemic-related variables (0.4 % responded with ‘prefer not to say’ for previous infection and 0.2 % for bereavement). For the outcomes, 12.2 % of participants responded with ‘prefer not to say’ for at least one item of the CES-D-8 and 6.4 % for at least one item of the GAD-7 (coded as missing as this cannot be used to create total score). For participants with complete data on at least 80 % of items, person mean imputation, averaging responses to available items, was conducted to compute prorated scale scores ( $N = 11,540$  for depression,  $N = 11,825$  for anxiety). As a sensitivity analysis, complete case analyses using pairwise deletion are presented in supplementary materials ( $N = 10,671$  for depression,  $N = 11,372$  for anxiety). See Fig. S1 for participant flow diagram.

## 2.7. Statistical analysis

All analyses were conducted in STATA/SE 15 (StataCorp., 2017). For each ethnic group, unweighted frequencies and weighted prevalence estimates for depression and anxiety caseness are reported (age-standardised to the 2013 WHO European Standard Population), alongside 95 % confidence intervals (CIs), means and standard deviations. Weighted logistic regression models, adjusting for age, sex, and month of survey completion, were used to determine ethnic differences in meeting criteria for depression and anxiety, compared with White British. Odds ratios and marginal effects with 95 % CIs, were used to infer the magnitude of differences and precision around estimates. These analyses were repeated using weighted linear regressions as sensitivity analyses, maintaining continuous outcomes, to explore ethnic differences on an absolute scale. Age was included as a cubic spline through all

adjustments to model the non-linear association between age and the outcomes.

Exploratory analyses were conducted to investigate whether ethnic differences in depression and anxiety remained if levels of previous infection, bereavement due to COVID-19, and existing clinical diagnoses of depression and/or anxiety were consistent across groups. Weighted logistic and linear regressions were conducted, statistically adjusting for these variables, in addition to age, sex, and month of survey completion.

Subsequently, analyses of effect modification (on both multiplicative and additive scales) were conducted to explore whether ethnic differences in depression and anxiety were consistent across age and sex subgroups. Two-way interaction terms were included in the regression models, specifying a full-factorial model to include the main effects of ethnicity and potential effect modifiers: ethnicity with sex (reference = male), ethnicity with age (reference = aged 45–60 years old). ORs or  $\beta$  coefficients and marginal effects, with 95 % CIs, are presented for each ethnic group (versus White British) within the strata of potential effect modifiers.

## 2.8. Ethics

The EVENS survey received ethical approval from the University of Manchester Research Ethics Committee (2021–10,455-18,699). Additional ethical approval was not required for this secondary analysis of EVENS data.

## 3. Results

### 3.1. Sample characteristics

The sample included 12,161 participants (52 % female). The unweighted Ns and weighted proportions for ethnicity, age, and sex, are presented in Table 1, along with the proportion of data that were imputed.

### 3.2. Prevalence of CMD across ethnic groups

The weighted age-standardised prevalence of meeting criteria for depression for the whole sample was 44 % and 26 % for anxiety. The unweighted Ns, weighted age-standardised prevalence estimates, means and standard deviations, for depression and anxiety, across ethnic

**Table 1**  
Sample characteristics (unweighted Ns and weighted %). Total  $N = 12,161$ .

Variable	N	%
Sex		
Male	5073	48.37
Female	7088	51.63
Age		
Mean $\pm$ SD	36.15	11.69
Ethnicity		
Asian: Bangladeshi	403	1.13
Asian: Chinese	653	1.00
Asian: Indian	1229	3.39
Asian: Pakistani	841	2.58
Any other Asian background	653	1.84
Black: African	1032	2.71
Black: Caribbean	527	1.14
Any other Black background	174	0.40
Mixed: White and Asian	511	0.60
Mixed: White and Black African	154	0.29
Mixed: White and Black Caribbean	344	0.70
Any other Mixed background	358	0.63
Gypsy/Traveller/Roma	284	0.34
White British	3134	71.83
Any other White background	1058	8.95
Arab	149	0.58
Jewish	413	0.36
Any other ethnicity	244	1.52

groups are presented in Table 2 (complete case analysis presented in supplementary Table S1).

