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The mental health and experiences of discrimination of LGBTQ+ people during the COVID-19 pandemic: Findings from the Queerantine Study

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The mental health and experiences of discrimination of LGBTQ+ people during the COVID-19 pandemic: Findings from the Queerantine Study

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Abstract

Objectives: To assess the mental health and experiences of discrimination amongst a sample of Lesbian, Gay, Bisexual, Transgender, Queer people (LGBTQ) during the COVID-19 pandemic.

Design: Data come were collected through a cross-sectional survey targeted towards LGBTQ+ people. Data on mental health measures, experiences of discrimination and a number of other pandemic-related experiences were collected. Bivariate analyses were undertaken and regression models constructed; models were adjusted for a range of demographic and socioeconomic variables.

Setting: A web-based survey was used to collect data between the end of April and mid-July 2020.

Participants: A total of 398 LGBTQ+ respondents aged 18 and over.

Main outcome measures: We assessed mental health with the 4-item Perceived Stress Scale (PSS-4), and with the 10-item Center for Epidemiological Studies Depression scale (CES-D-10). We asked respondents about discriminatory experiences because of their LGBTQ+ identity during the coronavirus pandemic.

Results: Perceived stress scores among our LGBTQ+ sample were high (Mean: 7.67; Standard Deviation: 3.22). Based on a score of ten or over on the CES-D-10, the majority of participants had high levels of depressive symptoms (72%). Around one-in-six respondents reported some form of discrimination since the start of the pandemic because they were LGBTQ+ (16.7%). The average score for perceived stress increased by 1.44 points (95% Confidence Interval (CI): 0.517-2.354) for respondents who had experienced discrimination versus those who had not. Similarly, the odds of exhibiting significant depressive symptomology increased three-fold among those who had experienced discrimination compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052).

Conclusions: The coronavirus pandemic has had a detrimental impact on the mental health of the LGBTQ+ community. These associations were partially explained by experiences of discrimination which had a large, consistent and pernicious impact on stress and mental health.

Keywords: COVID-19; LGBTQ+; mental health; stress; discrimination.

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Article summary – strengths and limitations of this study

- This study provides an insight into the impacts of the coronavirus pandemic on LGBTQ+ mental health. Using validated tools, the study finds that the pandemic triggered very high levels of stress and depressive symptoms among LGBTQ+ people.
- An online convenience sample was deemed appropriate due to the absence of robust data on LGBTQ+ people from large surveys that could help to determine the characteristics of a representative sample of LGBTQ+ people. An online approach was particularly suitable for those respondents who may have been sheltering or shielding in households where their LGBTQ+ status was unknown to other members of the household.
- However, an online convenience sample can introduce potential issues around sample selection and the possibility that those living in stressful situations or with depressive symptoms were more likely to self-select into the survey.
- Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community, and fully examine how experiences vary according to social locations such as ethnicity, age, and gender identity.
- The present study advances the argument for continued exploration of LGBTQ+ mental health through identifying not only high levels of mental health issues during the pandemic, but also demonstrating that sexuality- and gender-based discrimination is an important mediator.

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Introduction

The coronavirus pandemic has exposed and magnified existent societal and health inequities operating across multiple and intersecting systems of oppression. Given documented stark health and socioeconomic inequalities across social locations related to sexuality, and gender expression and identity, [1] the coronavirus disease (COVID-19) and subsequent social and economic implications could be expected to disproportionately impact on Lesbian, Gay, Bisexual, Transgender, and Queer (LGBTQ+, the "plus" including those who don't identify with any such label) people. To date there is a dearth of information on whether this is the case.

Higher levels of pre-existing health conditions compared to cisgender and heterosexual populations, may place the LGBTQ+ community at additional risk of adverse prognosis. This includes long-term chronic illness, and higher rates of smoking and asthma among LGBTQ+ people; [2-5] higher rates of obesity, and alcohol consumption among lesbian, bisexual, and queer women; [5-7] and increased likelihood of being immunocompromised (e.g. HIV+ with a low CD4 cell count or with untreated HIV) among gay men and transgender people. [8] In addition, the impacts of social distancing and lockdown may be felt acutely by LGBTQ+ people, who even before the pandemic started, were at higher risk of poorer mental health as indicated by higher levels of suicide attempts and suicidal ideation, and lower levels of mental wellbeing. [9 10]

Theoretical frameworks including the Minority Stress Model suggest that stark health inequalities are the result of distal and proximal stressors caused by living within a homophobic, heterosexist, transphobic culture, results in cumulative experiences of discrimination, harassment, victimization, expectations of rejection, and internalized

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transphobia and homophobia. [11 12] These experiences have been extensively documented across several studies, where high prevalence of experiences of stigma and discrimination has been reported among the LGBTQ+ community. [13 14]

Within the heterogeneous LGBTQ+ umbrella term, individual groups may be positioned at a distinct disadvantage. Transgender and gender-diverse (TGGD) individuals have a gender identity or expression that differs from the culturally-bound gender associated with one's assigned birth. [15] TGGD people are known to experience higher rates of adverse mental health compared to cisgender individuals (people whose gender identity or expression matches their sex assigned at birth), particularly anxiety, depression, and suicidality. [3 4 16]

In the context of the coronavirus pandemic where existent inequalities are being exacerbated, it is paramount to document whether, and how, inequalities between the LGBTQ+ community and heterosexual, cisgender individuals are being further amplified. The present study aims to address this need through analysing data from the Queerantine Study (a portmanteau Queer and Quarantine), a web-based survey that assesses how LGBTQ+ people are experiencing the coronavirus pandemic.

Methods

Data collection was conducted via a cross-sectional, web-based anonymous survey that began on 27 April 2020). Data for the present analyses were collected until 13 July 2020. The target sample included respondents aged 18 and over, and who self-identify as lesbian, gay, bisexual, transgender, queer, as having another minority sexual orientation, gender non-binary, or as intersex. Cisgender respondents who self-identify as heterosexual were not excluded from the survey, although recruitment and survey design were tailored towards the

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LGBTQ+ community. The Queerantine survey asks respondents about their sociodemographic characteristics, their physical and mental health, health behaviours, and experiences and anxieties relating to the pandemic and their identity.

Patient and Public Involvement

Expert input broadened the focus to consider how respondents had experienced changes in support from LGBTQ+ service providers and organisations; this input also helped to shape the measures around gender identity. Community organisations also helped in the dissemination of the study through social media and inclusion of the study within newsletters. However, no further public involvement was sought in the design or analysis of the survey.

Outcome variables

In this analysis we focus on three outcomes: depression, stress, and experiences of discrimination. We assessed depression with the 10-item Center for Epidemiological Studies Depression Scale (CES-D-10), which asks respondents to consider how much in the past week they have experienced feelings of loneliness, happiness, and fear. [17] In total the scale includes three items on depressed affect, five items on somatic symptoms, and two on positive affect. [18] Scores range between 0 and 30, with thresholds used to denote 'depressive symptoms' based on a score of ten or over [17]. In the present study we examine the CES-D-10 both as continuous (Cronbach's α=0.87), and as a binary measure, with a cut-off of 10 or more indicating significant depressive symptomology.

We measured stress with the 4-item Perceived Stress Scale (PSS-4), which assesses the extent to which situations in life are viewed as stressful. [19] The scale asks respondents about their ability to control important things in life, confidence in handling personal problems, the extent to which they felt things were going their way, and whether difficulties were piling up

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so high they were becoming insurmountable, using the past month as a frame of reference. Scores range between 0 and 15, and have good levels of internal consistency in our analytical sample (Cronbach's α=0.83).

We measured experiences of discrimination with a set of questions that asked respondents whether, since the start of the coronavirus pandemic, they had experienced verbal harassment, physical harassment, sexual harassment, threats of violence, exclusion from events/activities, involuntary disclosure of LGBTQ+ identity, or other forms of inappropriate treatment because they were LGBTQ+ or were perceived as being LGBTQ+. Individual measures were combined into one summary variable of 'any discrimination.'

Sexual orientation and gender identity or expression

Gender identity was assessed using the recommended two-step method [20] with two items: (1) assigned sex at birth and (2) current gender identity. The two items were cross-tabulated to categorise participants as either TGGD or cisgender. Sexual orientation was captured with a question that asked participants to select their sexual orientation from the following categories: Bisexual; Gay/Lesbian; Heterosexual/Straight; Don't know; Prefer not to say; and an Other, free-text category.

We examine sexual orientation, and gender identity or expression as different constructs, and also combine both into a separate variable that examines the intersection of sexual orientation and gender identity or expression using five categories: (i) cisgender female lesbian/gay; (2) cisgender female other non-heterosexual (including bisexual, other, don't know, and prefer not to say); (3) transgender and gender diverse; (4) cisgender male gay; (5) cisgender male other non-heterosexual (including bisexual, other, don't know, and prefer not to say).

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Covariates

We adjusted for variables thought to confound the association between our exposure and outcome variables. This included age, relationship status, ethnicity, and country of residence. We also controlled for socioeconomic status with a variable that asked respondents about their subjective social status (modelled on a validated approach [21]), and how this had changed since the start of the pandemic, with categories reflecting no change, positive change, and negative change.

Analytical plan

The analysis consisted of a complete case analysis of respondents. Summary statistics were calculated for baseline characteristics and associations between exposure variables and outcomes were tested in unadjusted analyses using the χ^2 test of association and ANOVA as appropriate. Ordinary Least Squares regression models were constructed for continuous models of stress and depression, and binary logistic regression models were constructed for high depressive symptomology. For models where depression or stress are the outcomes of interest, we used the measure of discrimination as the main exposure variable. For models where discrimination is the outcome of interest we only adjusted for sexual orientation, gender identity or expression, age, ethnicity, and location. Additional analysis examining when in the pandemic harassment and discrimination occurred is also included to contextualise the discussion. Adjusted and unadjusted models are presented. We conducted all analyses in Stata 14. [22]

Results

Between April 27th and July 13th, a total of 426 responses were received. Of these 24 were excluded because they did not provide their age, and 4 were excluded because they were aged

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under 18. Of the remaining 398, we were able to calculate PSS-4 and CES-D-10 scores for 325 and 324 respondents respectively. Once we had accounted for missingness on other covariates, the analytical sample consisted of 310 respondents for models of mental health, excluding one further cisgender heterosexual respondent.

