



BMJ Open Loneliness, coping, suicidal thoughts and self-harm during the COVID-19 pandemic: a repeat cross-sectional UK population survey

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ABSTRACT

Objectives There has been speculation on the impact of the COVID-19 pandemic and the associated lockdown on suicidal thoughts and self-harm and the factors associated with any change. We aimed to assess the effects and change in effects of risk factors including loneliness and coping, as well as pre-existing mental health conditions on suicidal thoughts and self-harm during the COVID-19 pandemic.

Design This study was a repeated cross-sectional online population-based survey.

Participants and measures Non-probability quota sampling was adopted on the UK adult population and four waves of data were analysed during the pandemic (17 March 2020 to 29 May 2020). Outcomes were suicidal thoughts and self-harm associated with the pandemic while loneliness, coping, pre-existing mental health conditions, employment status and demographics were covariates. We ran binomial regressions to evaluate the adjusted risks of the studied covariates as well as the changes in effects over time.

Results The proportion of individuals who felt lonely increased sharply from 9.8% to 23.9% after the UK lockdown began. Young people (aged 18–24 years), females, students, those who were unemployed and individuals with pre-existing mental health conditions were more likely to report feeling lonely and not coping well. 7.7%–10.0% and 1.9%–2.2% of respondents reported having suicidal thoughts and self-harm associated with the pandemic respectively throughout the period studied. Results from cross-tabulation and adjusted regression analyses showed young adults, coping poorly and with pre-existing mental health conditions were significantly associated with suicidal thoughts and self-harm. Loneliness was significantly associated with suicidal thoughts but not self-harm.

Conclusions The association between suicidality, loneliness and coping was evident in young people during the early stages of the pandemic. Developing effective interventions designed and coproduced to address loneliness and promote coping strategies during prolonged social isolation may promote mental health and help mitigate suicidal thoughts and self-harm associated with the pandemic.

Strengths and limitations of this study

- This is a novel and timely study exploring the determinants (and their changes) in suicidal thoughts and self-harm in the UK general population in the ongoing COVID-19 pandemic.
- Potential sampling bias through use of an online survey with non-probability quota sampling.
- Repeated cross-sectional design.
- Variables regarding self-harm and suicidal thoughts were missing at baseline.
- Validated measures assessing mental health conditions were lacking in this study.

INTRODUCTION

Worldwide research efforts have understandably been focused on preventive and therapeutic strategies¹ against the COVID-19 pandemic.² The immediate and potential long-term impacts on mental health, suicide and self-harm have not yet been widely addressed.^{3 4} Without effective treatment or vaccines, extensive lockdown and social/physical distancing measures were implemented worldwide to contain the pandemic. In addition to the threat of infection, public mental health and well-being were expected to deteriorate in tandem with these dramatic changes at personal (eg, restricted freedom), social (eg, due to isolation and distancing) and economic levels (eg, unemployment and financial hardship), particularly for vulnerable individuals.^{3 5} Studies from China in the very early stages of COVID-19 pandemic have found high levels of mental health problems and distress in the general population.^{6 7}

Previous epidemics where similar public health measures were taken, for example, SARS, resulted in an elevated suicide rate in elderly population (over 65 years) in Hong Kong in 2003.^{8 9} This was associated with



anxiety and worry concerning their susceptibility to the pandemic, pre-existing health conditions, lack of social support and higher reliance on the health services that were under pressure during the outbreak. However, important psychological factors such as loneliness, perceived stress level and coping were not examined.

Loneliness, the self-perceived deficiency of an individual's social relation network in quantitative or qualitative terms,¹⁰ has been identified as an important factor associated with suicidal thoughts and behaviours.^{11–17} The effect of loneliness on suicidal thoughts and behaviours is more prominent in younger (16–20 years) and older (>58 years) populations because these two age groups similarly experience periods where drastic changes in social status occur.¹³ Previously, social isolation and loneliness were linked to health protection measures similar to those taken in the COVID-19 pandemic resulting in a deterioration in children and young people's mental health.¹⁸ Similarly, individuals' perceived stress level is often associated with suicidal behaviours alongside mental disorders such as depression.^{19–21} Perceived stress and poor coping mechanisms are associated with suicidal behaviours in both younger^{22–25} and older individuals.²⁶

A UK-wide lockdown was announced on 23 March 2020 which included instructions to the general population to stay at home, socially/physically distance and self-isolate if they had symptoms. This was accompanied by guidance regarding movements outside the home for exercise and grocery shopping. These restrictions were fully in place until 13 May 2020 when they were gradually eased. Given the potential for such measures to be implemented in any further waves of COVID-19 or other pandemics, it is important to understand the effects of these measures on mental health and well-being in order to mitigate them in the future and address them currently. A growing body of emerging research focuses on assessing mental health and well-being in response to the pandemic and measures taken to curb its spread at a population level.²⁷ Outcomes related to self-harm and suicidality have not been commonly reported in repeated surveys although they are included in some.^{28–29} This study aimed to explore the risk factors for suicidal thoughts and self-harm in response to the COVID-19 pandemic in the UK population using a repeated cross-sectional online population survey representative of the adult UK population. We assessed the effects of known modifiable psychological risk factors including loneliness and coping, as well as pre-existing mental health conditions and other sociodemographic covariates.

METHODS

Study design and participants

This study, a part of a larger mixed-methods study to investigate mental impacts of COVID-19 pandemic in the UK,³⁰ was a repeated cross-sectional online population survey using a quota survey design and a sampling frame allowing recruitment of a national sample. We examined the

public's mental health by assessing emotional responses, sources of social distress, coping, suicidal thoughts and self-harm in relation to the COVID-19 pandemic from individuals aged ≥ 18 years living in the UK. Data for the 'Coronavirus: Mental Health in the Pandemic' study were first collected shortly before the UK-wide lockdown was announced and repeated approximately every 3–4 weeks. In this study, we report on the first four waves with wave 1, wave 2, wave 3 and wave 4 conducted on 17–18 March 2020, 2–3 April 2020, 24–26 April 2020 and 28–29 May 2020, respectively. We aimed at a sample size of ~ 2000 in waves 1 and 2 but this was then doubled to ~ 4000 in later waves to increase statistical power for subgroups. Data collection is still underway although at increased intervals and all surveys were administered online by YouGov, a social market research company that recruited participants to form a panel containing over 1 million individuals from the UK.²⁷ Quota sampling was used and data were weighted to be representative to the UK adult population. Detailed procedures for sampling and weighting were described in the Suppl Methods (online supplemental file 1). Participants were different in each wave but taken from the same panel and representative of the UK adult population. Weighted bases, counts and percentages were reported unless otherwise specified to avoid identification of individuals in the case of small counts.

Participants signed up to YouGov to participate in surveys and they read and agreed to the terms and conditions of use and privacy policy before responding.³¹

Patient and public involvement

The survey forms part of a larger programme of work by the Mental Health Foundation (MHF) which includes focus groups of individuals (general population, risk groups, those with pre-existing mental illness) from the extensive networks of the MHF where themes identified from the survey are further discussed and questions for the next survey suggested.

Measures

Outcomes

The outcomes of this study were self-reported experience of suicidal thoughts and self-harm behaviours, which were available in wave 2, wave 3 and wave 4 (see online supplemental table 1, see also a copy of the survey in online supplemental file 2). Participants were prompted first about the sensitivity of the topic and provided an option to skip the related questions. For participants who proceeded, they were prompted 'Have you done or experienced any of the following, as a result of the Coronavirus (COVID-19) pandemic in the past 2 weeks? (Please select one option on each row)' and then presented with two descriptions with one for suicidal thoughts ('experienced suicidal thoughts/feelings') and the other for self-harm ('deliberately hurt myself'). Respondents were given three options: 'yes', 'no' and 'prefer not to say' for these two questions.

Covariates

The main covariates were loneliness and coping with stress. For loneliness, participants were first prompted 'Which, if any, of the following emotions have you felt as a result of the Coronavirus (COVID-19) pandemic in the past 2 weeks? (Please select all that apply)' and loneliness was one of the emotions. As a result, we analysed this binary variable reflecting whether individuals felt lonely due to the pandemic. For coping, participants were asked 'For the following question, if you have not experienced any stress related to the Coronavirus pandemic, please select the "Not applicable" option. Overall, how well do you think you are coping with stress related to the Coronavirus (COVID-19) pandemic?'. Respondents were given options of 'very well', 'fairly well', 'not very well', 'not at all well', 'don't know', 'prefer not to say' and 'not applicable I have not experienced any stress related to the Coronavirus' to answer. We combined 'very well' and 'fairly well' into 'well' category, as well as 'not very well' and 'not at all well' into a 'not well' category.