### 3.3. Ethnic inequalities in depression

Compared to White British (Table 3), the odds of meeting criteria for depression caseness were much lower for people identifying as any other Asian background (OR:0.53, 95%CI: 0.39 to 0.72, marginal difference –14.27 %, 95%CI: –20.75 to –7.79) and Black African people (OR:0.55, 95%CI: 0.42 to 0.72, marginal difference –13.70 %, 95%CI: –19.48 to –7.91), remaining after controlling for ethnic differences in the level of previous infection, bereavement, and existing clinical diagnoses. Odds were also lower for Chinese people (OR: 0.63, 95%CI: 0.46 to 0.85, marginal difference –10.85 %, 95%CI: –17.69 to –4.00), though this attenuated after controlling for pandemic-related factors. These findings remained in the complete case analysis (Table S2) and sensitivity analysis of continuous depression symptoms (Table S3). Odds of meeting criteria for depression were reduced for Mixed White and Black African people (OR:0.51, 95%CI: 0.30 to 0.86, marginal difference –15.25 %, 95%CI: –23.79 to –4.45), remaining after controlling for pandemic-related factors, however, these estimates were less precise, and no differences were found with continuous depression symptomology.

### 3.4. Ethnic inequalities in anxiety

Compared to White British (Table 4), Arab people showed more than double the odds of anxiety caseness (OR: 2.57, 95%CI: 1.35 to 4.91), with large but imprecise marginal differences in percentage points (20.38 %, 95%CI: 5.01 to 35.75), and greater anxiety symptomology (Table S5), remaining after controlling for pandemic-related factors. The odds of meeting criteria for anxiety were also greater (and anxiety symptomology was greater) for the following ethnic groups: any other Black background (OR: 2.22, 95%CI: 1.28 to 3.87, marginal difference 16.95 %, 95%CI: 4.05 to 29.85), Mixed White and Black Caribbean (OR: 1.57, 95%CI: 1.07 to 2.30, marginal difference 9.01 %, 95%CI: 0.82 to 17.21), and any other Mixed background (OR: 1.58, 95%CI: 1.08 to 2.31, marginal difference 9.11 %, 95%CI: 0.97 to 17.25). However, confidence intervals were wide. For people identifying as any other Black background, the odds of anxiety caseness increased after controlling for pandemic-related factors, but differences attenuated for the Mixed White and Black Caribbean and any other Mixed background groups. These findings remained in the complete case analysis (Table S4).

### 3.5. Sex differences in ethnic inequalities in CMD

The effect modifications of sex on ethnic differences in depression, on multiplicative and additive scales, are presented in supplementary Tables S6 and S7, respectively. Compared to White British men, as the single reference group, White British women had greater odds of meeting criteria for depression caseness (OR: 1.61 95%CI: 1.32 to 1.97) and greater depression symptomology. Men, but not women, from Mixed White and Asian and Mixed White and Black African groups were less likely to report depression than White British men and women. Mixed White and Black African women reported greater depression symptomology (marginal means 3.77, 95%CI: 3.01 to 4.54) than Mixed White and Black African men (marginal means 1.96, 95%CI: 1.27 to 2.65) and White British men (marginal means 2.99, 95%CI: 2.79 to 3.19), on an additive scale.

The effect modification of sex on ethnic differences in anxiety, on multiplicative and additive scales, are presented in supplementary Tables S8 and S9. Compared to White British men, White British women had greater odds of reporting anxiety (OR: 1.43, 95%CI: 1.14 to 1.81) and greater anxiety symptomology. For the Arab ethnic group, men had 3.43 times the odds (95%CI: 1.40 to 8.38) of reporting anxiety compared to White British men, with no meaningful difference between Arab

**Table 2**  
Unweighted Ns and weighted age-standardised prevalence estimates (%) and mean scores (±standard deviation [SD]) for depression (N = 11,540) and anxiety (N = 11,825) for each ethnic group.