TABLE 1 HERE

The analytical sample broadly mirrored the sociodemographic characteristics of the recent UK government National LGBT Survey. [23] The distribution of respondents by sexual orientation was very similar, albeit with a higher share of respondents who identified as Queer in the Queerantine survey (8% vs approximately 1%). The proportion of respondents aged 18-24 was lower at 15.1% (compared with approximately 37.4%), with higher proportions at older age groups in line with the UK population as a whole. Almost a quarter of the sample (23.5%) were categorised as TGGD, suggesting greater representation than in the UK National LGBT Survey sample where the proportion of TGGD respondents stood at approximately 15%. [23]

Descriptively, the results suggested that the sample had high levels of stress and depression. The mean score for PSS-4 (Mean(M): 7.67; Standard Deviation (SD): 3.22) was higher than that observed in UK community samples in previous studies [24] and selected studies of sexual minorities conducted elsewhere. [25] Using the recommended threshold of 10 or more to identify depressive symptomatology, we observed high levels of respondents falling into this category (71.9%), a higher proportion than observed among other populations known to be susceptible to depression such as people living with HIV/AIDS. [26] Cis-female respondents who identify as gay or lesbian had the lowest scores for perceived stress or depressive

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symptoms (see Table 1); conversely transgender and gender diverse individuals had the highest scores (83.6%).

One-in-six respondents reported some form of harassment since the start of the pandemic because they were LGBTQ+ (16.7%); the most common forms being verbal harassment including insults or other hurtful comments (8.7%), exclusion from events or activities (5.6%), and involuntary disclosure of LGBTQ+ identity (3.5%). Stress was markedly higher for those who had experienced discrimination (PSS-4 M: 9.44 SD: 2.99) compared to those who had not (PSS-4 M: 7.35 SD: 3.16). Respondents who had experienced discrimination also had higher depression symptomology scores (CES-D-10 M: 17.87 SD: 6.21) compared to those who had not (CES-D-10 M: 13.43 SD: 6.97).

TABLE 2 HERE

We examined the relationship between gender identity and sexual orientation and discrimination in logistic regression models (see Table 2). Based on the association observed in Table 1, we used TGGD as the reference category and explored whether the higher risk of TGGD to experience discrimination remained after controlling for basic sociodemographic covariates. The results from adjusted models showed that the odds of experiencing discrimination were lower for all other groups, and significantly lower in the case of cisgender gay males (OR: 0.237, 95% Confidence Interval (CI):0.091-0.617) and cisgender females who identified with a sexual minority orientation other than gay/lesbian (OR: 0.361, CI: 0.141-0.921). Within the sample, the results were suggestive of a u-shaped trend in terms of age, with the youngest and the oldest LGBTQ+ respondents in the sample being at greatest

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risk of experiencing discrimination, although differences by age were generally not statistically significant.

Experiences of discrimination were clear predictors of poorer mental health. The average score for perceived stress increased by 1.44 points (CI: 0.517-2.354) for those who had experienced discrimination, compared to those who had not. Similarly, the odds of exhibiting significant depressive symptomology (CES-D-10 scores of 10 or more) increased three-fold among those who had experienced discrimination based on their gender or sexuality compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052). These marked associations remained after adjusting for potential confounders (see Models 1 to 4 in Table 3).

TABLE 3 HERE

Cisgender female lesbian or gay respondents had lower stress levels than other LGBTQ+ groups. TGGD respondents and non-heterosexual cisgender males who identified as gay had among the highest average stress scores in adjusted models. Although a similar trend was observed in the odds of experiencing depressive symptomatology, the evidence was ultimately inconclusive. Further exploration of the CES-D-10 as a continuous measure (see appendix table) shows that TGGD had substantially higher CES-D-10 scores than cisgender lesbian or gay females, with an average score 3.38 points (95% CI: 1.172-5.595) higher after adjusting for other covariates. A clear trend by age was observed in models 3 and 4 (see Table 3), with younger respondents having significantly poorer mental health than older individuals, both for stress and significant depressive symptomology, after adjusting for other covariates.

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Discussion

In this study we present data on the levels of depression, stress, and experiences of discrimination of LGBTQ+ people during the COVID-19 pandemic. We show that scores for stress and depressive symptoms among our LGBTQ+ sample are high, and higher than observed in community samples and vulnerable populations in the recent past (for example [24] [26]). Furthermore, the pandemic may not be impacting the LGBTQ+ acronym evenly, with TGGD individuals having particularly high scores for stress and depressive symptoms relative to cisgender gay and lesbian individuals. Non-heterosexual respondents who are cisgender but do not identify as lesbian or gay also had elevated scores for stress and depressive symptoms. Similarly, there was a clear age gradient with younger LGBTQ+ people having much higher risks of showing symptoms of stress and depression.

Our analyses of discrimination reinforce the theoretical basis for undertaking analyses of LGBTQ+ health and mental health, with LGBTQ+ people theorised at greater risk of health complications due to a unique set of internal and external homophobic, heteronormative, and transphobic stressors. [27] We found that almost one-in-five respondents reported experiencing some form of discrimination during the pandemic, with TGGD respondents again at heightened risk of experiencing discrimination relative to other LGBTQ+ groups. Our results show that experiencing discrimination was a risk factor for higher stress and depressive symptomology; the odds of reporting depressive symptomatology among individuals who had experienced discrimination were three times higher than among individuals who had not experienced any discrimination. Open ended responses to the survey described various experiences of discrimination and inappropriate incidents including increased or excessive scrutiny, misgendering, and online abuse.

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To further understand the results, we explored how mental health and discrimination varied over the course of the pandemic. We observed that mental health scores in the sample were poorer during the period April 27th-May 10th (the moment of 'maximum risk' as defined by the UK Prime Minister) and during the period between May 23rd-June 14th (coinciding with revelations of lockdown breaches by government officials in the UK, transphobic comments on social media made by high profile people, and protests surrounding the murder of George Floyd), although these differences were not significant. Similarly, we observed non-statistically significant differences in the proportion of respondents reporting instances of discrimination, with the initial easing of the lockdown and particularly the period from June 15th onwards coinciding with increases in discrimination (see Figure 1), albeit based on a small sample in the latter period.

FIGURE 1 HERE

Limitations

Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community, and fully examine how experiences vary according to social locations such as ethnicity, age, and gender identity. Studies in the US show that the highest levels of violence are reported among transgender women of colour, and among young and low-income transgender people, [13 14] suggesting that violence on the basis of transgender identity or expression often affects the most marginalized subpopulations. Although we have adjusted for these factors in our models, we have not been able to further disaggregate across social locations to examine the role of interlocking systems of oppression in patterning experiences of discrimination and adverse mental health.

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While our data collection efforts are limited by the inherent challenge of surveying a small, dispersed, diverse, and difficult to reach population, it is nonetheless critically important to study the lives and experiences of discrimination and mental health among LGBTQ+ communities because of the stark health and social inequalities they experience.

New purposeful data collection was deemed appropriate as although a number of large representative studies (e.g. the UK Household Longitudinal Study) are currently collecting data on COVID-19 experiences, they typically contain small numbers of LGBTQ+ people, [6] [10] often do not collect information on TGGD identities, and contain heteronormative measures that can be exclusionary to LGBTQ+ respondents. An online convenience sample was deemed appropriate due to the absence of robust data on LGBTQ+ people from large surveys that could help to determine the characteristics of a representative sample of LGBTQ+ people. An online approach was particularly suitable for those respondents who may have been sheltering or shielding in households where their LGBTQ+ status was unknown to other members of the household. Furthermore, this approach is in line with other recent large scale efforts at understanding the health of LGBT people in the UK. [23] We do, nevertheless, acknowledge that an online convenience sample can introduce potential issues around sample selection and the possibility that those living in stressful situations or with depressive symptoms were more likely to self-select into the survey.

Public Health Implications

Results from the Queerantine Study suggest that groups within LGBTQ+ acronym may be at differential risk of exhibiting stress or depressive symptomology, although the sample as a whole may also be at higher risk than the general population of stress and depressive symptomology due to minority stress. Homophobic and transphobic harassment and exclusion experienced during the pandemic has a deleterious impact on LGBTQ+ mental

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health, demonstrated by the strong and consistent associations between harassment and poorer mental health in the models. Open-ended responses to survey questions emphasise the importance of LGBTQ+ social networks, often facilitated by the work of LGBTQ+ organisations, in supporting LGBTQ+ individuals. However, these are the very organisations who are facing financial challenges with many now on the brink of closure. [28]

Globally, LGBT+ rights organisations have alerted policy-makers about the need to address the vulnerability of the LGBTQ+ community to the coronavirus pandemic, including collecting sexual orientation and gender identity data for COVID-19 cases, increased socioeconomic support for disadvantaged individuals, and support for organisations working with the community. [29] Our findings provide support to these demands given the documented high prevalence of depression and stress, and the concerning reports of experiences of discrimination. Poor LGBTQ+ mental health may remain unchecked without substantial commitment and funding directed to ameliorating health inequalities exacerbated by the pandemic.

Contributors

DK and LB are equal contributors to this study. Both designed the Queerantine survey, developed the research focus, analysed the data, and drafted and edited the manuscript. DK and LB are the guarantors for this study and gave full approval of this version to be published.

Data sharing statement

No additional data are available.

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Ethical approval

Ethical approval was obtained from the ethics board of the University of Sussex (ER/LB516/4) and University College London (REC 1335).

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Tables and Figures

Table 1: Mental health, experiences of discrimination, and sociodemographic characteristics of the Queerantine Study respondents

	Cis female Gay/Lesbian	Cis female bisexual/ other/ don't know/ prefer not to say	Trans-gender and Gender Diverse (TGGD)	Cis male Gay	Cis male bisexual/ other/don't know/ prefer not to say	Total
	%	%	%	%	%	%
Mental health outcomes						
PSS-4 Score, M(SD)	6.44 (3.18)	8.33 (3.14)	8.96 (2.99)	7.03 (2.97)	9.00 (3.37)	7.672 (3.218)
CES-D-10, M(SD)	12.0 (6.65)	15.0 (5.86)	17.15 (6.6)	12.75 (7.17)	16.15 (7.5)	14.174 (6.948)
Depressive Symptomology						
No evidence (<10)	36.62	18.33	16.44	38.71	15.38	28.06
Evidence of depressive symptomology (≥10)	63.38	81.67	83.56	61.29	84.62	71.94
Any harassment or inappropriate incidents						
None reported	74.65	81.67	64.38	87.10	84.62	77.81
Harassment reported	19.72	13.33	28.77	7.53	15.38	16.72
No information	5.63	5.00	6.85	5.38	0	5.47
Age Group						
18-24	9.86	18.33	31.51	2.15	30.77	15.11
25-34	18.31	45.00	31.51	32.26	23.08	30.87
35-44	39.44	23.33	16.44	31.18	23.08	27.65
45-54	23.94	10.00	16.44	23.66	15.38	19.29
55+	8.45	3.33	4.11	10.75	7.69	7.07
Change in perceived social status						
Negative change in status	25.35	26.67	36.99	23.66	23.08	27.65
No change	52.11	43.33	35.62	51.61	61.54	46.95
Positive change	22.54	30.00	27.40	24.73	15.38	25.40
Total						100.00
Relationship status						
Single	21.13	25.00	42.47	19.35	23.08	26.37
Dating or in a relationship but not living together	21.13	30.00	19.18	26.88	46.15	25.08
Cohabiting/Married/Civil Partnership	56.34	45.00	34.25	49.46	30.77	45.98
Divorced, Widowed or Prefer Not to Say	1.41	0	4.11	4.30	0	2.57
Identify as ethnic minority						
Not an ethnic minority	87.32	81.67	90.41	83.87	76.92	85.53
Ethnic minority	12.68	16.67	9.59	12.90	23.08	13.18
Prefer Not to Say	0	1.67	0	3.23	0	1.29
Location						
UK	81.69	80.00	82.19	90.32	76.92	83.60
Rest of the world	18.31	20.00	17.81	9.68	23.08	16.40
Total (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Total (N)	**71**	**60**	**73**	**93**	**13**	**310**