Other covariates included sex, age, marital, work and socioeconomic status and household information. Detailed descriptions of these variables were summarised in Suppl Methods (online supplemental file 1). We also included variables concerning pre-existing mental health conditions, living arrangements and urban/rural classification starting from wave 3. For waves 3 and 4, we asked the participants who were employed whether they were temporarily furloughed by their employer. We combined working and furlough status as a single categorical variable for analyses whenever appropriate (Suppl Methods in online supplemental file 1). For pre-existing mental health conditions, participants were asked 'Do you have a current pre-existing mental health condition or psychiatric diagnosis?' and participants were given options 'Yes', 'No', 'Don't know', 'Prefer not to say' and 'Refused' to respond (Suppl Methods in online supplemental file 1).

Statistical analyses

Sample weighting was incorporated in all statistical analyses to obtain UK representative estimates. The level of statistical significance was set at $p=0.05$ and all analyses were performed with Stata V.16.1.³² We reported sample characteristics and percentage of suicidal thoughts, self-harm with 95% CIs stratified by loneliness, coping and other sample characteristics for each wave of data collection where possible. For two-way and three-way cross-tabulations (figures 1–3), the significance of the association variables including wave, loneliness, coping, sex, age and working status was assessed by Wald χ^2 statistics after conducting full factorial binomial regression analyses. In these analyses, coping variables were grouped into a binary variable ('not well' vs 'well'/'no stress').

Binomial regression analyses were conducted using the 'BINREG' procedure in Stata³³ with suicidal thoughts and self-harm separately as the dependent variable. We combined the data collected in wave 3 and wave 4 only for the regression because these two waves contained

the largest number of variables of interest as well as the largest sample size. To pool data from two waves, sampling weights for each wave were reweighted using the sample population of each wave according to previously described methodology for analysing multiple independent surveys.³⁴

Both unadjusted and adjusted analyses for suicidal thoughts and self-harm were performed with the independent variables including time (wave 3 vs wave 4), loneliness, coping, sex, age, marital status, social grade, working status, pre-existing mental health conditions, household information, variables for living arrangements and urban/rural characteristics. All independent variables were included in the models as binary or categorical variables. We also included wave-by-loneliness, wave-by-coping, wave-by-sex, wave-by-age and wave-by-working status interaction terms in the adjusted model to explore change in effects of risk factors over time. Due to model convergence issues, the 'employed' category of the working status variable was not further stratified by furlough status in the regression analyses. We reported both risk ratios (RR) and risk difference (RD) with the corresponding 95% CIs and p values for independent variables. For the adjusted analysis, we also reported the Wald χ^2 statistics to examine the significance of overall effects for all independent variables and interactions. To assess the trend of the effect sizes over age, we performed the χ^2 test for linear trend to the model coefficients for the age variable in the adjusted analyses. To examine the robustness of the main analyses, we conducted a sensitivity analysis by repeating the regression on the combined data from wave 2 to wave 4, where suicidal thoughts and self-harm were available in these waves (online supplemental table 1). Details of the sensitivity analysis are described in Suppl Methods (online supplemental file 1).

RESULTS

Sample and participant characteristics

Between March 2020 and May 2020, the number of respondents for wave 1, wave 2, wave 3 and wave 4 of data collection was 2126, 2221, 4246 and 4382, respectively (table 1 for sample characteristics, see also online supplemental table 2). Missing data and inconclusive responses, including answers of 'prefer not to say', 'don't know' and 'refused to answer', were considered minimal (online supplemental table 1) and were thus excluded in cross-tabulations and regression analyses, given the assumptions of negligible effect of missing data.³⁵ The highest proportion of missing data was found for suicidal thoughts, self-harm and pre-existing mental health conditions. Cross-tabulation of these variables showed that missing data/inconclusive responses on suicidal thoughts/self-harm were more likely to be associated with missing data/inconclusive responses on having pre-existing mental health conditions (online supplemental table 1A). However, missing data/inconclusive responses

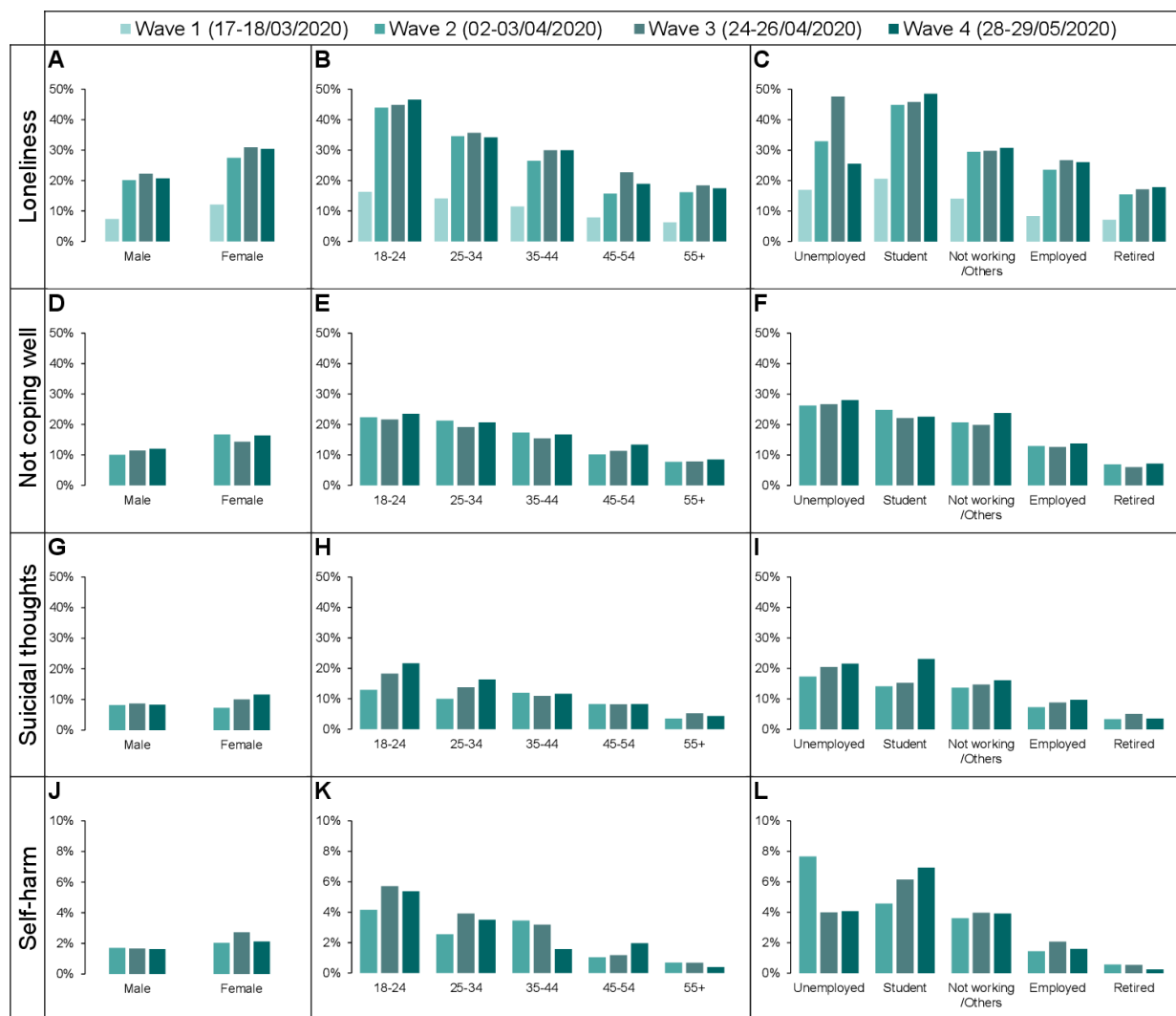


Figure 1 Distribution of loneliness (A–C), not coping well with stress (D–F), suicidal thoughts (G–I) and self-harm (J–L) in the past 2 weeks during the COVID-19 pandemic stratified by sex (B, E, H, K), age (B, E, H, K) and working status (C, F, I, L).

on having mental health conditions were more likely to have suicidal thoughts or self-harm.

Loneliness

The proportion of participants feeling lonely at wave 1, prior to the UK lockdown announcement, was 9.8% (95% CI 8.6% to 11.2%). This increased to 23.9% (95% CI 22.1% to 25.8%), 26.7% (95% CI 25.4% to 28.1%) and 25.7% (95% CI 24.3% to 27.1%) at wave 2, wave 3 and wave 4, respectively. The effect of wave was statistically significant ($\chi^2=186.4$, $df=3$, $p<0.001$) reflecting the dramatic rise of proportion of individuals feeling lonely between wave 1 and wave 2 (figure 1A–C). Further details of the proportion of respondents who felt lonely in the past 2 weeks for each wave stratified by sample characteristics are available in online supplemental table 3.

Respondents who were female ($\chi^2=103.0$, $df=1$, $p<0.001$), younger, that is, 18–24 years ($\chi^2=455.5$, $df=4$, $p<0.001$ for the effect of age), full-time students or unemployed ($\chi^2=265.2$, $df=4$, $p<0.001$ for the effect of working status) were more likely to report feeling lonely across all

waves (figure 1A–C). Respondents who had pre-existing mental health conditions/psychiatric diagnosis were more likely to report feeling lonely (wave 3: 44.0% vs 21.6%; wave 4: 40.7% vs 20.8%).