Ethnicity	CES-D-8 Non-Case		CES-D-8 Case		CES-D-8		GAD-7 Non-Case		GAD-7 Case		GAD-7	
	N	% (95 % CI)	N	% (95 % CI)	Mean (±SD)	% (95 % CI)	N	% (95 % CI)	N	% (95 % CI)	Mean (±SD)	
Asian: Bangladeshi	174	58.83 (50.20 to 66.94)	196	41.17 (33.05 to 49.80)	3.93 (2.67)	69.46 (61.16 to 76.67)	247	69.46 (61.16 to 76.67)	136	30.54 (23.33 to 38.84)	7.90 (6.02)	
Asian: Chinese	365	67.99 (62.05 to 73.39)	261	32.01 (26.61 to 37.94)	3.13 (2.37)	79.13 (73.80 to 83.62)	468	79.13 (73.80 to 83.62)	176	20.87 (16.38 to 26.20)	6.68 (5.01)	
Asian: Indian	643	57.63 (53.24 to 61.89)	532	42.37 (38.11 to 46.75)	3.35 (2.64)	74.10 (70.22 to 77.64)	853	74.10 (70.22 to 77.64)	338	25.90 (22.36 to 29.78)	6.83 (5.67)	
Asian: Pakistani	380	55.43 (49.80 to 60.91)	388	44.57 (39.09 to 50.20)	3.62 (2.72)	72.70 (67.82 to 77.09)	539	72.70 (67.82 to 77.09)	258	27.30 (22.91 to 32.18)	7.17 (5.80)	
Any other Asian background	361	68.37 (62.64 to 73.60)	256	31.63 (26.40 to 37.36)	3.23 (2.46)	81.74 (76.55 to 85.99)	475	81.74 (76.55 to 85.99)	163	18.26 (14.01 to 23.45)	6.73 (5.70)	
Black: African	585	68.69 (63.74 to 73.25)	385	31.31 (26.75 to 36.26)	3.08 (2.56)	75.48 (70.91 to 79.55)	729	75.48 (70.91 to 79.55)	269	24.52 (20.45 to 29.09)	6.14 (5.62)	
Black: Caribbean	255	54.68 (47.74 to 61.45)	248	45.32 (38.55 to 52.26)	3.60 (2.55)	74.55 (67.55 to 80.48)	378	74.55 (67.55 to 80.48)	136	25.45 (19.52 to 32.45)	6.47 (5.70)	
Any other Black background	86	57.17 (46.84 to 66.91)	70	42.83 (33.09 to 53.16)	3.52 (2.58)	64.29 (54.13 to 73.31)	113	64.29 (54.13 to 73.31)	51	35.71 (26.69 to 45.87)	7.43 (5.10)	
Mixed: White and Asian	285	63.91 (56.13 to 71.03)	209	36.09 (28.97 to 43.87)	3.30 (2.54)	74.47 (67.39 to 80.45)	362	74.47 (67.39 to 80.45)	139	25.53 (19.55 to 32.61)	6.84 (5.96)	
Mixed: White and Black African	74	72.02 (63.41 to 79.26)	71	27.98 (20.74 to 36.59)	3.25 (2.53)	75.25 (64.66 to 83.48)	94	75.25 (64.66 to 83.48)	59	24.75 (16.52 to 35.34)	8.04 (6.20)	
Mixed: White and Black Caribbean	143	50.55 (42.09 to 58.98)	180	49.45 (41.02 to 57.91)	3.68 (2.44)	65.44 (57.57 to 72.54)	220	65.44 (57.57 to 72.54)	116	34.56 (27.46 to 42.43)	7.94 (6.19)	
Any other Mixed background	154	50.03 (41.98 to 58.09)	185	49.97 (41.91 to 58.02)	3.93 (2.60)	64.75 (56.86 to 71.90)	222	64.75 (56.86 to 71.90)	124	35.25 (28.10 to 43.14)	7.99 (6.22)	
White: British	1611	55.10 (52.30 to 57.87)	1404	44.90 (42.13 to 47.70)	3.44 (2.67)	74.17 (71.65 to 76.54)	2278	74.17 (71.65 to 76.54)	788	25.83 (23.46 to 28.35)	6.24 (5.95)	
Gypsy/Traveller/Roma	193	68.03 (58.29 to 76.42)	83	31.96 (23.58 to 41.71)	2.55 (2.67)	76.03 (67.36 to 82.98)	209	76.03 (67.36 to 82.98)	67	23.97 (17.02 to 32.64)	5.80 (6.23)	
Any other White background	569	61.15 (56.38 to 65.72)	430	38.85 (34.28 to 43.62)	3.19 (2.60)	76.02 (71.67 to 79.88)	758	76.02 (71.67 to 79.88)	273	23.98 (20.12 to 28.32)	6.45 (5.61)	
Arab	67	45.36 (35.66 to 55.43)	72	54.64 (44.57 to 64.34)	3.87 (2.73)	51.62 (39.80 to 63.26)	81	51.62 (39.80 to 63.26)	62	48.38 (36.74 to 60.20)	8.88 (5.58)	
Jewish	237	63.65 (57.10 to 69.73)	157	36.35 (30.26 to 42.90)	3.07 (2.56)	78.09 (72.25 to 82.98)	294	78.09 (72.25 to 82.98)	107	21.91 (17.02 to 27.75)	6.55 (5.76)	
Any other ethnicity	128	49.92 (39.69 to 60.47)	104	50.08 (39.69 to 60.47)	3.40 (2.56)	68.99 (59.52 to 77.09)	170	68.99 (59.52 to 77.09)	73	31.01 (22.91 to 40.48)	7.27 (5.51)	