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Table 2: Logistic regression results for unadjusted and adjusted associations between gender identity/sexual orientation and discrimination during COVID-19 pandemic (Odds ratios and exponentiated standard errors in brackets)

	Experiences of discrimination	
	Model 1	Model 2
	O.R. (SE)	O.R. (SE)
Gender ID and Sex Orientation baseline: Transgender and gender diverse		
Cis female Gay/Lesbian	0.576	0.743
	(0.228)	(0.320)
Cis female Bisexual/other/don't know/prefer not to say	0.364**	0.361**
	(0.167)	(0.172)
Cis male gay	0.218***	0.237***
	(0.0985)	(0.116)
Cis male Bisexual/other/don't know/prefer not to say	0.364	0.334
	(0.293)	(0.278)
Age group baseline: 18-24 years		
25-34 years		0.981
		(0.436)
35-44 years		0.302**
		(0.168)
45-54 years		0.409
		(0.225)
55+ years		1.567
		(0.957)
Ethnic minority (baseline: not an ethnic minority)		1.345
		(0.653)
Location: Rest of the world (baseline: UK)		0.530
		(0.258)
Observations	295	295

*** p<0.01, ** p<0.05, * p<0.1

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Table 3: Results of unadjusted and adjusted OLS Regression for PSS-4 score (Models 1 and 2; regression coefficients and standard errors in brackets) and unadjusted and adjusted logistic regression results for odds of significant depressive symptomology indicated by CES-D-10 scores ≥10 (Models 3 and 4; odds ratios and exponentiated standard errors in brackets)

	Model 1	Model 2	Model 3	Model 4
	B(SE)	B(SE)	B(SE)	B(SE)
Any harassment or inappropriate incidents baseline: None				
Form of harassment reported	1.882***	1.436***	4.228***	3.252**
	(0.470)	(0.467)	(2.120)	(1.699)
No information	-0.378	-0.756	2.325	1.796
	(0.755)	(0.733)	(1.541)	(1.256)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian				
Cis female Bisexual/other/don't know/prefer not to say	2.014***	1.367***	2.881**	2.154*
	(0.527)	(0.519)	(1.219)	(0.971)
Transgender and gender diverse	2.357***	1.561***	2.748**	1.904
	(0.502)	(0.504)	(1.126)	(0.853)
Cis male gay	0.824*	0.769*	1.061	0.986
	(0.476)	(0.464)	(0.355)	(0.355)
Cis male Bisexual/other/don't know/prefer not to say	2.624***	1.982**	3.626	2.553
	(0.906)	(0.878)	(2.961)	(2.175)
Age group baseline: 18-24 years				
25-34 years		-1.070**		0.558
		(0.537)		(0.319)
35-44 years		-1.995***		0.480
		(0.558)		(0.274)
45-54 years		-2.401***		0.309**
		(0.596)		(0.181)
55+ years		-3.384***		0.361
		(0.774)		(0.258)
Change in social status since pandemic baseline: positive change				
Negative change in status		1.375***		1.653
		(0.456)		(0.670)
No change		0.217		0.882
		(0.410)		(0.300)
Relationship status baseline: Single				
Dating or in a relationship but not living together		0.225		0.953
		(0.461)		(0.409)

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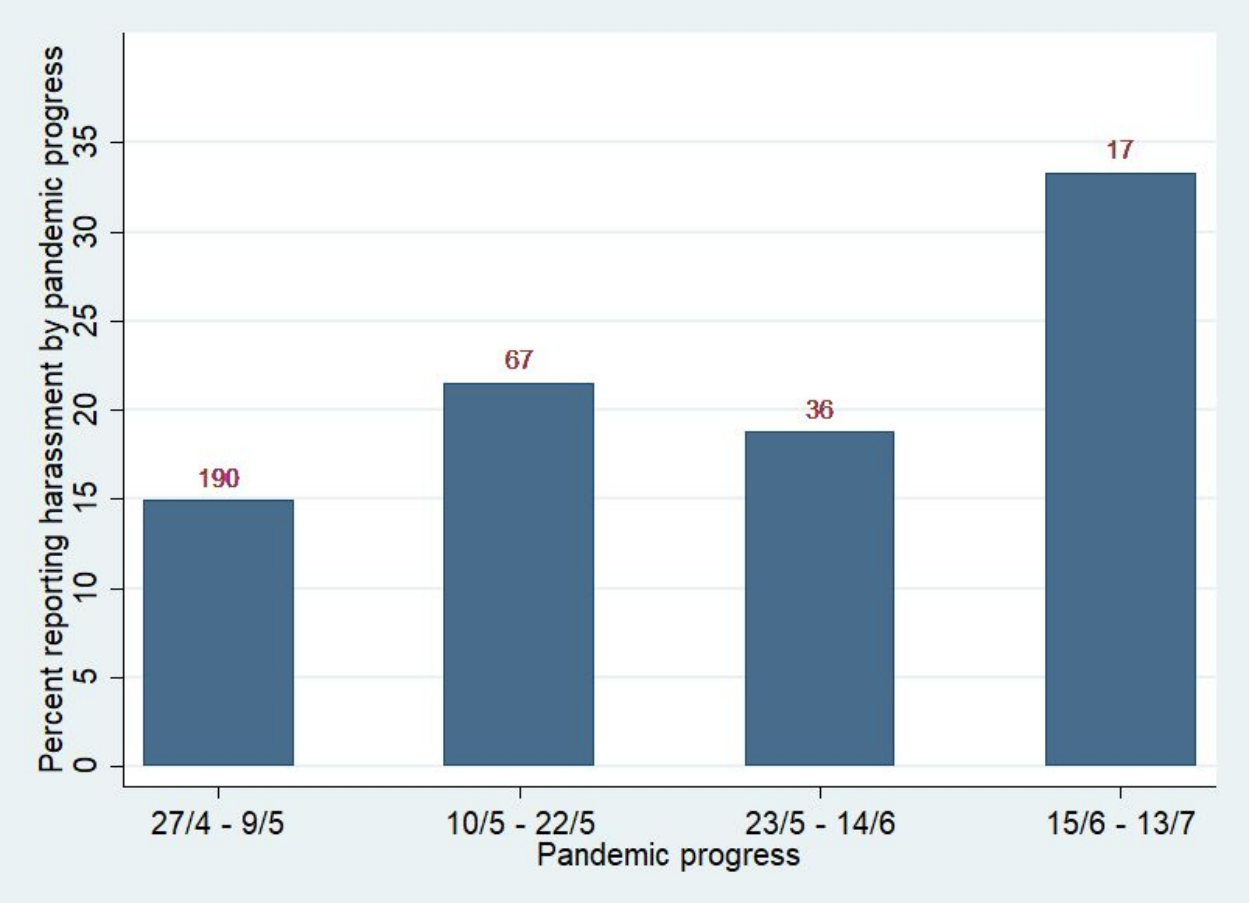
Cohabiting/Married/Civil Partner		-0.332		0.499*
		(0.420)		(0.182)
Divorced, Widowed or Prefer not to say		-0.328		0.625
		(1.085)		(0.529)
Ethnicity baseline: not an ethnic minority				
Ethnic Minority		-0.378		1.525
		(0.495)		(0.674)
Prefer not to say		1.621		1.778
		(1.470)		(2.189)
Location: Rest of the world (baseline: UK)		-0.0235		1.076
		(0.454)		(0.425)
Constant	6.087***	7.774***		
	(0.372)	(0.688)		
Observations	310	310	310	310
R-squared	0.147	0.263		

*** p<0.01, ** p<0.05, * p<0.1

Figure 1: Proportion of respondents reporting discrimination by period in the pandemic



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1

2 **Supplementary Table 1 – Continuous model estimates of CES-D-10**

	Model 1	Model 2
	B(SE)	B(SE)
Any harassment or inappropriate incidents baseline: None		
Form of harassment reported	3.875***	2.700**
	(1.028)	(1.045)
No information	0.257	-0.623
	(1.651)	(1.641)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian		
Cis female Bisexual/other/don't know/prefer not to say	3.249***	2.132*
	(1.153)	(1.162)
Transgender and gender diverse	4.797***	3.383***
	(1.098)	(1.128)
Cis male gay	1.226	1.027
	(1.042)	(1.040)
Cis male Bisexual/other/don't know/prefer not to say	4.336**	2.781
	(1.983)	(1.965)
Age group baseline: 18-24 years		
25-34 years		-1.932
		(1.203)
35-44 years		-2.899**
		(1.250)
45-54 years		-4.453***
		(1.335)
55+ years		-3.974**
		(1.733)
Change in social status since pandemic baseline: positive change		
Negative change in status		2.649***
		(1.021)
No change		0.746
		(0.919)
Relationship status baseline: Single		
Dating or in a relationship but not living together		0.440
		(1.032)
Cohabiting/Married/Civil Partner		-1.979**
		(0.941)
Divorced, Widowed or Prefer not to say		0.416
		(2.429)
Ethnicity baseline: not an ethnic minority		
Ethnic Minority		0.404
		(1.109)
Prefer not to say		1.076

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		(3.292)
Location: Rest of the world (baseline: UK)		-0.0193
		(1.016)
Constant	11.22***	14.31***
	(0.813)	(1.540)
Observations	310	310
R-squared	0.126	0.208

*** p<0.01, ** p<0.05, * p<0.1

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5-8
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	5-7
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	6
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9, 23-24
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	9, 23-24

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-12, 24-26
		(*b*) Report category boundaries when continuous variables were categorized	10-12, 24-26
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	12-13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13-14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	13-14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Discrimination as a predictor of mental health issues among LGBTQ+ people during the COVID-19 pandemic: cross-sectional analysis of the online Queerantine Study

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Discrimination as a predictor of mental health issues among LGBTQ+ people during the COVID-19 pandemic: cross-sectional analysis of the online Queerantine Study

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Abstract

Objectives: To assess the mental health and experiences of discrimination amongst Lesbian, Gay, Bisexual, Transgender, Queer people (LGBTQ) at the start of the COVID-19 pandemic.