Coping with stress during the COVID-19 pandemic

For coping with stress during the pandemic in the past 2 weeks, 11.8% (out of 2159; 95% CI 10.5% to 13.3%), 14.9% (out of 4132; 95% CI 13.8% to 16.0%) and 16.2% (out of 4280; 95% CI 15.1% to 17.4%) did not feel stressed due to the pandemic at wave 2, wave 3 and wave 4, respectively (online supplemental table 4–6). The proportion of respondents who responded coping ‘not well’ for wave 2 to wave 4 was 13.5% (95% CI 12.1% to 15.0%), 12.9% (95% CI 11.9% to 14.0%) and 14.2% (95% CI 13.2% to 15.4%), respectively. These proportions did not vary significantly across waves ($\chi^2=3.4$, $df=2$, $p=0.18$). We found individuals who were female ($\chi^2=28.8$, $df=1$, $p<0.001$), younger ($\chi^2=216.4$, $df=4$, $p<0.001$ for the effect of age), unemployed and full-time students ($\chi^2=244.0$, $df=4$, $p<0.001$ for the effect of working status) were more likely to respond

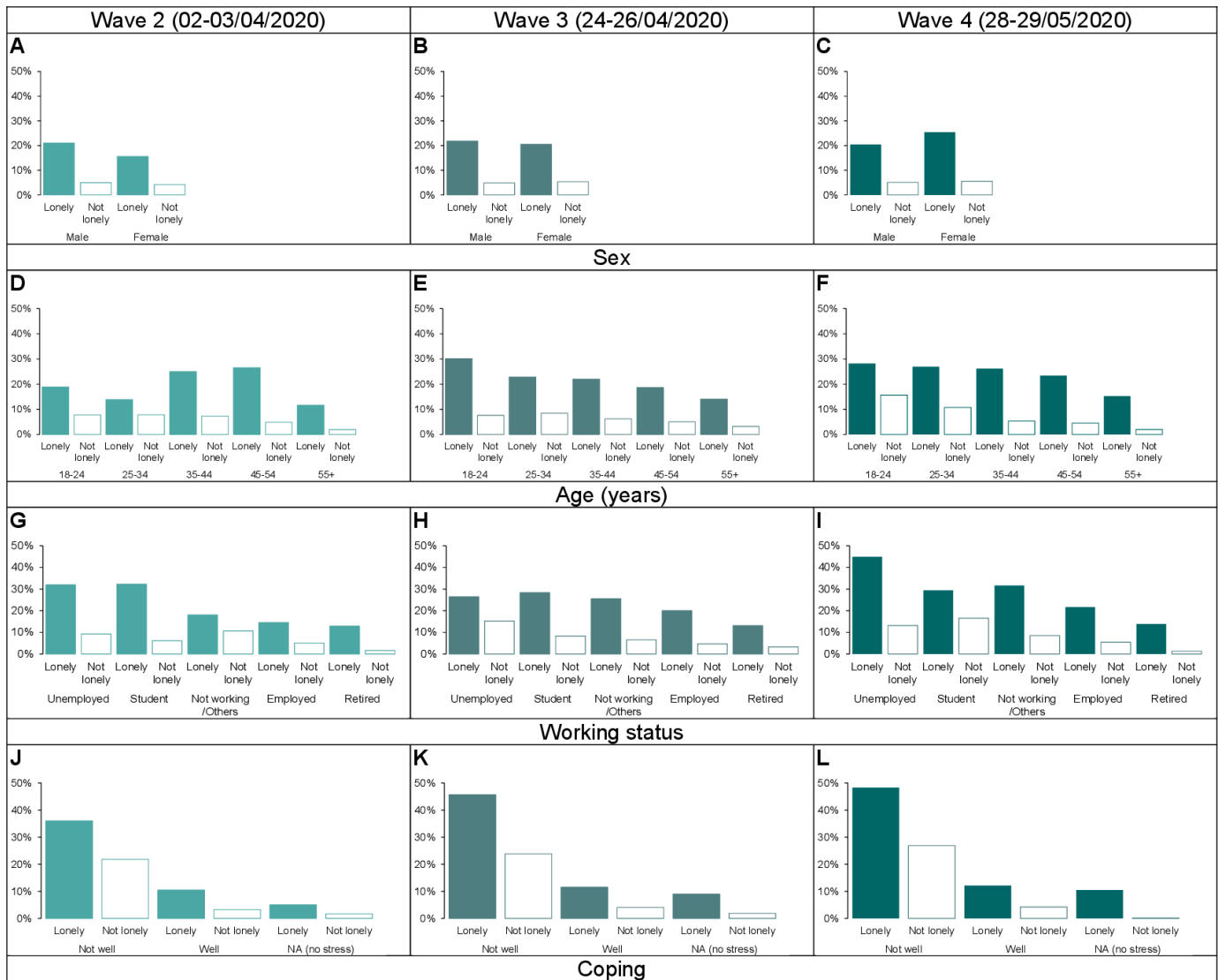


Figure 2 Association of suicidal thoughts in the past 2 weeks during the COVID-19 pandemic and loneliness stratified by sex (A–C), age (D–F), working status (G–I) and coping (J–L). NA, not applicable.

coping ‘not well’ (figure 1D–F). From wave 3 and wave 4, we found respectively 27.3% and 32.1% of individuals with pre-existing mental health conditions responded coping ‘not well’ compared with only 7.8% and 8.6% for respondents without mental health conditions (online supplemental table 5–6). We also found participants who were employed and temporarily furloughed had only slightly higher proportion of not coping well with stress (15.2% vs 11.9% and 16.2% vs 13.2% for wave 3 and wave 4, respectively, online supplemental table 7).

Suicidal thoughts and self-harm during the COVID-19 pandemic

We analysed individual responses on suicidal thoughts (online supplemental table 8) and self-harm behaviours (online supplemental table 9) in the past 2 weeks due to the COVID-19 pandemic collected at wave 2 to wave 4. The proportion of participants with suicidal thoughts slightly increased from 7.7% (out of 2097; 95% CI 6.6% to 9.0%) at wave 2 to 9.4% (out of 3968; 95% CI 8.5%

to 10.3%) at wave 3 and 10.0% (out of 4135; 95% CI 9.1% to 11.1%) at wave 4. The proportion of participants who self-harmed was similar across waves at around 2% (wave 2: 1.9% out of 2111, 95% CI 1.3% to 2.6%; wave 3: 2.2% out of 3988, 95% CI 1.8% to 2.8%; wave 4: 1.9% out of 4156, 95% CI 1.5% to 2.4%; online supplemental table 9). The change in proportion of suicidal thoughts ($\chi^2=5.3$, $df=2$, $p=0.069$) and change in proportion of self-harm ($\chi^2=1.5$, $df=2$, $p=0.480$) were not significantly different across waves. Effects of being female ($\chi^2=8.6$, $df=1$, $p=0.034$ on suicidal thoughts; $\chi^2=4.8$, $df=1$, $p=0.029$ on self-harm), younger age ($\chi^2=228.4$, $df=4$, $p<0.001$ on suicidal thoughts; $\chi^2=87.6$, $df=4$, $p<0.001$ on self-harm) and working status ($\chi^2=199.0$, $df=4$, $p<0.001$ on suicidal thoughts; $\chi^2=80.8$, $df=4$, $p<0.001$ on self-harm) were statistically evident on suicidal thoughts (figure 1G–I, online supplemental table 8) and self-harm (figure 1J–L, online supplemental table 9). Participants who were employed and those furloughed had only slightly higher