**Table 3**  
Weighted logistic regression analyses for the adjusted odds of depression (CES-D-8) caseness for ethnic minority groups, compared to White British.

Ethnicity	Adjusted for age, sex, and month of survey completion			Adjusted for age, sex, month of survey completion, previous infection, bereavement, and clinical diagnosis		
	OR (95 % CI)	Predicted margins % (95 % CI)	Marginal differences % (95 % CI)	OR (95 % CI)	Predicted margins % (95 % CI)	Marginal differences % (95 % CI)
White: British (Ref.)	1.00	44.51 (42.02 to 47.01)	Ref.	1.00	43.62 (41.26 to 45.97)	Ref.
Asian: Bangladeshi	0.89 (0.60 to 1.31)	41.63 (32.82 to 50.44)	-2.89 (-12.20 to 6.43)	1.01 (0.66 to 1.53)	43.73 (35.15 to 52.30)	0.11 (-8.95 to 9.18)
Asian: Chinese	0.63 (0.46 to 0.85)**	33.67 (27.51 to 39.82)	-10.85 (-17.69 to -4.00)**	0.81 (0.60 to 1.10)	39.24 (33.65 to 44.84)	-4.37 (-10.66 to 1.91)
Asian: Indian	0.88 (0.70 to 1.11)	41.50 (36.81 to 46.18)	-3.02 (-8.55 to 2.51)	1.00 (0.78 to 1.27)	43.52 (39.17 to 47.88)	-0.09 (-5.31 to 5.12)
Asian: Pakistani	1.02 (0.78 to 1.33)	45.00 (39.24 to 50.76)	0.49 (-5.98 to 6.96)	1.14 (0.85 to 1.53)	46.46 (40.78 to 52.13)	-2.84 (-3.51 to 9.19)
Any other Asian background	0.53 (0.39 to 0.72)***	30.24 (24.46 to 36.03)	-14.27 (-20.75 to -7.79)***	0.63 (0.46 to 0.87)**	34.30 (28.87 to 39.73)	-9.32 (-15.44 to -3.20)**
Black: African	0.55 (0.42 to 0.72)***	30.82 (25.84 to 35.79)	-13.70 (-19.48 to -7.91)***	0.63 (0.48 to 0.85)**	34.31 (29.42 to 39.21)	-9.30 (-14.99 to -3.61)**
Black: Caribbean	1.06 (0.75 to 1.50)	46.02 (38.20 to 53.84)	1.50 (-6.85 to 9.86)	1.05 (0.75 to 1.49)	44.71 (37.84 to 51.59)	1.10 (-6.35 to 8.54)
Any other Black background	1.12 (0.66 to 1.90)	47.25 (34.74 to 59.75)	2.73 (-10.08 to 15.55)	1.31 (0.75 to 2.29)	49.51 (37.50 to 61.52)	5.89 (-6.42 to 18.21)
Mixed: White and Asian	0.70 (0.50 to 0.97)*	36.27 (29.35 to 42.99)	-8.34 (-15.81 to -0.88)*	0.73 (0.52 to 1.05)	37.20 (30.64 to 43.76)	-6.42 (-13.61 to 0.78)
Mixed: White and Black African	0.51 (0.30 to 0.86)*	29.26 (18.91 to 39.61)	-15.25 (-26.04 to -4.45)**	0.52 (0.32 to 0.85)**	30.53 (22.01 to 39.05)	-13.08 (-22.10 to -4.07)**
Mixed: White and Black Caribbean	1.24 (0.86 to 1.78)	49.68 (41.27 to 58.08)	5.16 (-3.78 to 14.10)	1.14 (0.78 to 1.66)	46.41 (38.67 to 54.16)	2.80 (-5.50 to 11.09)
Any other Mixed background	1.13 (0.79 to 1.61)	47.43 (39.26 to 55.59)	2.91 (-5.81 to 11.64)	1.01 (0.69 to 1.47)	43.82 (36.23 to 51.41)	0.20 (-7.94 to 8.35)
Gypsy/Traveller/Roma	0.57 (0.34 to 0.96)	31.78 (21.13 to 42.42)	-12.74 (-23.79 to -1.68)*	0.68 (0.40 to 1.16)	35.61 (25.30 to 45.91)	-8.01 (-18.71 to 2.69)
Any other White background	0.80 (0.64 to 1.00)*	39.22 (34.85 to 43.59)	-5.29 (-10.48 to -0.11)*	0.97 (0.77 to 1.22)	42.93 (38.67 to 47.19)	-0.68 (-5.70 to 4.33)
Arab	1.37 (0.75 to 2.53)	52.25 (37.74 to 66.77)	7.74 (-7.08 to 22.56)	1.54 (0.83 to 2.89)	53.21 (39.67 to 66.75)	9.59 (-4.25 to 23.44)
Jewish	0.76 (0.55 to 1.05)	37.98 (30.90 to 45.06)	-6.53 (-14.07 to 1.00)	0.74 (0.52 to 1.05)	37.34 (30.72 to 43.96)	-6.28 (-13.33 to 0.77)
Any other ethnicity	1.18 (0.74 to 1.87)	48.48 (37.55 to 59.41)	3.97 (-7.34 to 15.27)	1.25 (0.76 to 2.05)	48.52 (38.05 to 58.99)	4.90 (-5.95 to 15.76)