Design: Data come from a cross-sectional online survey targeted at LGBTQ+ people, which collected data on mental health, experiences of discrimination, and a number of other pandemic-related experiences. To examine the association between sexual orientation and gender, and mental health and experiences of discrimination, we conducted regression analyses that adjusted for a range of sociodemographic variables.

Setting: A web-based survey was used to collect data between the end of April and mid-July 2020.

Participants: An analytical sample of 310 LGBTQ+ respondents aged 18 and over.

Main outcome measures: We assessed mental health with the 4-item Perceived Stress Scale (PSS-4), and with the 10-item Center for Epidemiological Studies Depression scale (CES-D-10). We asked respondents about discriminatory experiences because of their LGBTQ+ identity during the coronavirus pandemic.

Results: Perceived stress scores among our LGBTQ+ sample were high (Mean: 7.67; Standard Deviation: 3.22). Based on a score of ten or over on the CES-D-10, the majority of participants had high levels of depressive symptoms (72%). Around one-in-six respondents reported some form of discrimination since the start of the pandemic because they were LGBTQ+ (16.7%). The average score for perceived stress increased by 1.44 points (95% Confidence Interval (CI): 0.517-2.354) for respondents who had experienced discrimination versus those who had not. Similarly, the odds of exhibiting significant depressive symptomology increased three-fold among those who had experienced discrimination compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052).

Conclusions: The LGBTQ+ community exhibited increased levels of depression, stress, and experienced discrimination during the coronavirus pandemic. Increased levels of poor mental health were partially explained by experiences of discrimination which had a large, consistent and pernicious impact on mental health.

Keywords: COVID-19; LGBTQ+; mental health; stress; discrimination.

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Article summary – strengths and limitations of this study

- This study uses tools that have been validated among diverse populations to identify high levels of perceived stress and depressive symptoms among LGBTQ+ people.
- An online convenience sample was deemed appropriate for a number of reasons including the inherent risk of transmission of COVID-19 with methods involving physical contact and to better include respondents who were sheltering or shielding in households where their LGBTQ+ status was concealed .
- An online convenience sample can introduce issues around representativeness and the possibility that those with greater mental health issues self-selected into the survey.
- Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community.
- Designing a survey that captured LGBTQ+ specific experiences allowed us to identify that sexuality- and gender-based discrimination experienced during the pandemic is an important predictor of mental health issues.

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Introduction

The coronavirus pandemic has exposed and magnified existent societal and health inequities operating across multiple and intersecting systems of oppression. [1 2] Given documented stark health and socioeconomic inequalities across social locations related to sexuality, and gender expression and identity, [3] the coronavirus disease (COVID-19) and subsequent social and economic implications could be expected to have disproportionate impacts on Lesbian, Gay, Bisexual, Transgender, and Queer people (LGBTQ+, the "plus" including those who identify as non-heterosexual and/or non-cisgender in another way).

Higher levels of pre-existing health conditions compared to cisgender and heterosexual populations, may place the LGBTQ+ community at additional risk of adverse prognosis. This includes long-term chronic illness, and higher rates of smoking and asthma among LGBTQ+ people; [4-7] higher rates of obesity, and alcohol consumption among lesbian, bisexual, and queer women; [7-9] and increased likelihood of being immunocompromised (e.g. HIV+ with a low CD4 cell count or with untreated HIV) among gay men and transgender people. [10] In addition, the impacts of social distancing and lockdown may be felt acutely by LGBTQ+ people, who were at greater risk of poorer mental health prior to the pandemic including higher risks of suicide attempts and suicidal ideation, higher levels of common mental disorders, and lower levels of mental wellbeing. [11 12 13] For example, studies using the 4-item Perceived Stress Score (PSS-4), a measure used in the present study (see methods), have found mean values have ranged between 6.75 and 7.43 for US college students who identified as 'homosexual' and bisexual respectively, compared to 6.09 among heterosexual students. [14] Similarly, studies examining depression using the Center for Epidemiological Studies Depression Scale (CES-D-10), a measure of depressive symptomatology used in the present study (see methods), have found that the proportion reporting substantial depressive

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symptomology among African American LGB young people to stand at roughly double that of heterosexual young people in the southern United States (56.1% vs 28.4%). [15] Comparative data on LGBTQ+ experiences during the pandemic are rare, although in the UK general population the average stress score (using the PSS-4 scale) was estimated to be 6·48 (Standard Deviation: 3·3), [16] above a 6-point threshold used to indicate 'high' levels of stress elsewhere. [17] Estimates within the general (US) population during the COVID-19 pandemic have suggested that up to a third of people may be experiencing substantial depressive symptomology (using the CES-D-10 scale). [18]

Within the heterogeneous LGBTQ+ umbrella term, individual groups may be positioned at a distinct disadvantage. Transgender and gender-diverse (TGGD) individuals have a gender that differs from the culturally-bound gender associated with one's assigned birth. [19] TGGD people are known to experience higher rates of adverse mental health compared to cisgender individuals (people whose gender matches their sex assigned at birth), particularly anxiety, depression, and suicidality. [5 6 20]

Despite the accumulation of evidence indicating poorer health among LGBTQ+ people predating the pandemic, there is a dearth of information on whether the hypothesised additional risks outlined above have actually materialised in poorer outcomes among LGBTQ+ people during the COVID-19 pandemic. Indicative evidence suggests that some LGBTQ+ groups may exhibit higher levels of psychological trauma during the COVID-19 pandemic [21] and other studies suggest that mental health among LGBTQ+ people may have deteriorated during the pandemic compared to pre-pandemic levels. [22] Certainly, LGBTQ+ people face stressors during the pandemic that are not shared with heterosexual and cisgender people, including spending periods of 'lockdown' in households that are not affirming or

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supportive of their sexual orientation or gender identity or expression, [23] being separated from social networks that are supportive and affirming to their identity, [24 25] and interruptions to accessing gender affirming care among transgender and gender non-binary people [26 27].

Theoretical frameworks including the Minority Stress Model suggest that stark health inequalities are the result of distal and proximal stressors caused by living within a homophobic, heterosexist, transphobic culture, results in cumulative experiences of discrimination, harassment, victimization, expectations of rejection, and internalized transphobia and homophobia. [28 29] These experiences have been extensively documented across several studies, where high prevalence of experiences of stigma and discrimination has been reported among the LGBTQ+ community. [30 31] During the pandemic, experiences of discrimination may have become magnified because, as described above, LGBTQ+ people may have been sheltering in households that were unsupportive or hostile towards their identities, [23] or have not received support from networks and relevant organisations. In some contexts, the pandemic has triggered a rise in hate speech and targeted attacks on the LGBTQ+ community, and members of the LGBTQ+ community have been blamed for the very emergence of the virus. [32] Unrelated to the cornavirus itself, the lockdown coincided with online debates around sex and gender, which have manifested in transphobic comments made and supported by high profile figures, and a hostile online environment for many transgender people. [33] These attacks occurred at a time when many in the community were unable to draw on their usual support networks.

In the context of the coronavirus pandemic where existent inequalities are being exacerbated across social locations, [2] it is paramount to document how the LGBTQ+ community has fared during the initial stages of the coronavirus pandemic. The present study aims to address this

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need through analysing data from the Queerantine Study (a portmanteau Queer and Quarantine), a web-based survey that assesses how LGBTQ+ adults are experiencing the coronavirus pandemic. In the present paper, we examine extent to which respondents to the Queerantine survey experienced forms of sexuality or gender-based discrimination, including harassment and exclusion, during the coronavirus pandemic. We also examine how widespread experiences of perceived stress and depressive symptomology were among respondents to the Queerantine survey and examine to what extent instances of harassment and exclusion predict poorer mental health among LGBTQ+ respondents during the coronavirus pandemic.

Methods

Data collection was conducted via a cross-sectional, web-based anonymous survey. It began on 27th April 2020 and ended on 30th December 2020.. Twitter, Facebook and Instagram accounts were created for the study and were used to disseminate links to the survey in order to maximise the response rate. We contributed guest blogs and created a website in order to help publicise the study (https://queerantinestudy.wixsite.com/queerantine). The link to the survey was distributed through a number of LGBTQ+ organisations including through the newsletter of the LGBT Consortium, the largest network of LGBT+ groups, projects and organisations in the UK, as well as directly by local organisations such as the East London Out Project (ELOP). The target sample included respondents aged 18 and over, and who self-identify as lesbian, gay, bisexual, queer, as having another minority sexual orientation; or who were transgender or gender diverse in other ways including being non-binary or intersex. Cisgender respondents who self-identify as heterosexual were not excluded from the survey, although recruitment and survey design were tailored towards the LGBTQ+ community, and their responses were not included in the analyses presented here. The Queerantine survey

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asked respondents about their sociodemographic characteristics, their physical and mental health, health behaviours, and experiences and anxieties relating to the pandemic and their identity. Ethical approval was obtained from the ethics board of the University of Sussex (ER/LB516/4) and University College London (REC 1335).

Patient and Public Involvement

Expert input from a representative of a national LGBT umbrella organisation broadened the focus of the survey to consider how respondents had experienced changes in support from LGBTQ+ service providers and organisations; this input also helped to shape the measures around gender. Community organisations also helped in the dissemination of the study through social media and inclusion of the study within newsletters. However, no further public involvement was sought in the design or analysis of the survey.

Outcome variables

In this analysis we focus on three outcomes: depressive symptoms, perceived stress, and experiences of discrimination. We assessed depression with the 10-item Center for Epidemiological Studies Depression Scale (CES-D-10), which asks respondents to consider how much in the past week they have experienced feelings of loneliness, happiness, and fear. [34] The CES-D-10 includes three items on depressed affect, five items on somatic symptoms, and two on positive affect. [35] Scores range between 0 and 30 with good levels of internal consistency in our analytical sample (Cronbach's α=0.87). Thresholds were used to denote significant depressive symptoms' based on a score of ten or over [34]. In the present study we mainly examine the CES-D-10 as a binary measure, with supplementary analyses presenting data on CES-D-10 in continuous models.

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We measured stress with the 4-item Perceived Stress Scale (PSS-4), which assesses the extent to which situations in life are viewed as stressful. [36] The scale asks respondents about respondents' perceived ability to control important things in life, confidence in handling personal problems, the extent to which they felt things were going their way, and whether difficulties were piling up so high they were becoming insurmountable, using the past month as a frame of reference. Scores range between 0 and 15, and have good levels of internal consistency in our analytical sample (Cronbach's α=0.83).