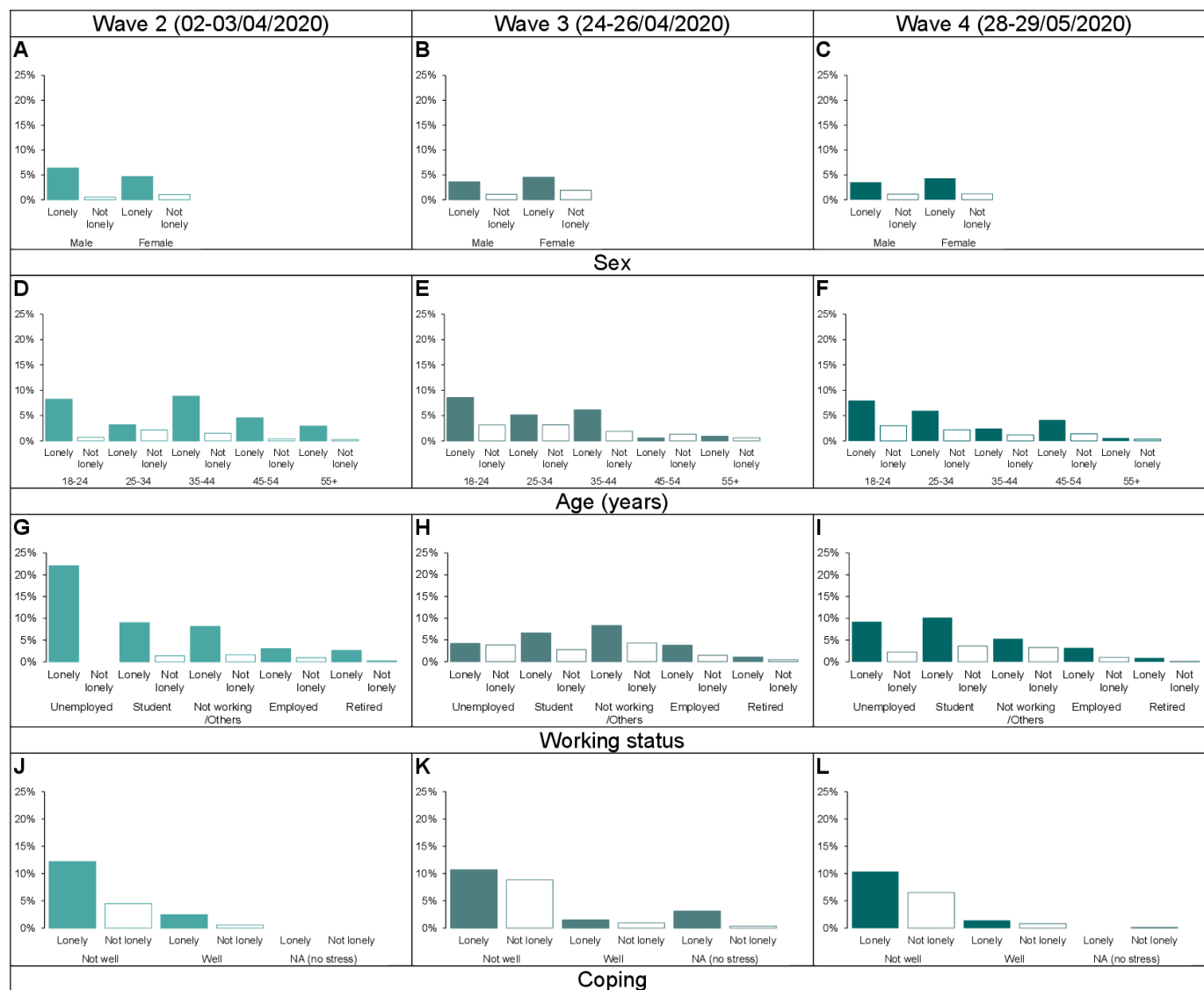


Figure 3 Association of self-harm in the past 2 weeks during the COVID-19 pandemic and loneliness stratified by sex (A–C), age (D–F), working status (G–I) and coping (J–L). NA, not applicable.

proportion of having suicidal thoughts (9.1% vs 8.7% and 11.5% vs 9.3% for wave 3 and wave 4, respectively, online supplemental table 7) and self-harm (2.1% vs 2.1% and 2.3% vs 1.4% for wave 3 and wave 4, respectively, online supplemental table 7) compared with those not being furloughed. Although we observed the proportion of having suicidal thoughts increased over time only in age groups 18–24 and 25–34 years (figure 1H), the wave-by-age interaction was not statistically significant ($\chi^2=9.8$, $df=8$, $p=0.280$).

Suicidal thoughts and self-harm by loneliness and coping

Respondents who felt lonely were more likely to have suicidal thoughts (17.7% out of 2097 for wave 2, 21.0% out of 3968 for wave 3 and 23.5% out of 4135 for wave 4) and to have harmed themselves (5.4% out of 2111 for wave 2, 4.1% out of 3988 for wave 3 and 4.0% out of 4156 for wave 4) than the general population (online supplemental

tables 8 and 9). Compared with respondents who did not feel stressed during the pandemic, we found higher proportions of suicidal thoughts and self-harm for respondents who responded coping ‘not well’ (online supplemental tables 8 and 9). We also performed three-way cross-tabulations on suicidal thoughts (figure 2) and self-harm (figure 3) by loneliness, coping, sex, age and working status to elucidate the effects from these factors across waves. Individuals with the highest risks of suicidal thoughts and self-harm in response to the pandemic were those feeling lonely ($\chi^2=379.9$, $df=1$, $p<0.001$ on suicidal thoughts; $\chi^2=11.0$, $df=1$, $p<0.001$ on self-harm) and responded coping ‘not well’ ($\chi^2=511.8$, $df=1$, $p<0.001$ on suicidal thoughts; $\chi^2=162.0$, $df=1$, $p<0.001$ on self-harm). Both younger age ($\chi^2=119.0$, $df=4$, $p<0.001$ on suicidal thoughts; $\chi^2=53.2$, $df=4$, $p<0.001$ on self-harm) and working status ($\chi^2=111.9$, $df=4$, $p<0.001$ on suicidal thoughts; $\chi^2=62.5$, $df=1$, $p<0.001$ on self-harm) were also

Table 1 Sample characteristics

	Wave 1 (17–18 March 2020)			Wave 2 (2–3 April 2020)			Wave 3 (24–26 April 2020)			Wave 4 (28–29 May 2020)		
	Counts*	%*	95% CI	Counts*	%*	95% CI	Counts*	%*	95% CI	Counts*	%*	95% CI
Sex												
Male	1031.1	48.5	46.3 to 50.7	1077.2	48.5	46.4 to 50.6	2059.3	48.5	47.0 to 50.0	2125.3	48.5	46.9 to 50.1
Female	1094.9	51.5	49.3 to 53.7	1143.8	51.5	49.4 to 53.6	2186.7	51.5	50.0 to 53.0	2256.7	51.5	49.9 to 53.1
Age (years)												
18–24	236.0	11.1	9.6 to 12.7	246.5	11.1	9.7 to 12.6	471.3	11.1	10.1 to 12.2	486.4	11.1	9.9 to 12.4
25–34	355.0	16.7	15.1 to 18.4	360.4	16.2	14.7 to 17.9	682.4	16.1	15.0 to 17.2	694.6	15.9	14.7 to 17.1
35–44	345.7	16.3	14.7 to 17.9	379.3	17.1	15.5 to 18.8	700.2	16.5	15.4 to 17.7	738.6	16.9	15.7 to 18.0
45–54	368.1	17.3	15.8 to 19.0	353.9	15.9	14.5 to 17.5	701.0	16.5	15.4 to 17.7	761.9	17.4	16.3 to 18.6
55+	821.3	38.6	36.6 to 40.7	880.8	39.7	37.6 to 41.7	1691.1	39.8	38.4 to 41.3	1700.5	38.8	37.3 to 40.3
Social grade												
ABC1	1211.8	57.0	54.8 to 59.2	1266.0	57.0	54.9 to 59.1	2420.2	57.0	55.5 to 58.5	2497.7	57.0	55.4 to 58.6
C2DE	914.2	43.0	40.8 to 45.2	955.0	43.0	40.9 to 45.1	1825.8	43.0	41.5 to 44.5	1884.3	43.0	41.4 to 44.6
Marital status												
Married/civil partnership	955.1	44.9	42.8 to 47.1	1006.4	45.3	43.2 to 47.4	1855.9	43.7	42.2 to 45.2	1995.2	45.5	44.0 to 47.1
Living as married	302.1	14.2	12.8 to 15.8	298.3	13.4	12.1 to 14.9	576.6	13.6	12.6 to 14.7	605.3	13.8	12.8 to 14.9
Separated/divorced	180.3	8.5	7.4 to 9.7	204.3	9.2	8.1 to 10.5	375.0	8.8	8.0 to 9.7	366.8	8.4	7.6 to 9.2
Widowed	85.8	4.0	3.3 to 4.9	74.0	3.3	2.7 to 4.1	146.8	3.5	3.0 to 4.0	137.2	3.1	2.7 to 3.7
Never married	589.5	27.7	25.8 to 29.8	621.0	28.0	26.0 to 30.0	1272.3	30.0	28.6 to 31.4	1244.4	28.4	26.9 to 29.9
Not known	13.2	0.6	0.4 to 1.1	16.9	0.8	0.5 to 1.3	19.4	0.5	0.3 to 0.7	33.0	0.8	0.5 to 1.1
Working status												
Employed†	1189.0	55.9	53.8 to 58.1	1265.1	57.0	54.9 to 59.0	2247.3	52.9	51.4 to 54.4	2378.3	54.3	52.7 to 55.8
Unemployed	79.5	3.7	3.0 to 4.7	86.7	3.9	3.1 to 4.9	198.0	4.7	4.0 to 5.4	181.9	4.2	3.5 to 4.9
Not working/others	207.9	9.8	8.5 to 11.2	214.8	9.7	8.5 to 11.0	491.4	11.6	10.6 to 12.6	521.0	11.9	10.9 to 12.9
Full-time student	148.2	7.0	5.8 to 8.3	135.6	6.1	5.1 to 7.3	245.7	5.8	5.1 to 6.6	218.4	5.0	4.2 to 5.9
Retired	501.4	23.6	21.8 to 25.4	518.9	23.4	21.7 to 25.1	1063.7	25.1	23.8 to 26.4	1082.5	24.7	23.5 to 26.0
Mental health condition/psychiatric diagnosis												
No	–	–	–	–	–	–	3091.2	72.8	71.4 to 74.1	3180.5	72.6	71.1 to 74.0
Yes	–	–	–	–	–	–	856.9	20.2	19.0 to 21.4	933.6	21.3	20.0 to 22.6
Prefer not to say/not known	–	–	–	–	–	–	297.8	7.0	6.3 to 7.9	267.9	6.1	5.4 to 6.9
Being parent/guardian	1220.9	57.4	55.2 to 59.6	1240.9	55.9	53.7 to 58.0	2307.7	54.4	52.8 to 55.9	2402.9	54.8	53.3 to 56.4
Number of children in household												
0	1458.3	68.6	66.5 to 70.6	1579.2	71.1	69.1 to 73.0	3111.3	73.3	71.9 to 74.6	3152.9	72.0	70.5 to 73.4