\*  $p < 0.05$ .  
 \*\*  $p < 0.01$ .  
 \*\*\*  $p < 0.001$ .

women and White British men or women on a multiplicative scale. Mixed White and Black Caribbean women had slightly increased odds (1.63, 95%CI: 1.01 to 2.63) of meeting criteria for anxiety and reported greater anxiety symptomology (marginal means 8.62, 95%CI: 7.25 to 9.99), though no difference was observed for Mixed White and Black Caribbean men compared with White British men.

### 3.6. Age differences in ethnic inequalities in CMD

The effect modification of age on ethnic differences in depression on multiplicative and additive scales are presented in supplementary Tables S10 and S11. Compared with White British people aged 45–60 years old, as the single reference category, White British people aged 18–29 years old had greater odds of reporting depression (OR: 1.36, 95% CI: 1.04 to 1.78) and greater depression symptomology, though no differences were observed for those aged 30–44 years old. For Chinese and Black African ethnic groups, reduced odds of depression caseness and lower depression symptomology were observed for those aged 18–29 and those aged 45–60 years old (but not those aged 30–44 years old), compared to their White British counterparts. Those identifying as any other Asian background, aged 30–44 and 45–60 years old (but not aged 18–29 years old), were less likely to report depression than White British people of the same age. Opposing the pattern observed among White British people, older Arab people were more likely to report depression than White British people of the same age, and Arab people in the

younger age groups were less likely to report depression.

The effect modifications of age on ethnic differences in anxiety are displayed in supplementary Tables S12 and S13. Compared White British people aged 45–60 years old, White British people aged 18–29 years old had 2.14 times the odds (95%CI: 1.59 to 2.88) of meeting criteria for anxiety and those aged 30–44 years old had 1.37 times the odds (95%CI: 1.06 to 1.77), and these age groups reported greater anxiety symptomology. As with depression, Arab people aged 45–60 and 30–44 were more likely to report anxiety than White British people of the same age and Arab people aged 18–29 were less likely to report anxiety. A similar pattern was observed for Mixed White and Black Caribbean people, whereby those aged 45–60 were more likely to report anxiety than White British people of the same age, but the younger age Mixed White and Black Caribbean people showed reduced odds.