We measured experiences of discrimination with a set of options that asked respondents whether, since the start of the coronavirus pandemic, they had experienced verbal harassment, physical harassment, sexual harassment, threats of violence, exclusion from events/activities, involuntary disclosure of LGBTQ+ identity, or other forms of inappropriate treatment because they were LGBTQ+ or were perceived as being LGBTQ+. Individual measures were combined into one summary variable of 'any discrimination.'

Sexual orientation and gender

Gender was assessed using the recommended two-step method [37] with two items: (1) the gender that participants felt best represented them (options included: Female (including trans woman); Male (including trans man); Non-binary; Other (free text category)), and (2) whether this gender was the same as assigned at birth (options included: Yes; No; Don't Know). The two items were cross-tabulated to categorise participants as either transgender and gender diverse (TGGD) or cisgender. Sexual orientation was captured with a question that asked participants to select their sexual orientation from the following categories: Bisexual; Gay/Lesbian; Heterosexual/Straight; Don't know; Prefer not to say; and an Other, free-text category. Using pre-defined response categories, respondents could only select one

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category, although those who identified with multiple categories (e.g. Queer and Bisexual or Male and Non-binary) could use the free-text option to state this, with respondents declaring more than one gender being categorised as transgender and gender diverse, and respondents selecting more than one sexual orientation categorised as having another non-heterosexual orientation.

We present data on sexual orientation and gender as different constructs in supplementary analyses, although the main analyses use a variable that examines the intersection of sexual orientation and gender using five categories: (i) cisgender female lesbian/gay; (2) cisgender female with another non-heterosexual orientation (including bisexual, other, don't know, and prefer not to say); (3) transgender and gender diverse; (4) cisgender male gay; (5) cisgender male with another non-heterosexual orientation (including bisexual, other, don't know, and prefer not to say).

Covariates

We adjusted for variables thought to confound the association between our exposure and outcome variables. Socioeconomic status was measured through a variable that asked respondents about their subjective social status (modelled on an approach used in general population surveys [38]), and how this had changed since the start of the pandemic, with categories reflecting no change, positive change, and negative change.

Analytical plan

Data for the present analyses includes responses collected until 13 July 2020. The analysis mainly consisted of a complete case analysis of respondents, although a dummy category of no information (missing) for the harassment variable was created for models of mental health

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in order to preserve sample size. Summary statistics were calculated for baseline characteristics and associations between exposure variables and outcomes were tested in unadjusted analyses using the χ^2 test of association and ANOVA as appropriate. The modelling began with exploring selected predictors of discrimination before examining how discrimination itself predicted poorer mental health. Binary logistic regression models were constructed for harassment and high depressive symptomology; Ordinary Least Squares (OLS) regression models were constructed for continuous models of perceived stress and depressive symptoms. Results for both binary and continuous specifications of CES-D-10 are discussed, with the results for the continuous specification included in supplementary analyses, as a form of sensitivity analysis. For models where discrimination is the outcome of interest we only adjusted for sexual orientation and gender, age, ethnicity, and location. For models where depressive symptomology or perceived stress are the outcomes of interest, we used the measure of discrimination as the main exposure variable, and adjusted for the same covariates as above as well socioeconomic status and relationship status. A different set of controls was used between models as the potential confounders were theorised to differ slightly and due to the lower number of 'events' in the model of discrimination. Additional analysis examining when in the pandemic harassment and discrimination occurred is also included to contextualise the discussion. Adjusted and unadjusted models are presented, and in line with suggested practice, estimates were evaluated based the exact p-value, the magnitude of the coefficients and the width of the confidence intervals, rather than on a single test statistic. [39] We conducted all analyses in Stata 14. [40] The decision on how to present the findings across diverse identities is challenging, particularly as we combined information on sexual orientation and gender in deriving categories. Our decisions reflected considerations of the conceptual similarities/differences between groups, the numbers across groups within our sample, as well as the decision to adopt an 'inclusive' or 'specific'

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approach [41] when analysing the data based on observed differences in key variables. Some preliminary analysis (not shown) was undertaken to explore the validity of bringing different groupings together before the decision was taken to use five main categories combining sexual orientation and gender.

Results

Between April 27th and July 13th we received a total of 426 responses. Of these 24 were excluded because they did not provide their age, and 4 were excluded because they were aged under 18. Of the remaining 398, we were able to calculate PSS-4 and CES-D-10 scores for 325 and 324 respondents respectively. Once we had accounted for missingness on other covariates, the analytical sample consisted of 310 respondents for models of mental health, excluding one further cisgender heterosexual respondent.

TABLE 1 HERE

Participants identified their sexual orientation and gender in a number of different ways. The largest group identified as cisgender gay males (30.0%); almost a quarter of the sample (23.5%) were categorised as TGGD (of different sexual orientations); cisgender gay and lesbian females comprised 22.9% of the respondents; while cisgender females with another non-heterosexual orientation accounted for 19.4% of respondents, and cisgender males with another non-heterosexual orientation accounted for 4.2% of respondents. A further breakdown of respondents' identities is available in the supplementary materials, with descriptive information on key variables. Respondents aged 18-24 accounted for less than a fifth of the sample (15.1%), while those aged 55+ accounted for less than a tenth of the sample (7.1%), with a greater representation of respondents aged 25-54 years old.

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Descriptively, the mean scores for PSS-4 suggested that the sample had high levels of perceived stress (Mean (M): 7.67; Standard Deviation (SD): 3.22). Using the recommended threshold of 10 or more to identify significant depressive symptomatology, we observed that the majority of respondents fell into this category (71.9%). Cis-female respondents who identify as gay or lesbian had the lowest scores for perceived stress or depressive symptoms (see Table 1); conversely transgender and gender diverse individuals had the highest scores (83.6%).

One-in-six respondents reported some form of harassment since the start of the pandemic because they were LGBTQ+ (16.7%); the most common forms being verbal harassment including insults or other hurtful comments (8.7%), exclusion from events or activities (5.6%), and involuntary disclosure of LGBTQ+ identity (3.5%). Perceived stress was markedly higher for those who had experienced discrimination (PSS-4 M: 9.44 SD: 2.99) compared to those who had not (PSS-4 M: 7.35 SD: 3.16). Respondents who had experienced discrimination also had higher depressive symptomology scores (CES-D-10 M: 17.87 SD: 6.21) compared to those who had not (CES-D-10 M: 13.43 SD: 6.97).

TABLE 2 HERE

We examined the relationship between gender and sexual orientation and discrimination in logistic regression models (see Table 2). Based on the association observed in Table 1, we used TGGD as the reference category and explored whether the higher risk of TGGD people to experience discrimination remained after controlling for basic sociodemographic covariates. The results from adjusted models showed that the odds of experiencing discrimination were lower for all other groups, and significantly lower in the case of

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cisgender gay males (OR: 0.237, 95% Confidence Interval (CI):0.091-0.617) and cisgender females who identified with a sexual minority orientation other than gay/lesbian (OR: 0.361, CI: 0.141-0.921). Within the sample, the results were suggestive of a u-shaped trend in terms of age, with the youngest and the oldest LGBTQ+ respondents in the sample being at greatest risk of experiencing discrimination, although differences by age were generally not statistically significant.

Experiences of discrimination were clear predictors of poorer mental health. The average score for perceived stress increased by 1.44 points (CI: 0.517-2.354) for those who had experienced discrimination, compared to those who had not. Similarly, the odds of exhibiting significant depressive symptomology (CES-D-10 scores of 10 or more) increased three-fold among those who had experienced discrimination based on their gender or sexuality compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052). These marked associations remained after adjusting for potential confounders (see Models 1 to 4 in Table 3).

TABLE 3 HERE

Cisgender female lesbian or gay respondents had lower perceived stress levels than other LGBTQ+ groups. TGGD respondents and non-heterosexual cisgender males who didn't identify as gay had among the highest average perceived stress scores in adjusted models. Although similar trends were observed in the odds of experiencing depressive symptomatology, the evidence was ultimately inconclusive for these groups, although cisgender females with another non-heterosexual orientation besides lesbian or gay had a higher risk of significant depressive symptoms relative lesbian/gay cisgender women. Further

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sensitivity analysis of the CES-D-10 as a continuous measure (see supplementary files) shows that TGGD people had substantially higher CES-D-10 scores than cisgender lesbian or gay females, with an average score 3.38 points (95% CI: 1.172-5.595) higher after adjusting for other covariates. A clear trend by age was observed in models 3 and 4 (see Table 3), with younger respondents having significantly poorer mental health than older individuals, both for perceived stress and significant depressive symptomology, after adjusting for other covariates.

Discussion

In this study we present data on the levels of depressive symptoms, perceived stress, and experiences of discrimination of LGBTQ+ people during the COVID-19 pandemic collected through a web-based survey. Respondent characteristics broadly mirrored the sociodemographic characteristics of the recent UK government National LGBT Survey. [42] The distribution of respondents by sexual orientation was very similar, albeit with a higher share of respondents who identified as Queer in the Queerantine survey (8% vs approximately 1%). The proportion of respondents aged 18-24 was lower at 15.1% (compared with approximately 37.4%), with higher proportions at older age groups in line with the UK population as a whole. The Queerantine survey had a larger proportion of participants who were TGGD than the UK National LGBT Survey (23.5% vs 15%). [42]

We find that scores for perceived stress and depressive symptoms among our LGBTQ+ sample are high, and higher than observed in community samples and vulnerable populations in the recent past (for example [43 44]). Furthermore, we find that the pandemic may not be impacting the LGBTQ+ community evenly, with TGGD individuals having particularly high scores for perceived stress and depressive symptoms relative to cisgender gay and lesbian

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individuals. Non-heterosexual respondents who are cisgender but do not identify as lesbian or gay also had elevated scores for perceived stress and depressive symptoms. Similarly, there was a clear age gradient with younger LGBTQ+ people having much higher risks of showing symptoms of stress and depression. An important caveat to these results is that because of our cross-sectional design, we are unable to definitively state that mental health status *deteriorated* as a result of the pandemic and whether any deterioration in mental health was concentrated among TGGD respondents or younger respondents; our study design also means we are unable to make direct comparisons to ascertain whether LGBTQ+ people are faring worse during the pandemic than heterosexual cisgender people. However, the underlying pathways through which LGBTQ+ people may have experienced greater and specific challenges during the pandemic and lockdown are becoming evident, [22-27] providing a basis for an assumption that LGBTQ+ people may have experienced greater stressors, with TGGD people facing particular sets of stressors, albeit on a theoretical basis and in need of further exploration and verification. Furthermore the very high levels of mental health issues uncovered here make it challenging to simply attribute such stark levels of mental health issues as the status quo pre-pandemic, although this assumption again needs further exploration and verification using a different study design. Regardless, the data definitively show that the pandemic has had a pernicious effect on the mental health of the LGBTQ+ community.