Continued



Table 1 Continued

	Wave 1 (17–18 March 2020)			Wave 2 (2–3 April 2020)			Wave 3 (24–26 April 2020)			Wave 4 (28–29 May 2020)		
	Counts*	%*	95% CI	Counts*	%*	95% CI	Counts*	%*	95% CI	Counts*	%*	95% CI
	n=2126 (2126.0)*			n=2221 (2221.0)*			n=4246 (4246.0)*			n=4382 (4382.0)*		
1	298.3	14.0	12.6 to 15.6	278.2	12.5	11.2 to 14.0	472.8	11.1	10.2 to 12.1	550.2	12.6	11.5 to 13.7
2	248.4	11.7	10.3 to 13.2	213.3	9.6	8.4 to 10.9	421.8	9.9	9.1 to 10.9	415.3	9.5	8.6 to 10.4
3+	87.2	4.1	3.3 to 5.1	88.3	4.0	3.2 to 4.9	151.4	3.6	3.0 to 4.2	181.7	4.1	3.5 to 4.8
Refused to answer	33.8	1.6	1.1 to 2.2	62.1	2.8	2.2 to 3.6	88.7	2.1	1.7 to 2.6	82.0	1.9	1.5 to 2.4
Living arrangements‡												
Alone	-	-	-	-	-	-	850.6	20.0	18.8 to 21.3	758.3	17.3	16.2 to 18.5
Spouse/partner	-	-	-	-	-	-	2380.5	56.1	54.5 to 57.6	2576.5	58.8	57.2 to 60.4
Relative(s)	-	-	-	-	-	-	1444.2	34.0	32.6 to 35.5	1610.8	36.8	35.2 to 38.3
Friend(s)/housemate(s)	-	-	-	-	-	-	184.9	4.4	3.7 to 5.1	129.0	2.9	2.5 to 3.5

*Weighted bases.

†Includes working full-time and part-time.

‡Row % do not add up to 100% because categories are non-mutually exclusive.

significant risk factors. We did not observe significant effect of sex, wave nor wave-related interactions on suicidal thoughts/self-harm from all three-way cross-tabulations.

Factors associated with suicidal thoughts and self-harm during the COVID-19 pandemic

We built binomial regression models to quantify the effect size (RR and RD) of loneliness, coping and other covariates on suicidal thoughts (table 2, online supplemental table 10) and self-harm (table 2, online supplemental table 11) for data collected at wave 3 and wave 4 only. In the unadjusted analyses for suicidal thoughts, RRs and RDs were all significantly greater than 1 and 0 respectively for loneliness, coping 'not well', young age, unemployment and being full-time students compared with the respective references. Similar patterns were observed for self-harm although the RD between unemployed and employed categories was marginally non-significant (RD=0.022, 95% CI -0.001 to 0.045, p=0.055). The effect of having pre-existing mental health conditions was also strong and statistically significant for both suicidal thoughts (RR=4.9, 95% CI 4.2 to 5.7, p<0.001; RD=0.191, 95% CI 0.169 to 0.214, p<0.001, online supplemental table 10) and self-harm (RR=6.9, 95% CI 4.8 to 10.0, p<0.001; RD=0.047, 95% CI 0.036 to 0.059, p<0.001, online supplemental table 11).

The effect sizes of the variables on suicidal thoughts and self-harm were reduced in the adjusted models (table 2, online supplemental tables 10 and 11). For suicidal thoughts, effect sizes of loneliness and coping 'not well' with stress remained statistically significant. The effect sizes were the largest in the younger age group (18–24, 25–34 and 35–44 years) and remained significant in the adjusted analysis but decreased monotonically with older age groups (for RR: χ^2 for testing linear trend=8.8, df=1, p=0.003; for RD: χ^2 for testing linear trend=8.5, df=1, p=0.004). Effect of working status was no longer a significant risk factor in the adjusted model. For self-harm, only coping 'not well' and age remained strong and robust risk factors in the adjusted model, with the effect sizes of age decreased for older age groups (table 2 and online supplemental table 11; for RR: χ^2 for testing linear trend=15.3, df=1, p<0.001; for RD: χ^2 for testing linear trend=9.5, df=1, p=0.002). Loneliness and working status were no longer significant effects. Not surprisingly, having pre-existing mental health conditions remained a statistically robust factor in the adjusted analysis for both suicidal thoughts (RR=2.2, 95% CI 1.9 to 2.7, p<0.001; RD=0.077, 95% CI 0.059 to 0.094, p<0.001, table 2 and online supplemental table 10) and self-harm (RR=2.8, 95% CI 1.9 to 4.2, p<0.001; RD=0.020, 95% CI 0.012 to 0.028, p<0.001, table 2 and online supplemental table 11). Between wave 2 and wave 4, we did not find statistical evidence supporting for change in the risk of having suicidal thoughts/self-harm, nor change in the time-related interactions with loneliness, coping, sex, age or working status.

Table 2 Summary of risk ratios (RR) and risk differences (RD) (with 95% CIs) of time (wave), loneliness, coping, age and working status on suicide thoughts and self-harm in unadjusted and adjusted binomial regression models based on data from wave 3 and wave 4