## 4. Discussion

This is the most comprehensive analysis of ethnic differences in CMD in the UK to date, comparing the prevalence of depression and anxiety across 18 ethnic groups during the second year of the COVID-19 pandemic. Compared with White British people, we found evidence of greater levels of anxiety among Arab (particularly older people, who also displayed greater levels of depression), Mixed White and Black Caribbean (driven by women and those of an older age), any other Black, and any other Mixed ethnic groups; and lower levels of depression

**Table 4**  
Weighted logistic regression analyses for the adjusted odds of anxiety (GAD-7) caseness for ethnic minority groups, compared to White British.

Ethnicity	Adjusted for age, sex, and month of survey completion			Adjusted for age, sex, month of survey completion, previous infection, bereavement, and clinical diagnosis		
	OR (95 % CI)	Predicted margins (95 % CI)	Marginal differences (95 % CI)	OR (95 % CI)	Predicted margins (95 % CI)	Marginal differences (95 % CI)
White: British (Ref.)	1.00	24.75 (22.61 to 26.89)	Ref.	1.00	24.00 (22.02 to 25.99)	Ref.
Asian: Bangladeshi	1.43 (0.94 to 2.16)	31.74 (23.52 to 39.97)	6.99 (−1.63 to 15.62)	1.74 (1.09 to 2.77)*	33.76 (25.16 to 42.36)	9.76 (0.80 to 18.71)*
Asian: Chinese	0.85 (0.60 to 1.20)	21.87 (16.47 to 27.26)	−2.88 (−8.82 to 3.06)	1.16 (0.82 to 1.66)	26.49 (20.99 to 32.00)	2.49 (−3.47 to 8.45)
Asian: Indian	1.07 (0.83 to 1.38)	25.98 (21.90 to 30.06)	1.23 (−3.53 to 5.99)	1.27 (0.97 to 1.66)	27.92 (23.94 to 31.90)	3.92 (−0.69 to 8.52)
Asian: Pakistani	1.20 (0.89 to 1.60)	28.14 (23.04 to 33.24)	3.39 (−2.29 to 9.07)	1.41 (1.03 to 1.93)	29.85 (24.80 to 34.90)	5.84 (0.27 to 11.42)*
Any other Asian background	0.67 (0.47 to 0.95)*	18.20 (13.48 to 22.93)	−6.55 (−11.85 to −1.25)*	0.83 (0.57 to 1.20)	21.13 (16.18 to 26.08)	−2.88 (−8.33 to 2.57)
Black: African	1.01 (0.75 to 1.35)	24.87 (20.18 to 29.57)	0.12 (−5.19 to 5.44)	1.26 (0.93 to 1.73)	27.90 (23.15 to 32.65)	3.89 (−1.42 to 9.21)
Black: Caribbean	1.17 (0.77 to 1.77)	27.69 (20.00 to 35.38)	2.94 (−5.14 to 11.01)	1.10 (0.75 to 1.61)	25.47 (19.64 to 31.30)	1.46 (−4.82 to 7.74)
Any other Black background	2.22 (1.28 to 3.87)*	41.70 (29.04 to 54.36)	16.95 (4.05 to 29.85)*	2.80 (1.61 to 4.89)***	43.63 (32.01 to 55.24)	19.62 (7.78 to 31.46)**
Mixed: White and Asian	1.02 (0.70 to 1.48)	25.06 (18.68 to 31.43)	0.31 (−6.56 to 7.17)	1.11 (0.75 to 1.66)	25.73 (19.61 to 31.85)	1.72 (−4.83 to 8.28)
Mixed: White and Black African	1.02 (0.59 to 1.75)	25.07 (15.44 to 34.70)	0.32 (−9.65 to 10.29)	1.11 (0.65 to 1.90)	25.74 (17.25 to 34.22)	1.73 (−7.09 to 10.55)
Mixed: White and Black Caribbean	1.57 (1.07 to 2.30)*	33.76 (25.99 to 41.54)	9.01 (0.82 to 17.21)*	1.49 (1.01 to 2.21)*	30.90 (24.18 to 37.62)	6.89 (−0.26 to 14.04)
Any other Mixed background	1.58 (1.08 to 2.31)*	33.86 (26.13 to 41.59)	9.11 (0.97 to 17.25)*	1.39 (0.93 to 2.09)	29.63 (22.77 to 36.48)	5.62 (−1.65 to 12.90)
Gypsy/Traveller/Roma	0.93 (0.52 to 1.66)	23.37 (13.50 to 33.23)	−1.38 (−11.59 to 8.82)	1.15 (0.64 to 2.07)	26.30 (16.79 to 35.81)	2.29 (−7.54 to 12.12)
Any other White background	0.98 (0.77 to 1.26)	24.44 (20.68 to 28.20)	−0.31 (−4.76 to 4.13)	1.23 (0.95 to 1.60)	27.45 (23.63 to 31.27)	3.45 (−0.98 to 7.87)
Arab	2.57 (1.35 to 4.91)**	45.13 (29.99 to 60.27)	20.38 (5.01 to 35.75)**	3.18 (1.64 to 6.16)**	46.40 (32.39 to 60.51)	22.40 (8.07 to 36.73)**
Jewish	0.84 (0.59 to 1.19)	21.63 (16.20 to 27.05)	−3.12 (−8.99 to 2.75)	0.85 (0.60 to 1.21)	21.51 (16.74 to 26.29)	−2.49 (−7.70 to 2.72)
Any other ethnicity	1.24 (0.74 to 2.07)	28.90 (19.00 to 38.80)	4.15 (−6.04 to 14.34)	1.33 (0.76 to 2.31)	28.77 (19.27 to 38.27)	4.76 (−5.01 to 14.54)