Our analyses of discrimination reinforce the rationale for undertaking analyses of LGBTQ+ health and mental health, with LGBTQ+ people theorised at greater risk of health complications due to a unique set of internal and external homophobic, heteronormative, and transphobic stressors. [45] We found that almost one-in-six respondents reported experiencing some form of discrimination during the pandemic, with TGGD respondents again at

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heightened risk of experiencing discrimination relative to other LGBTQ+ groups. Our results show that experiencing discrimination was a risk factor for higher perceived stress and depressive symptomology; the odds of reporting depressive symptomatology among individuals who had experienced discrimination were three times higher than among individuals who had not experienced any discrimination. Open ended responses to the survey described various experiences of discrimination and inappropriate incidents including increased or excessive scrutiny, misgendering, exclusion, and online abuse.

To further understand the results, we explored how mental health and discrimination varied over the course of the survey. We observed that mental health scores in the sample were poorer during the period April 27th-May 10th (the moment of 'maximum risk' as defined by the UK Prime Minister) and during the period between May 23rd-June 14th (coinciding with revelations of lockdown breaches by government officials in the UK, transphobic comments on social media made by high profile figures, and protests surrounding the murder of George Floyd), although these differences were not significant. Similarly, we observed non-statistically significant differences in the proportion of respondents reporting instances of discrimination, with the initial easing of the lockdown and particularly the period from June 15th onwards coinciding with increases in discrimination (see Figure 1), albeit based on a small sample in the latter period. These trends help contextualise the results and illuminate the hostile environments which LGBTQ+ people, and particularly TGGD respondents, were experiencing.

FIGURE 1 HERE

Limitations

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Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community, and fully examine how experiences vary according to social locations such as ethnicity, age, and gender. Studies in the US show that the highest levels of violence are reported among transgender women of colour, and among young and low-income transgender people, [30 31] suggesting that violence on the basis of transgender identity or expression often affects the most marginalised subpopulations. Although we have adjusted for these factors in our models, we have not been able to further disaggregate across social locations to examine the role of interlocking systems of oppression in patterning experiences of discrimination and adverse mental health.

While our data collection efforts are limited by the inherent challenge of surveying a small, dispersed, diverse, and difficult to reach population, it is nonetheless critically important to study the lives and experiences of discrimination and mental health among LGBTQ+ communities because of the stark health and social inequalities they experienced before the pandemic. Our choice of mental health measures reflected the need to field short scales within a web-based survey where there was no incentive provided for respondents to complete the questions. However, other more comprehensive or alternative measures of mental health, and particularly mental wellbeing, may have yielded further nuance to the results presented here.

New purposeful data collection was deemed appropriate as although a number of large representative studies (e.g. the UK Household Longitudinal Study) are currently collecting data on COVID-19 experiences, they typically contain small numbers of LGBTQ+ people, [8 12] often do not collect information on TGGD identities, and contain heteronormative measures that can be exclusionary to LGBTQ+ respondents. An online convenience sample

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was deemed appropriate due to the absence of robust data on LGBTQ+ people from large surveys that could help to determine the characteristics of a representative sample of LGBTQ+ people, as well as the risks inherent with any form of physical data collection during the pandemic. An online approach was particularly suitable for those respondents who may have been sheltering or shielding in households where their LGBTQ+ status was unknown to other members of the household. Furthermore, this approach is in line with other recent large scale efforts at understanding the health of LGBT people in the UK. [42] We do, nevertheless, acknowledge that an online convenience sample can introduce potential issues around sample selection, such as the omission of those without internet access, and the possibility that those living in stressful situations or with depressive symptoms were more likely to self-select into the survey. Although rudimentary checks for data patterns that could indicate that 'bots' completed the survey were implemented, focussed on identifying cases where the same response had been provided to all Likert scale type questions, or where the middle response had been consistently provided, there remains a possibility that some responses may be based on false or duplicate records. Further measures that could have been implemented, such as password protection or identity checking, were not congruent with a format that allowed respondents to complete the survey anonymously, or believe that they were doing so.

As the inferential analysis consisted of three regression models where we show the development of the model by including additional regressors, we did not implement additional correction for multiple hypotheses (e.g. Bonferroni). We do note that, given a scenario where 20 hypotheses were being tested at a 5% level, we would expect to see at least one such deviation where we would interpret a result as being 'statistically significant'

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inappropriately [46]; however, as discussed earlier, we also took a broader approach to evaluating estimates than interpreting p-values as being "significant" or "nonsignificant". [39]

Public Health Implications

Results from the Queerantine Study suggest that groups within LGBTQ+ acronym may be at differential risk of experiencing stress or depressive symptomology, although the sample as a whole may also be at higher risk than the general population of stress and depressive symptomology due to minority stress. Homophobic and transphobic harassment and exclusion experienced during the pandemic has a deleterious impact on LGBTQ+ mental health, demonstrated by the strong and consistent associations between harassment and poorer mental health in the models. Open-ended responses to survey questions emphasise the importance of LGBTQ+ social networks, often facilitated by the work of LGBTQ+ organisations, in supporting LGBTQ+ individuals. However, these are the very organisations that are facing financial challenges with many on the brink of closure. [47]

Globally, LGBT+ rights organisations have alerted policy-makers about the need to address the vulnerability of the LGBTQ+ community to the coronavirus pandemic, including collecting sexual orientation and gender data for COVID-19 cases, increased socioeconomic support for disadvantaged individuals, and support for organisations working with the community. [48] Our findings provide support to these demands given the documented high prevalence of depressive symptomology and stress, and the concerning reports of experiences of discrimination. Poor LGBTQ+ mental health may remain unchecked without substantial commitment and funding directed to ameliorating health inequalities exacerbated by the pandemic.

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Contributors

DK and LB are equal contributors to this study. Both designed the Queerantine survey, developed the research focus, analysed the data, and drafted and edited the manuscript. DK and LB are the guarantors for this study and gave full approval of this version to be published.

Data sharing statement

No additional data are available.

Competing interests

None to declare. Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting individual level data is not available.

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Ethical approval

Ethical approval was obtained from the ethics board of the University of Sussex (ER/LB516/4) and University College London (REC 1335).

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social media and in other ways. We would also like to thank Joanna Boyce for contributing social media expertise that helped to boost the response rate. We would like to thank the peer reviewers of this article for their comments and suggestions on an earlier draft.

Figure 1 Proportion of respondents reporting discrimination by period in the pandemic

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Tables and Figures

Table 1: Mental health, experiences of discrimination, and sociodemographic characteristics of the Queerantine Study respondents

	Cis female Gay/Lesbian	Cis female of another non-heterosexual orientation	Trans-gender and Gender Diverse (TGGD)	Cis male Gay	Cis male of another non-heterosexual orientation	Total
	%	%	%	%	%	%
Mental health outcomes						
PSS-4 Score, M(SD)	6.44 (3.18)	8.33 (3.14)	8.96 (2.99)	7.03 (2.97)	9.00 (3.37)	7.672 (3.218)
CES-D-10 Score, M(SD)	12.0 (6.65)	15.0 (5.86)	17.15 (6.6)	12.75 (7.17)	16.15 (7.5)	14.174 (6.948)
Evidence of significant depressive Symptomology						
No evidence (<10)	36.62	18.33	16.44	38.71	15.38	28.06

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Evidence of significant depressive symptomology (≥10)	63.38	81.67	83.56	61.29	84.62	71.94
Any LGBTQ+ related harassment or inappropriate incidents						
None reported	74.65	81.67	64.38	87.10	84.62	77.81
Harassment reported[$]	19.72	13.33	28.77	7.53	15.38	16.72
No information (missing)	5.63	5.00	6.85	5.38	0	5.47
Age Group						
18-24	9.86	18.33	31.51	2.15	30.77	15.11
25-34	18.31	45.00	31.51	32.26	23.08	30.87
35-44	39.44	23.33	16.44	31.18	23.08	27.65
45-54	23.94	10.00	16.44	23.66	15.38	19.29
55+	8.45	3.33	4.11	10.75	7.69	7.07
Identify as ethnic minority						
Not an ethnic minority	87.32	81.67	90.41	83.87	76.92	85.53
Ethnic minority	12.68	16.67	9.59	12.90	23.08	13.18
Prefer Not to Say	0	1.67	0	3.23	0	1.29
Location						
UK	81.69	80.00	82.19	90.32	76.92	83.60
Rest of the world	18.31	20.00	17.81	9.68	23.08	16.40
Change in perceived social status						
Negative change in status	25.35	26.67	36.99	23.66	23.08	27.65
No change	52.11	43.33	35.62	51.61	61.54	46.95
Positive change	22.54	30.00	27.40	24.73	15.38	25.40
Total						100.00
Relationship status						
Single	21.13	25.00	42.47	19.35	23.08	26.37
Dating or in a relationship but not living together	21.13	30.00	19.18	26.88	46.15	25.08
Cohabiting/Married/Civil Partnership	56.34	45.00	34.25	49.46	30.77	45.98
Divorced, Widowed or Prefer Not to Say	1.41	0	4.11	4.30	0	2.57
Total (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Total (N)	**71**	**60**	**73**	**93**	**13**	**310**

Notes: M = Mean; SD = Standard Deviation; [$] see methods for types of incidents

Table 2: Logistic regression results for unadjusted and adjusted associations between gender identity/sexual orientation and discrimination during COVID-19 pandemic (Odds ratios and confidence intervals in brackets)

	Experiences of discrimination	
	Unadjusted	Adjusted
	O.R. (CI)	O.R. (CI)
Gender ID and Sex Orientation baseline: Transgender and gender diverse		

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Cis female Gay/Lesbian	0.576 (0.265 - 1.252)	0.743 (0.320 - 1.727)
Cis female of another non-heterosexual orientation	0.364** (0.147 - 0.897)	0.361** (0.141 - 0.921)
Cis male gay	0.218*** (0.090 - 0.529)	0.237*** (0.091 - 0.617)
Cis male of another non-heterosexual orientation	0.364 (0.075 - 1.765)	0.334 (0.066 - 1.704)
Age group baseline: 18-24 years		
25-34 years		0.981 (0.411 - 2.347)
35-44 years		0.302** (0.102 - 0.896)
45-54 years		0.409 (0.139 - 1.205)
55+ years		1.567 (0.474 - 5.188)
Ethnic minority (baseline: not an ethnic minority)		1.345 (0.520 - 3.484)
Location: Rest of the world (baseline: UK)		0.530 (0.204 - 1.375)
Observations	295	295