Outcome	Variable	Category	Unadjusted model						Adjusted model*					
			Risk Ratio (RR)			Risk Difference (RD)			Risk Ratio (RR)			Risk Difference (RD)		
			RR	P value	95% CI	RD	P value	95% CI	RR	P value	95% CI	RD	P value	95% CI
Suicidal thoughts	Wave†	Wave 4	1.1	<0.001	0.9 to 1.2	0.007	<0.001	-0.007 to 0.020	0.9	0.510	0.7 to 1.2	0.008	<0.001	-0.004 to 0.020
	Loneliness‡	Yes	4.3	<0.001	3.7 to 5.0	0.171	<0.001	0.150 to 0.200	1.8	<0.001	1.5 to 2.1	0.053	<0.001	0.036 to 0.069
	Coping§	NA (no stress)	0.3	<0.001	0.2 to 0.4	-0.044	<0.001	-0.054 to -0.034	0.3	<0.001	0.2 to 0.6	-0.041	<0.001	-0.055 to -0.027
		Not well	6.3	<0.001	5.5 to 7.2	0.321	<0.001	0.289 to 0.353	3.4	<0.001	2.8 to 4.0	0.150	<0.001	0.124 to 0.176
	Sex¶	Female	1.3	0.001	1.1 to 1.5	0.024	0.001	0.010 to 0.038	1.0	0.470	0.9 to 1.2	0.005	0.420	-0.007 to 0.017
	Age (years)**	18-24	4.2	<0.001	3.4 to 5.3	0.153	<0.001	0.120 to 0.186	1.7	0.005	1.2 to 2.4	0.048	0.005	0.014 to 0.081
		25-34	3.2	<0.001	2.6 to 3.9	0.103	<0.001	0.081 to 0.126	1.5	0.023	1.1 to 2.1	0.034	0.019	0.006 to 0.062
		35-44	2.4	<0.001	1.9 to 3.0	0.065	<0.001	0.046 to 0.085	1.4	0.049	1.0 to 1.9	0.026	0.043	0.001 to 0.051
		45-54	1.7	<0.001	1.4 to 2.2	0.034	<0.001	0.018 to 0.050	1.2	0.240	0.9 to 1.6	0.014	0.240	-0.009 to 0.037
	Working status††	Unemployed	2.3	<0.001	1.8 to 2.9	0.117	<0.001	0.068 to 0.167	1.1	0.150	1.0 to 1.4	0.014	0.140	-0.005 to 0.033
	Not working/others	1.7	<0.001	1.4 to 2.0	0.062	<0.001	0.035 to 0.088	1.1	0.490	0.9 to 1.3	0.005	0.520	-0.011 to 0.021	
Self-harm	Wave†	Wave 4	0.9	0.340	0.6 to 1.2	-0.003	0.330	-0.010 to 0.003	0.6	0.150	0.3 to 1.2	-0.001	0.760	-0.008 to 0.006
	Loneliness‡	Yes	3.1	<0.001	2.2 to 4.3	0.028	<0.001	0.018 to 0.037	1.2	0.360	0.8 to 1.7	0.003	0.370	-0.004 to 0.011
	Coping§	NA (no stress)	0.3	0.043	0.1 to 1.0	-0.007	0.003	-0.011 to -0.002	0.4	0.160	0.1 to 1.4	-0.005	0.120	-0.012 to 0.001
	Sex¶	Not well	9.1	<0.001	6.5 to 12.8	0.082	<0.001	0.063 to 0.102	4.6	<0.001	3.1 to 6.8	0.040	<0.001	0.027 to 0.053
	Age (years)**	Female	1.5	0.030	1.0 to 2.1	0.008	0.023	0.001 to 0.014	1.1	0.520	0.8 to 1.6	0.003	0.510	-0.005 to 0.010
		18-24	10.4	<0.001	5.9 to 18.2	10.400	<0.001	5.900 to 18.200	5.7	<0.001	2.3 to 14.2	0.034	0.004	0.011 to 0.057
		25-34	6.9	<0.001	4.0 to 12.1	6.900	<0.001	4.000 to 12.100	4.0	0.001	1.8 to 9.0	0.022	0.001	0.009 to 0.035
		35-44	4.4	<0.001	2.4 to 7.9	4.400	<0.001	2.400 to 7.900	2.8	0.007	1.3 to 5.9	0.014	0.004	0.005 to 0.024
		45-54	3.0	0.001	1.6 to 5.6	3.000	0.001	1.600 to 5.600	2.0	0.068	1.0 to 4.1	0.007	0.057	0.000 to 0.015
	Working status††	Unemployed	2.2	0.010	1.2 to 4.0	0.022	0.055	-0.001 to 0.045	1.1	0.780	0.6 to 2.2	0.002	0.780	-0.011 to 0.015
	Not working/others	2.2	<0.001	1.4 to 3.3	0.021	0.003	0.007 to 0.035	1.5	0.100	0.9 to 2.5	0.009	0.140	-0.003 to 0.021	
Mental health condition/psychiatric diagnosis‡‡	Full-time student	2.1	<0.001	1.6 to 2.6	0.097	<0.001	0.054 to 0.141	1.1	0.610	0.8 to 1.3	0.007	0.530	-0.016 to 0.030	
	Retired	0.5	<0.001	0.4 to 0.6	-0.050	<0.001	-0.063 to -0.038	1.0	0.770	0.8 to 1.4	0.006	0.720	-0.025 to 0.036	
Suicide thoughts	Wave†	Wave 4	4.1	<0.001	3.2 to 5.3	0.154	<0.001	0.110 to 0.198	2.5	<0.001	1.9 to 3.1	0.089	<0.001	0.058 to 0.121
	Loneliness‡	Yes	3.1	<0.001	2.2 to 4.3	0.028	<0.001	0.018 to 0.037	1.2	0.360	0.8 to 1.7	0.003	0.370	-0.004 to 0.011
	Coping§	NA (no stress)	0.3	0.043	0.1 to 1.0	-0.007	0.003	-0.011 to -0.002	0.4	0.160	0.1 to 1.4	-0.005	0.120	-0.012 to 0.001
	Sex¶	Not well	9.1	<0.001	6.5 to 12.8	0.082	<0.001	0.063 to 0.102	4.6	<0.001	3.1 to 6.8	0.040	<0.001	0.027 to 0.053
	Age (years)**	Female	1.5	0.030	1.0 to 2.1	0.008	0.023	0.001 to 0.014	1.1	0.520	0.8 to 1.6	0.003	0.510	-0.005 to 0.010
		18-24	10.4	<0.001	5.9 to 18.2	10.400	<0.001	5.900 to 18.200	5.7	<0.001	2.3 to 14.2	0.034	0.004	0.011 to 0.057
		25-34	6.9	<0.001	4.0 to 12.1	6.900	<0.001	4.000 to 12.100	4.0	0.001	1.8 to 9.0	0.022	0.001	0.009 to 0.035
		35-44	4.4	<0.001	2.4 to 7.9	4.400	<0.001	2.400 to 7.900	2.8	0.007	1.3 to 5.9	0.014	0.004	0.005 to 0.024
		45-54	3.0	0.001	1.6 to 5.6	3.000	0.001	1.600 to 5.600	2.0	0.068	1.0 to 4.1	0.007	0.057	0.000 to 0.015
	Working status††	Unemployed	2.2	0.010	1.2 to 4.0	0.022	0.055	-0.001 to 0.045	1.1	0.780	0.6 to 2.2	0.002	0.780	-0.011 to 0.015
	Not working/others	2.2	<0.001	1.4 to 3.3	0.021	0.003	0.007 to 0.035	1.5	0.100	0.9 to 2.5	0.009	0.140	-0.003 to 0.021	
Mental health condition/psychiatric diagnosis‡‡	Full-time student	2.1	<0.001	1.6 to 2.6	0.097	<0.001	0.054 to 0.141	1.1	0.610	0.8 to 1.3	0.007	0.530	-0.016 to 0.030	
	Retired	0.5	<0.001	0.4 to 0.6	-0.050	<0.001	-0.063 to -0.038	1.0	0.770	0.8 to 1.4	0.006	0.720	-0.025 to 0.036	
Suicide thoughts	Wave†	Wave 4	4.1	<0.001	3.2 to 5.3	0.154	<0.001	0.110 to 0.198	2.5	<0.001	1.9 to 3.1	0.089	<0.001	0.058 to 0.121
	Loneliness‡	Yes	3.1	<0.001	2.2 to 4.3	0.028	<0.001	0.018 to 0.037	1.2	0.360	0.8 to 1.7	0.003	0.370	-0.004 to 0.011
	Coping§	NA (no stress)	0.3	0.043	0.1 to 1.0	-0.007	0.003	-0.011 to -0.002	0.4	0.160	0.1 to 1.4	-0.005	0.120	-0.012 to 0.001
	Sex¶	Not well	9.1	<0.001	6.5 to 12.8	0.082	<0.001	0.063 to 0.102	4.6	<0.001	3.1 to 6.8	0.040	<0.001	0.027 to 0.053
	Age (years)**	Female	1.5	0.030	1.0 to 2.1	0.008	0.023	0.001 to 0.014	1.1	0.520	0.8 to 1.6	0.003	0.510	-0.005 to 0.010
		18-24	10.4	<0.001	5.9 to 18.2	10.400	<0.001	5.900 to 18.200	5.7	<0.001	2.3 to 14.2	0.034	0.004	0.011 to 0.057
		25-34	6.9	<0.001	4.0 to 12.1	6.900	<0.001	4.000 to 12.100	4.0	0.001	1.8 to 9.0	0.022	0.001	0.009 to 0.035
		35-44	4.4	<0.001	2.4 to 7.9	4.400	<0.001	2.400 to 7.900	2.8	0.007	1.3 to 5.9	0.014	0.004	0.005 to 0.024
		45-54	3.0	0.001	1.6 to 5.6	3.000	0.001	1.600 to 5.600	2.0	0.068	1.0 to 4.1	0.007	0.057	0.000 to 0.015
	Working status††	Unemployed	2.2	0.010	1.2 to 4.0	0.022	0.055	-0.001 to 0.045	1.1	0.780	0.6 to 2.2	0.002	0.780	-0.011 to 0.015
	Not working/others	2.2	<0.001	1.4 to 3.3	0.021	0.003	0.007 to 0.035	1.5	0.100	0.9 to 2.5	0.009	0.140	-0.003 to 0.021	
Mental health condition/psychiatric diagnosis‡‡	Full-time student	2.1	<0.001	1.6 to 2.6	0.097	<0.001	0.054 to 0.141	1.1	0.610	0.8 to 1.3	0.007	0.530	-0.016 to 0.030	
	Retired	0.5	<0.001	0.4 to 0.6	-0.050	<0.001	-0.063 to -0.038	1.0	0.770	0.8 to 1.4	0.006	0.720	-0.025 to 0.036	
Suicide thoughts	Wave†	Wave 4	4.1	<0.001	3.2 to 5.3	0.154	<0.001	0.110 to 0.198	2.5	<0.001	1.9 to 3.1	0.089	<0.001	0.058 to 0.121
	Loneliness‡	Yes	3.1	<0.001	2.2 to 4.3	0.028	<0.001	0.018 to 0.037	1.2	0.360	0.8 to 1.7	0.003	0.370	-0.004 to 0.011
	Coping§	NA (no stress)	0.3	0.043	0.1 to 1.0	-0.007	0.003	-0.011 to -0.002	0.4	0.160	0.1 to 1.4	-0.005	0.120	-0.012 to 0.001
	Sex¶	Not well	9.1	<0.001	6.5 to 12.8	0.082	<0.001	0.063 to 0.102	4.6	<0.001	3.1 to 6.8	0.040	<0.001	0.027 to 0.053
	Age (years)**	Female	1.5	0.030	1.0 to 2.1	0.008	0.023	0.001 to 0.014	1.1	0.520	0.8 to 1.6	0.003	0.510	-0.005 to 0.010
		18-24	10.4	<0.001	5.9 to 18.2	10.400	<0.001	5.900 to 18.200	5.7	<0.001	2.3 to 14.2	0.034	0.004	0.011 to 0.057
		25-34	6.9	<0.001	4.0 to 12.1	6.900	<0.001	4.000 to 12.100	4.0	0.001	1.8 to 9.0	0.022	0.001	0.009 to 0.035
		35-44	4.4	<0.001	2.4 to 7.9	4.400	<0.001	2.400 to 7.900	2.8	0.007	1.3 to 5.9	0.014	0.004	0.005 to 0.024
		45-54	3.0	0.001	1.6 to 5.6	3.000	0.001	1.600 to 5.600	2.0	0.068	1.0 to 4.1	0.007	0.057	0.000 to 0.015
	Working status††	Unemployed	2.2	0.010	1.2 to 4.0	0.022	0.055	-0.001 to 0.045	1.1	0.780	0.6 to 2.2	0.002	0.780	-0.011 to 0.015
	Not working/others	2.2	<0.001	1.4 to 3.3	0.021	0.003	0.007 to 0.035	1.5	0.100	0.9 to 2.5	0.009	0.140	-0.003 to 0.021	
Mental health condition/psychiatric diagnosis‡‡	Full-time student	2.1	<0.001	1.6 to 2.6	0.097	<0.001	0.054 to 0.141	1.1	0.610	0.8 to 1.3	0.007	0.530	-0.016 to 0.030	
	Retired	0.5	<0.001	0.4 to 0.6	-0.050	<0.001	-0.063 to -0.038	1.0	0.770	0.8 to 1.4	0.006	0.720	-0.025 to 0.036	
Suicide thoughts	Wave†	Wave 4	4.1	<0.001	3.2 to 5.3	0.154	<0.001	0.110 to 0.198	2.5	<0.001	1.9 to 3.1	0.089	<0.001	0.058 to 0.121
	Loneliness‡	Yes	3.1	<0.001	2.2 to 4.3	0.028	<0.001	0.018 to 0.037	1.2	0.360	0.8 to 1.7	0.003	0.370	-0.004 to 0.011
	Coping§	NA (no stress)	0.3	0.043	0.1 to 1.0	-0.007	0.003	-0.011 to -0.002	0.4	0.160	0.1 to 1.4	-0.005	0.120	-0.012 to 0.001
	Sex¶	Not well	9.1	<0.001	6.5 to 12.8	0.082	<0.001	0.063 to 0.102	4.6	<0.001	3.1 to 6.8	0.040	<0.001	0.027 to 0.053
	Age (years)**	Female	1.5	0.030	1.0 to 2.1	0.008								