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

among Chinese, any other Asian, Black African, and Mixed White and Black African (driven by men, as women reported greater depression symptomology) ethnic groups. Some ethnic differences in CMD attenuated after controlling for differences in levels of infection, bereavement, and existing clinical diagnoses of CMD, indicating that these may be important explanations for certain ethnic groups.

The present study identified evidence of ethnic inequalities in anxiety but not depression. There were apparent ceiling effects for depression, as age-standardised prevalence estimates were high for all ethnic groups (lowest being 28 %, Mixed White and Black African), and particularly high for White British people (41 %), against which all ethnic minority groups were compared. This may reflect differences in the aetiology of these disorders. Depression follows loss (Brown et al., 1993; Finlay-Jones and Brown, 1981), and during the pandemic, the whole population, regardless of ethnicity, was at risk of loss, including loss of social interaction, loss of motivation and loss of meaning (Williams et al., 2020). In contrast, anxiety follows threat or danger (Brown et al., 1993; Finlay-Jones and Brown, 1981). It could be argued that threat and danger were greater for ethnic minority people, particularly as certain ethnic minority groups were more likely to become infected and die due to COVID-19 (Mathur et al., 2021). Additionally, people from ethnic minority groups were more likely to experience the threat of income and job loss during the pandemic (Hu, 2020). When researching ethnic differences in CMD, future work should consider how risk factors differ for depression and anxiety, to inform appropriate interventions.

These findings build upon longitudinal studies of ethnic differences in mental health during the COVID-19 pandemic, adding to the literature through the use of granular ethnicity data. Longitudinal studies showed greater increases in psychological distress in Asian (Niedzwiedz et al., 2020; Pierce et al., 2021) and Mixed (Pierce et al., 2021) ethnic groups. Within EVENS, higher levels of anxiety were found among Mixed White and Black Caribbean people and those of any other Mixed background, as well as Arab people. Previous literature may have underestimated the extent of ethnic inequalities in mental health for these groups, as we identified lower levels of depression among certain Asian and Mixed groups, therefore aggregating these groups disguises important heterogeneous experiences. Similarly, previous studies analysed ethnic differences in psychological distress, measured using the GHQ-12, which includes symptoms of both depression and anxiety, and the present study has shown that certain ethnic groups may be more likely to report anxiety but less likely to report depression.

The levels of CMD observed for Arab people are concerning, with approximately half meeting criteria for anxiety and depression. US literature has shown that discrimination due to Arab identity is associated with poor mental health (Abu-Ras and Abu-Bader, 2008; Moradi and Hasan, 2004) and wider literature suggests that Arab people are less likely to seek psychological help (Hamid and Furnham, 2013). Arab people in the UK face barriers to healthcare services, including insensitive care and discrimination (Firdous et al., 2020), inadequate access to interpreter services (Bawadi et al., 2020), and GPs not listening to or

addressing their concerns (Islam et al., 2015). These barriers must be addressed to ensure Arab people receive sufficient and appropriate care to address unmet mental health needs and prevent further mental health deterioration.