*** p<0.01, ** p<0.05, * p<0.1; O.R: Odds Ratio; CI: Confidence Interval

Table 3: Results of unadjusted and adjusted OLS Regression for PSS-4 score (Models 1 and 2; regression coefficients and confidence intervals in brackets) and unadjusted and adjusted logistic regression results for odds of significant depressive symptomology indicated by CES-D-10 scores ≥10 (Models 3 and 4; odds ratios and confidence intervals in brackets)

	PSS-4 score		CES-D-10 scores ≥10	
	Unadjusted	Adjusted	Unadjusted	Adjusted
	B(CI)	B(CI)	O.R. (CI)	O.R. (CI)
Any harassment or inappropriate incidents				

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baseline: None				
Form of harassment reported	1.882***	1.436***	4.228***	3.252**
	(0.957 - 2.807)	(0.517 - 2.354)	(1.582 - 11.30)	(1.168 - 9.052)
No information	-0.378	-0.756	2.325	1.796
	(-1.863 - 1.108)	(-2.198 - 0.686)	(0.634 - 8.520)	(0.456 - 7.074)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian				
Cis female of another non-heterosexual orientation	2.014***	1.367***	2.881**	2.154*
	(0.977 - 3.052)	(0.345 - 2.389)	(1.257 - 6.604)	(0.890 - 5.210)
Transgender and gender diverse	2.357***	1.561***	2.748**	1.904
	(1.369 - 3.345)	(0.570 - 2.552)	(1.231 - 6.134)	(0.791 - 4.580)
Cis male gay	0.824*	0.769*	1.061	0.986
	(-0.113 - 1.761)	(-0.145 - 1.683)	(0.550 - 2.046)	(0.487 - 1.998)
Cis male of another non-heterosexual orientation	2.624***	1.982**	3.626	2.553
	(0.840 - 4.407)	(0.255 - 3.709)	(0.732 - 17.97)	(0.481 - 13.56)
Age group baseline: 18-24 years				
25-34 years		-1.070**		0.558
		(-2.127 - -0.0125)		(0.182 - 1.713)
35-44 years		-1.995***		0.480
		(-3.094 - -0.897)		(0.157 - 1.470)
45-54 years		-2.401***		0.309**
		(-3.574 - -1.228)		(0.098 - 0.974)
55+ years		-3.384***		0.361
		(-4.907 - -1.860)		(0.089 - 1.469)
Change in social status since pandemic baseline: positive change				
Negative change in status		1.375***		1.653
		(0.478 - 2.272)		(0.747 - 3.657)
No change		0.217		0.882
		(-0.590 - 1.025)		(0.452 - 1.719)
Relationship status baseline: Single				
Dating or in a relationship but not living together		0.225		0.953
		(-0.682 - 1.132)		(0.410 - 2.211)
Cohabiting/Married/Civil Partner		-0.332		0.499*
		(-1.159 - 0.496)		(0.244 - 1.018)
Divorced, Widowed or Prefer not to say		-0.328		0.625
		(-2.463 - 1.806)		(0.119 - 3.282)
Ethnicity baseline: not an ethnic minority				
Ethnic Minority		-0.378		1.525
		(-1.353 - 0.598)		(0.642 - 3.626)
Prefer not to say		1.621		1.778
		(-1.272 - 4.515)		(0.159 - 19.85)
Location: Rest of the world (baseline: UK)		-0.0235		1.076
		(-0.916 - 0.869)		(0.496 - 2.332)
Constant	6.087***	7.774***		
	(5.355 - 6.818)	(6.420 - 9.128)		
Observations	310	310	310	310
R-squared	0.147	0.263		

*** p<0.01, ** p<0.05, * p<0.1; B: Regression coefficient; O.R: Odds Ratio; CI: Confidence Interval

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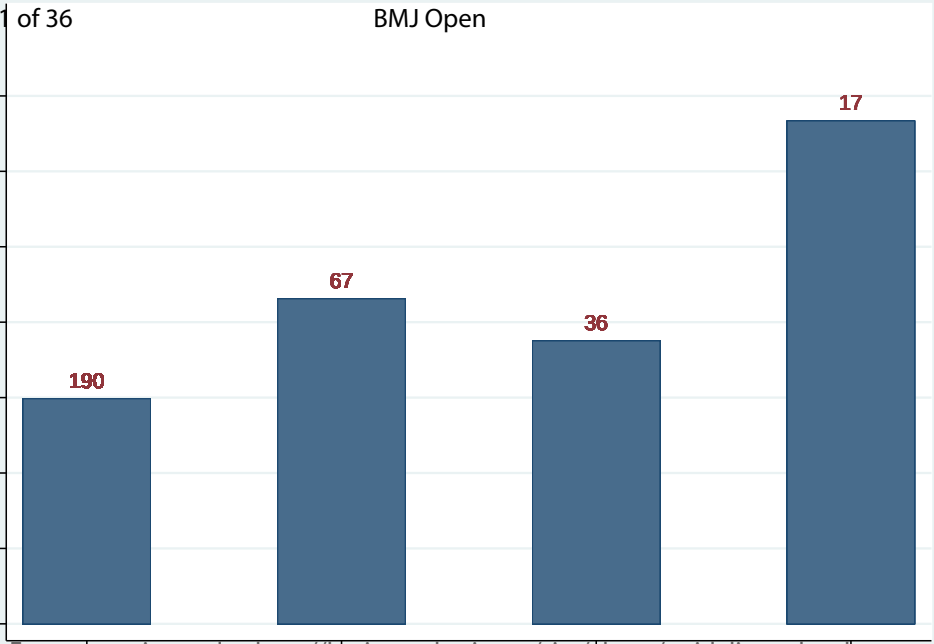

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Supplementary Materials

Supplementary Table 1 – Further breakdown of respondents' identities

	Cisgender Female	Cisgender Male	Transgender Female	Transgender Male	Non-binary or identify with another gender (e.g. agender)	Total
Straight-heterosexual	0	0	1	0	0	1
Gay/Lesbian	71	93	2	2	17	185
Bisexual	42	5	4	3	12	66
Queer	8	5	3	1	8	25
Asexual	3	0	0	1	5	9
Identify with another sexuality	6	1	2	0	8	17
Prefer not to say	0	2	1	0	3	6
Don't Know	1	0	0	0	0	1
Total	131	106	13	7	53	310

Supplementary Table 2 – Further breakdown of respondents' identities and mean PSS scores (standard deviation in brackets)

	Cisgender Female	Cisgender Male	Transgender Female	Transgender Male	Non-binary or identify with another gender (e.g. agender)	Total
Straight-heterosexual	/	/	/	/	/	/
Gay/Lesbian	6.43 (3.18)	7.03 (2.97)	/	/	7.71 (3.51)	6.92 (3.11)
Bisexual	8.36 (3.27)	9.20 (3.70)	/	/	9.33 (2.93)	6.00 (3.31)
Queer	9.00 (2.00)	8.8 (3.27)	/	/	10.38 (1.77)	9.36 (2.58)
Asexual	/	/	/	/	10.00 (2.24)	9.78 (1.92)
Identify with another sexuality	7.67 (3.33)	/	/	/	9.88 (2.59)	8.88 (2.85)

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Prefer not to say	/	/	/	/	/	9.00 (3.27)
Don't Know	/	/	/	/	/	/
Total	7.31 (3.29)	7.27 (3.07)	8.46 (3.31)	9.00 (2.94)	9.08 (2.97)	7.68 (3.22)

Notes: values for cells with less than 5 respondents suppressed

Supplementary Table 3 – Further breakdown of respondents' identities and proportion with CESD-D-10 scores suggesting significant depressive symptomology

	Cisgender Female	**Cisgender Male**	**Transgender Female**	**Transgender Male**	**Non-binary or identify with another gender (e.g. agender)**	**Total**
Straight-heterosexual	/	/	/	/	/	/
Gay/Lesbian	63.4%	61.3%	/	/	82.4%	64.3%
Bisexual	80.9%	80.0%	/	/	91.7%	80.3%
Queer	100.0%	100.0%	/	/	87.5%	96.0%
Asexual	/	/	/	/	100.0%	100.0%
Identify with another sexuality	66.7%	100.0%	/	/	75.0%	70.6%
Prefer not to say	/	/	/	/	/	83.3%
Don't Know	/	/	/	/	/	/
Total	71.8%	64.2%	76.9%	71.4%	86.8%	71.9%

Notes: values for cells with less than 5 respondents suppressed

Supplementary Table 4 – Continuous model estimates of CES-D-10

	Unadjusted	Adjusted
	B(SE)	B(SE)
Any harassment or inappropriate incidents baseline: None		

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Form of harassment reported	3.875***	2.700**
	(1.852 - 5.899)	(0.644 - 4.756)
No information	0.257	-0.623
	(-2.992 - 3.507)	(-3.852 - 2.606)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian		
Cis female of another non-heterosexual orientation	3.249***	2.132*
	(0.981 - 5.518)	(-0.156 - 4.420)
Transgender and gender diverse	4.797***	3.383***
	(2.636 - 6.958)	(1.164 - 5.602)
Cis male gay	1.226	1.027
	(-0.824 - 3.276)	(-1.020 - 3.074)
Cis male of another non-heterosexual orientation	4.336**	2.781
	(0.435 - 8.238)	(-1.087 - 6.648)
Age group baseline: 18-24 years		
25-34 years		-1.932
		(-4.299 - 0.436)
35-44 years		-2.899**
		(-5.359 - -0.439)
45-54 years		-4.453***
		(-7.080 - -1.826)
55+ years		-3.974**
		(-7.385 - -0.564)
Change in social status since pandemic baseline: positive change		
Negative change in status		2.649***
		(0.641 - 4.658)
No change		0.746
		(-1.061 - 2.554)
Relationship status baseline: Single		
Dating or in a relationship but not living together		0.440
		(-1.591 - 2.472)
Cohabiting/Married/Civil Partner		-1.979**
		(-3.831 - -0.127)
Divorced, Widowed or Prefer not to say		0.416
		(-4.364 - 5.196)
Ethnicity baseline: not an ethnic minority		
Ethnic Minority		0.404
		(-1.780 - 2.587)
Prefer not to say		1.076
		(-5.403 - 7.556)
Location: Rest of the world (baseline: UK)		-0.0193
		(-2.018 - 1.980)
Constant	11.22***	14.31***
	(9.622 - 12.82)	(11.28 - 17.34)
Observations	310	310

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R-squared	0.126	0.208

*** p<0.01, ** p<0.05, * p<0.1

Supplementary materials – further notes on measures of harassment and discrimination

Respondents were asked:

Since the start of the coronavirus pandemic, have you experienced any of the following in your day-to-day life (going to the shops, walking around the neighbourhood, etc…) because you are LGBTQ+ or others thought you were LGBTQ+?