Table 2 Continued

Outcome	Variable	Category	Unadjusted model						Adjusted model*					
			Risk Ratio (RR)			Risk Difference (RD)			Risk Ratio (RR)			Risk Difference (RD)		
			RR	P value	95% CI	RD	P value	95% CI	RR	P value	95% CI	RD	P value	95% CI
Mental health condition/psychiatric diagnosis ^{††}	Yes		6.9	<0.001	4.8 to 10.0	0.047	<0.001	0.036 to 0.059	2.8	<0.001	1.9 to 4.2	0.020	<0.001	0.012 to 0.028
	Prefer not to say/ not known		6.8	<0.001	4.0 to 11.8	0.047	<0.001	0.022 to 0.072	3.8	<0.001	2.1 to 6.8	0.030	0.004	0.009 to 0.051

*Adjusted for wave, loneliness, coping, sex, age, social grade, marital status, working status, mental health condition/psychiatric diagnosis, being parent/guardian, number of children in household, living arrangements, urban/rural residence, second-order interactions of wave-by-loneliness, wave-by-coping, wave-by-sex, wave-by-age and wave-by-working status.

†Reference: Wave 3.
 ‡Reference: Not lonely.
 §Reference: Coping well.
 ¶Reference: Male.
 **Reference: 55+.
 ††Reference: Employed.
 ‡‡Reference: No.

Results from the sensitivity analysis which combined data from wave 2 to wave 4 and contained only a subset of independent variables from the main analysis were generally consistent with the main analysis with minor exceptions (online supplemental tables 12 and 13). For the adjusted analysis on suicidal thoughts (online supplemental table 12), the statistically robust effects of loneliness, coping and younger age were consistent with the respective model of the main analysis (online supplemental table 10). However, the effect of working status became significant in the adjusted model of the sensitivity analysis, particularly for the unemployed and not working/others groups. In keeping with the main analysis, we found no significant effect of wave nor effects of wave-related interactions except the wave-by-sex interaction. This reflected the differential trends of the risk of having suicidal thoughts between sexes from wave 2 (male: 8.2%, 95% CI 6.5% to 10.2%; female: 7.3%, 95% CI 5.9% to 9.0%) to wave 3 (male: 8.7%, 95% CI 7.4% to 10.1%; female: 10.0%, 95% CI 8.8% to 11.4%, online supplemental table 8). For self-harm, we found significant effects of coping and younger age but not working status in the adjusted model of the sensitivity analysis (online supplemental table 13), concurring with the respective main analysis (online supplemental table 11). However, the effect of loneliness was statistically significant in the adjusted model of the sensitivity analysis but not in the respective model of the main analysis. Neither the effect of wave nor the effects of wave-related interactions reached the level of statistical significance.

DISCUSSION

Main findings

This study is one of the few examining the mental health and well-being of the UK population with baseline data from a week before lockdown was announced (wave 1) and for the next 10 weeks (wave 2 to wave 4). We documented a sharp increase in loneliness among the UK population between wave 1 (9.8%) and wave 2 (23.9%) of data collection (late March 2020) when lockdown measures were implemented, particularly in young people. The proportion of the population coping 'not well' across waves remained stable at around 13.5%. Suicidal thoughts and self-harm similarly remained stable between wave 2 and wave 4 at 7.7%–10.0% and 1.9%–2.2%, respectively. We found that feeling lonely, coping 'not well' with stress, as well as younger age groups and those with pre-existing mental health conditions were associated with the highest risk of having suicidal thoughts and self-harm. For individuals aged between 18 and 24 years, risk of suicidal thoughts and self-harm were ~15%–20% and 5%, respectively, and no statistically significant increase was found over time. Around 25% and 5% of individuals with pre-existing mental health conditions had suicidal thoughts and harmed themselves, respectively. Rates of suicidal thoughts and self-harm were slightly higher for individuals from the lower socioeconomic category

(8.0%–11.0% and 2.1%–2.3%, respectively) compared with those from the higher category but social grade was not a significant predictor when we controlled for other covariates.

Loneliness and coping remained significantly associated with suicidal thoughts whereas coping with stress but not loneliness was an important factor for self-harm when we adjusted our analyses for other covariates at a personal, household and area level. Having pre-existing mental health conditions or psychiatric diagnosis was a strong and statistically robust risk factor for both outcomes. For sociodemographic factors, we found that effect sizes remained the largest and statistically significant for the youngest (18–24 years) and monotonically decreased with older age groups for both suicidal thoughts and self-harm. In contrast, the effect of employment status was not statistically evident. Our results did not identify significant temporal changes in the risk of having suicidal thoughts/self-harm and the effects of the interested risk factors on the outcomes remained constant between wave 3 and wave 4. Our sensitivity analysis was in agreement with the main analysis with minor exceptions. We believed that those disagreements stem from the omission of important risk factors (eg, pre-existing mental health conditions) due to data unavailability at wave 2 in the sensitivity analysis, resulting in overestimation of other effects and interactions. Interestingly, loneliness was a statistically robust risk factor for self-harm only in the sensitivity but not in the main analysis where more covariates, including pre-existing mental health conditions, were included in the adjusted model. This difference and our other results are consistent with the findings of a recent review on the impact of loneliness and social isolation measures related to disease containment which showed high correlation of loneliness and mental health symptoms in children and young people.¹⁸

Due to differences in sampling methodologies and measures used, direct comparison of prevalences found in our study with other studies is not robust. Our measures on suicidal thoughts/self-harm were asked in relation to them being a consequence of the pandemic. Thus, the respective prevalences are lower than those from similar UK population-based survey (eg, Iob and colleagues²⁸) since instances not related to the pandemic might not be captured. Nonetheless, our prevalence of having mental health conditions (~20%) is in keeping with other UK studies (~17%–26%^{28 29 36–38}). After the UK lockdown from early April 2020 (wave 2 onwards), we did not observe any further significant increase in the proportion of participants with suicidal thoughts, self-harm, loneliness and coping not well. This is consistent with the constant or even decreasing trends of various mental health outcomes for the general population shortly after lockdown.^{29 37 38} Notably, our increasing, although non-significant trend of suicidal thoughts from early April to the end of May 2020 qualitatively tallies with the increase of suicidal ideation over the same period in a similar study.²⁹

Results from our unadjusted analyses are similar to others suggesting suicidal thoughts and self-harm are higher among women, younger ages, people experiencing socioeconomic disadvantage and those with pre-existing mental conditions.^{28 29} These factors are strongly associated with other adverse mental health outcomes during the pandemic as reported elsewhere.^{37–41} Comparison of effect sizes from multivariable analyses across studies is more challenging because of the differences in the use and definitions of outcomes and covariates. Nonetheless, pre-existing mental health conditions and lack of coping are strongly associated with suicidal thoughts/self-harm. Young people with pre-existing mental health issues and not coping well were unsurprisingly more likely to experience adverse outcomes, the effect size of loneliness reduced (especially in relation to self-harm) when all measured psychosocial, demographical and environmental factors were adjusted for.