#### 4.1. Strengths & limitations

EVENS contains the largest number of ethnic minority people in the UK, as well as certain ethnic minority groups which are typically underrepresented or not included in previous surveys (Finney et al., 2023), enabling a detailed analysis of CMD across ethnic groups that has not been possible with existing survey data. Due to the non-probability nature of the survey, robust statistical techniques were used to weight the sample to be representative of the UK population and to account for selection bias, allowing findings to be generalisable (Shlomo et al., 2023). However, the cross-sectional design is a limitation, as it is not possible to determine whether ethnic differences in CMD existed prior to the COVID-19 pandemic (particularly across ethnic groups underrepresented in previous survey) or the extent to which the pandemic exacerbated existing inequalities. Additionally, EVENS data were collected between February and November 2021, which does not capture experiences across the whole pandemic period, particularly the first wave of SARS-CoV-2 infections and early government-mandated lockdowns, though evidence suggests that increased levels of CMD were sustained throughout the pandemic period (Fancourt et al., 2022; Patel et al., 2022).

#### 4.2. Implications & conclusions

During the COVID-19 pandemic, there was clear evidence of ethnic inequalities in anxiety for people identifying as Arab, any other Black background, Mixed White and Caribbean, and any other Mixed background. Despite finding lower levels of depression among people from Chinese, Black African, Mixed White and Black African, and any other Asian ethnic groups, compared to White British people, the prevalence of depression was high across the whole sample, with approximately one third of people within each ethnic group meeting criteria. Concerningly, previous research has shown that people from ethnic minority groups are less likely to be provided with adequate mental health treatment (Ahmad et al., 2022; Cooper et al., 2013; Kapadia et al., 2018). We have now identified certain ethnic groups who may require more targeted support to improve mental health, to ensure equitable recovery from the pandemic. However, work is needed to address barriers to mental healthcare, by addressing structural inequalities that discriminate against ethnic minority people (e.g., investing in adequate interpreter services) and tackling racist attitudes (Kapadia et al., 2022). Further research is needed to disentangle the factors that contribute to high levels of CMD during the COVID-19 pandemic, such as the health impacts of the pandemic, economic precarity, and experiences of racism.

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#### Author contributions

PI conceptualised the data analysis plan, conducted the formal data analysis, interpreted the findings, wrote the original draft, and edited the manuscript. MP, LG, and SVK contributed to the conceptualisation of the data analysis plan, interpretation of the findings, and reviewing of the manuscript. HT, DK, LB, and JN were involved in the conceptualisation and development of EVENS, and contributed to the

present data analysis plan, interpretation of findings, and reviewing of the manuscript. All authors critically reviewed and approved the manuscript as submitted.

#### CRedit authorship contribution statement

**Patricia Irizar:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Validation, Visualization, Writing – original draft, Writing – review & editing. **Harry Taylor:** Conceptualization, Data curation, Methodology, Supervision, Validation, Visualization, Writing – review & editing. **Dharm Kapadia:** Conceptualization, Data curation, Funding acquisition, Supervision, Validation, Visualization, Writing – review & editing. **Matthias Pierce:** Formal analysis, Supervision, Validation, Visualization, Writing – review & editing. **Laia Bécares:** Supervision, Validation, Visualization, Writing – review & editing. **Laura Goodwin:** Validation, Visualization, Writing – review & editing, Supervision. **Srinivasa Vittal Katikireddi:** Formal analysis, Supervision, Validation, Visualization, Writing – review & editing. **James Nazroo:** Conceptualization, Data curation, Funding acquisition, Supervision, Validation, Visualization, Writing – review & editing.

#### Declaration of competing interest

SVK was co-chair of the Scottish Government's Expert Reference Group on Ethnicity and COVID-19 and a member of the UK Scientific Advisory Group on Emergencies (SAGE) subgroup on ethnicity. All other authors declare no conflicts of interest.

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#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2024.05.026>.

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