It has been suggested that young adults are more susceptible to stressors because of their ongoing transitions across multiple aspects of life.^{13 42–44} These transitions involve personal (becoming financially independent), interpersonal (building of romantic relationships), educational (graduating from schools), professional (entering the labour market) and environmental (beginning living away from family) changes which are unprecedented and uncertain.^{13 45} Distress could be exacerbated by the additional uncertainty, hopelessness and worries associated with the COVID-19 pandemic and lockdown.⁴⁵ The pandemic-associated economic decline may disproportionately impact young adults as they are already more likely to be at the margin of the labour market.^{46 47} Social isolation through stay at home orders likely impeded interactions with friends, colleagues or romantic partners thereby weakening existing social supports and promoting loneliness.¹³

Strength and limitations

This study is a novel and timely investigation that explores the determinants of suicidal thoughts and self-harm in the UK general population in the ongoing COVID-19 pandemic. Timeliness, including the need for prelockdown data, necessitated quota over probability sampling. We made use of an online population survey, the only feasible method of recruitment during lockdown that contained questions on suicidal thoughts, self-harm, loneliness coping with stress alongside a broad range of other factors. Since data were collected from panelists recruited from all UK nations with quota sampling and weighting, our results are representative for the UK adult general population. The survey is repeated approximately every 3–4 weeks, began prelockdown from mid-March 2020 so that change in outcomes and other factors due to the evolving nature of the outbreak (eg, increase in loneliness after lockdown) were captured. We included suicidal thoughts and self-harm behaviours as outcomes and examined their determinants. We adjusted for a number of covariates that cover psychosocial (loneliness



and coping), demographic and environmental aspects. We believe that similar population-based repeat surveys are not commonly reported.

A major limitation is the use of non-probability quota sampling through online recruitment.⁴⁸ However, while an opt-in online panel is cost-effective for recruiting a sizeable number of diverse individuals within a short time frame,⁴⁹ we could not determine the response rate for the survey. Doubts have also been cast on the representativeness of non-probability internet-based samples as the outcome of interest may differ from that of the target population even when quotas and weighting were applied.⁴⁹ Digital poverty (particularly for older population) and the digital divide may hamper representativeness and data validity. It is worth noting that full-time students were over-represented (~7%) in our sample when compared with available statistics (~4%, from ~2 million students studied in higher education institutions out of ~52 million UK adult population in 2019/2020^{50 51}). In order to increase statistical power for subgroup analyses, sample sizes in waves 3 and 4 were approximately doubled compared with those in waves 1 and 2. Therefore, our prevalences should not be regarded as precise and conventional estimates. Nonetheless, online surveys are a viable method to recruit participants within a short period at multiple instances and to circumvent the impossibility of using other recruitment and sampling strategies that require actual fieldwork (eg, face-to-face interview) due to the pandemic outbreak.

This study adopted a repeated cross-sectional approach where sample population were different at each wave. Caution is needed to interpret changes over time and between-subject variability across waves needed to be considered. The same limitation applies to establishing causation from data across time points. However, our results are still comparable across waves and representative of the adult UK population.

Questions on suicidal thoughts and self-harm were asked as a result of the pandemic. Thus, interpretation of the prevalences requires caution as the actual prevalence of these outcomes may be underestimated due to under-reporting of instances not related to the pandemic. As a public mental health survey, we did not include validated measures for screening of mental disorders and psychiatric conditions such as depression and anxiety as adopted by others.⁵² Not all individuals with mental health conditions experienced the same level of stress during the pandemic in the same way (eg, those with social phobia, differences in symptom severity and chronicity⁵³). Thus, our findings of a strong association between pre-existing mental health conditions and having suicidal thoughts/self-harm may vary across those with specific mental health issues. Not all participants provided conclusive answers on having pre-existing mental health conditions and we found similar relative risks of having suicidal thoughts/self-harm between participants having mental health conditions and those with missing/inconclusive responses. Given such similarity, we may surmise

that those who made inconclusive responses were likely to have mental health conditions. However, we cannot reliably exclude other factors that may have contributed to the elevated risks. In any case, we demonstrated that having pre-existing mental health conditions/psychiatric diagnosis was a robust factor associated with suicidal thoughts and self-harm.

Other limitations include the usual caveats of using self-reported data in surveys. We did not collect data on suicidal thoughts, self-harm outcomes and coping with stress at wave 1, thus baseline levels of these outcomes before the lockdown could not be assessed. Similarly, not all variables (eg, pre-existing mental health conditions) were available for analysis until wave 3 and wave 4. This could limit our ability to assess time trends and interactions between risk factors and time. If these variables were available at wave 1, we might be able to reveal temporal trends that may have been observed shortly before and after the lockdown (as was found for loneliness and in other studies that compare prepandemic and postpandemic/lockdown mental health outcomes^{39 40 54}). We also considered our data as preliminary given the early stage of our study with limited number of waves of data collection and the rapidly changing situation of the ongoing pandemic and the associated policy response. Our socioeconomic variable assessing social grade was dichotomous and as such crude in the assessment of the impact of socioeconomic adversity which may account for our findings and working status provided a more robust assessment. We did not collect data on participants' occupations, thus we were unable to analyse outcomes for specific occupation, for example, healthcare or key workers. Due to model convergence issues, we could not include furlough status into the regression models and thus comparisons of outcomes between individuals who were or were not furloughed during the pandemic remained descriptive.

Implications for policy and practice

The importance of loneliness for mental health and well-being has recently been recognised in policy.^{55 56} Our findings on loneliness, coping, young age and pre-existing mental health conditions being risk factors for suicidal thoughts and self-harm during the COVID-19 pandemic can better inform policies and intervention strategies for both vulnerable individuals and the general population. While a rise in suicide as a consequence of the pandemic is not inevitable,⁵ the rise in loneliness in young people and the association with suicidal thoughts and self-harm are of concern particularly given the findings of a recent report from the National Child Mortality Database which identifies a potential increase (although not significant) in suicides in under 18 year-olds in the early period of time after lockdown.⁵⁷

In view of our findings, we argue that any lockdown measures should be accompanied by universal interventions aimed at the general population that could: (1) protect mental health against loneliness and isolation; and (2) enhance coping and resilience under stress. The

robust association between loneliness and suicidality in young people in our study could partially explain the deterioration of mental health subsequent to the pandemic containment measures which appears to have disproportionately affected young adults.¹⁸⁻⁴⁰ Hence, efforts should be made to repurpose existing psychological strategies for promoting mental health and behavioural change in young people that are suitable for social isolation/quarantine settings.³⁻¹⁸ Recent reviews suggested benefits of using digital interventions, for example, computerised cognitive behavioural therapy for young people when conventional therapies are limited or delayed.⁵⁸⁻⁵⁹ However, further research evidence is required to evaluate the effectiveness of these digital interventions particularly for individuals lacking adequate digital resources, as well as to examine potential privacy issues.^{3-5, 18} Selective interventions may include exploring more effective ways of signposting, delivering mental health services and assisting individuals in crisis particularly for vulnerable groups,³⁻⁵ as well as locally driven peer support programmes.

Our study suggests that coping poorly, young age, pre-existing mental health conditions and loneliness are associated with suicidal thoughts while the same risk factors except loneliness are associated with self-harm behaviours during the early phases of the COVID-19 pandemic in the UK. While global attention is still dominated by the COVID-19 as the pandemic evolves, the associated impact on mental health, suicide and self-harm should not be overlooked and may be prolonged.⁴⁻⁵ Efforts to foster collaborative research between academics, government and service monitoring of trends in mental health and suicidal behaviours/self-harm and informing interventions should be prioritised in order to mitigate potential harms to mental health and support rapid translation in this evolving pandemic. Policy decisions about this and any future waves or pandemics should take into account the risks of loneliness.

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Contributors AJ, AAK and TVB conceived the study. AJ, SCL, SS, DC-K, SM, ADM, GD, TVB and AAK designed the study. SS oversaw data collection. AJ supervised

the study. SCL conducted the analysis. SCL and AJ wrote the initial draft. AJ, SCL, SS, DC-K, SM, ADM, GD, TVB and AAK commented on the interpretation of findings and the manuscript. AJ is the guarantor of this study who accepts full responsibility for the finished work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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