- verbal harassment, insults or other hurtful comments;
- physical harassment or violence;
- sexual harassment or violence;
- threat of physical or sexual harassment or violence;
- exclusion from events or activities;
- someone disclosing that you are LGBTQ+ to others without your permission;
- any other inappropriate comments or conduct not listed above (please state).
- None

Respondents were free to select multiple options in terms of forms of discrimination.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7-10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8-10*
Bias	9	Describe any efforts to address potential sources of bias	10-12,19
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-12
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	10-12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	8
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12, 25-26
		(b) Indicate number of participants with missing data for each variable of interest	12
Outcome data	15*	Report numbers of outcome events or summary measures	12, 25-26

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-15, 26-28
		(*b*) Report category boundaries when continuous variables were categorized	12-15, 26-28
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	15-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Discrimination as a predictor of mental health issues among LGBTQ+ people during the COVID-19 pandemic: cross-sectional analysis of the online Queerantine Study

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Discrimination as a predictor of mental health issues among LGBTQ+ people during the COVID-19 pandemic: cross-sectional analysis of the online Queerantine Study

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Abstract

Objectives: To assess the mental health and experiences of discrimination amongst Lesbian, Gay, Bisexual, Transgender, Queer people (LGBTQ) at the start of the COVID-19 pandemic.

Design: Data come from a cross-sectional online survey targeted at LGBTQ+ people, which collected data on mental health, experiences of discrimination, and a number of other pandemic-related experiences. To examine the association between sexual orientation and gender, and mental health and experiences of discrimination, we conducted regression analyses that adjusted for a range of sociodemographic variables.

Setting: A web-based survey was used to collect data between the end of April and mid-July 2020.

Participants: An analytical sample of 310 LGBTQ+ respondents aged 18 and over.

Main outcome measures: We assessed mental health with the 4-item Perceived Stress Scale (PSS-4), and with the 10-item Center for Epidemiological Studies Depression scale (CES-D-10). We asked respondents about discriminatory experiences because of their LGBTQ+ identity during the coronavirus pandemic.

Results: Perceived stress scores among our LGBTQ+ sample were high (Mean: 7.67; Standard Deviation: 3.22). Based on a score of ten or over on the CES-D-10, the majority of participants had high levels of depressive symptoms (72%). Around one-in-six respondents reported some form of discrimination since the start of the pandemic because they were LGBTQ+ (16.7%). The average score for perceived stress increased by 1.44 points (95% Confidence Interval (CI): 0.517-2.354) for respondents who had experienced discrimination versus those who had not. Similarly, the odds of exhibiting significant depressive symptomology increased three-fold among those who had experienced discrimination compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052).

Conclusions: The LGBTQ+ community exhibited increased levels of depression, stress, and experienced discrimination during the coronavirus pandemic. Increased levels of poor mental health were partially explained by experiences of discrimination which had a large, consistent and pernicious impact on mental health.

Keywords: COVID-19; LGBTQ+; mental health; stress; discrimination.

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Article summary – strengths and limitations of this study

- This study uses tools that have been validated among diverse populations to identify high levels of perceived stress and depressive symptoms among LGBTQ+ people.
- An online convenience sample was deemed appropriate for a number of reasons including the inherent risk of transmission of COVID-19 with methods involving physical contact and to better include respondents who were sheltering or shielding in households where their LGBTQ+ status was concealed .
- An online convenience sample can introduce issues around representativeness and the possibility that those with greater mental health issues self-selected into the survey.
- Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community.
- Designing a survey that captured LGBTQ+ specific experiences allowed us to identify that sexuality- and gender-based discrimination experienced during the pandemic is an important predictor of mental health issues.

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Introduction

The coronavirus pandemic has exposed and magnified existent societal and health inequities operating across multiple and intersecting systems of oppression. [1 2] Given documented stark health and socioeconomic inequalities across social locations related to sexuality, and gender expression and identity, [3] the coronavirus disease (COVID-19) and subsequent social and economic implications could be expected to have disproportionate impacts on Lesbian, Gay, Bisexual, Transgender, and Queer people (LGBTQ+, the "plus" including those who identify as non-heterosexual and/or non-cisgender in another way).

Higher levels of pre-existing health conditions compared to cisgender and heterosexual populations, may place the LGBTQ+ community at additional risk of adverse prognosis if diagnosed with COVID-19. This includes long-term chronic illness, and higher rates of smoking and asthma among LGBTQ+ people; [4-7] higher rates of obesity, and alcohol consumption among lesbian, bisexual, and queer women; [7-9] and increased likelihood of being immunocompromised (e.g. HIV+ with a low CD4 cell count or with untreated HIV) among gay men and transgender people. [10] In addition, the impacts of social distancing and lockdown may be felt acutely by LGBTQ+ people, who were at greater risk of poorer mental health prior to the pandemic including higher risks of suicide attempts and suicidal ideation, higher levels of common mental disorders, and lower levels of mental wellbeing. [11 12 13] For example, studies using the 4-item Perceived Stress Score (PSS-4), a measure used in the present study (see methods), have found mean values have ranged between 6.75 and 7.43 for US college students who identified as 'homosexual' and bisexual respectively, compared to 6.09 among heterosexual students. [14] Similarly, studies examining depression using the Center for Epidemiological Studies Depression Scale (CES-D-10), a measure of depressive symptomatology used in the present study (see methods), have found that the proportion

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reporting substantial depressive symptomology among African American LGB young people to stand at roughly double that of heterosexual young people in the southern United States (56.1% vs 28.4%). [15] Comparative data on LGBTQ+ experiences during the pandemic are rare, although in the UK general population the average stress score (using the PSS-4 scale) was estimated to be 6·48 (Standard Deviation: 3·3), [16] above a 6-point threshold used to indicate 'high' levels of stress elsewhere. [17] Estimates within the general (US) population during the COVID-19 pandemic have suggested that up to a third of people may be experiencing substantial depressive symptomology (using the CES-D-10 scale). [18]

Within the heterogeneous LGBTQ+ umbrella term, individual groups may be positioned at a distinct disadvantage. Transgender and gender-diverse (TGGD) individuals have a gender that differs from the culturally-bound gender associated with one's assigned birth. [19] TGGD people are known to experience higher rates of adverse mental health compared to cisgender individuals (people whose gender matches their sex assigned at birth), particularly anxiety, depression, and suicidality. [5 6 20]

Despite the accumulation of evidence indicating poorer health among LGBTQ+ people predating the pandemic, there is a dearth of information on whether the hypothesised additional risks outlined above have actually materialised in poorer outcomes among LGBTQ+ people during the COVID-19 pandemic. Indicative evidence suggests that some LGBTQ+ groups may exhibit higher levels of depression and stress during the COVID-19 pandemic [21] and other studies suggest that mental health among LGBTQ+ people may have deteriorated during the pandemic compared to pre-pandemic levels. [22]. However, while some studies indicate that LGBTQ+ people may be more susceptible to stress and depression during the COVID-19 pandemic, this has been largely attributed to existing inequalities in

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mental health status, with differences attenuating once pre-pandemic levels of mental health are accounted for [21]. In other words, although absolute differences in mental health status may be observed, there are few differences between the way in which LGBTQ+ and cisgender-heterosexual people's mental health changed during the pandemic [23]. The findings from these studies are a cause of concern in of themselves, given that the lockdown entailed a separation from social networks and formal support that could help people in managing mental health issues. However these studies, which drew on samples of both LGBTQ+ and cisgender-heterosexual respondents, did not account for other risk factors for mental health that may have continued and intensified in potency during the pandemic and resulting lockdown for LGBTQ+ people. Mental health inequalities during and predating the pandemic are a product of complex processes of discrimination and exclusion [24 25], and examinations of LGBTQ+ mental health that do not examine these process may provide an incomplete understanding of how LGBTQ+ people have fared during the pandemic.

Certainly, LGBTQ+ people face stressors during the pandemic that are not shared with heterosexual and cisgender people, including spending periods of 'lockdown' in households that are not affirming or supportive of their sexual orientation or gender identity or expression, [26] being separated from social networks that are supportive and affirming to their identity, [27 28] and interruptions to accessing gender affirming care among transgender and gender non-binary people [29 30]. Theoretical frameworks including the Minority Stress Model suggest that stark health inequalities are the result of distal and proximal stressors caused by living within a homophobic, heterosexist, transphobic culture, results in cumulative experiences of discrimination, harassment, victimization, expectations of rejection, and internalized transphobia and homophobia. [24 25] These experiences have been extensively documented across several studies, where high prevalence of experiences of stigma and discrimination has been reported among the LGBTQ+ community. [31 32] During the pandemic,

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experiences of discrimination may have become magnified because, as described above, LGBTQ+ people may have been sheltering in households that were unsupportive or hostile towards their identities, [26] or have not received support from networks and relevant organisations. In some contexts, the pandemic has triggered a rise in hate speech and targeted attacks on the LGBTQ+ community, and members of the LGBTQ+ community have been blamed for the very emergence of the virus. [33] Unrelated to the coronavirus itself, the lockdown coincided with online debates around sex and gender, which have manifested in transphobic comments made and supported by high profile figures, and a hostile online environment for many transgender people. [34] These attacks occurred at a time when many in the community were unable to draw on their usual support networks.

In the context of the coronavirus pandemic where existent inequalities are being exacerbated across social locations, [2] it is paramount to document how the LGBTQ+ community has fared during the initial stages of the coronavirus pandemic. The present study aims to address this need through analysing data from the Queerantine Study (a portmanteau Queer and Quarantine), a web-based survey that assesses how LGBTQ+ adults are experiencing the coronavirus pandemic. In the present paper, we examine extent to which respondents to the Queerantine survey experienced forms of sexuality or gender-based discrimination, including harassment and exclusion, during the coronavirus pandemic. We also examine how widespread experiences of perceived stress and depressive symptomology were among respondents to the Queerantine survey and examine to what extent instances of harassment and exclusion predict poorer mental health among LGBTQ+ respondents during the coronavirus pandemic.

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Methods

Data collection was conducted via a cross-sectional, web-based anonymous survey. It began on 27th April 2020 and ended on 30th December 2020.. Twitter, Facebook and Instagram accounts were created for the study and were used to disseminate links to the survey in order to maximise the response rate. We contributed guest blogs and created a website in order to help publicise the study (https://queerantinestudy.wixsite.com/queerantine). The link to the survey was distributed through a number of LGBTQ+ organisations including through the newsletter of the LGBT Consortium, the largest network of LGBT+ groups, projects and organisations in the UK, as well as directly by local organisations such as the East London Out Project (ELOP). The target sample included respondents aged 18 and over, and who self-identify as lesbian, gay, bisexual, queer, as having another minority sexual orientation; or who were transgender or gender diverse in other ways including being non-binary or intersex. Cisgender respondents who self-identify as heterosexual were not excluded from the survey, although recruitment and survey design were tailored towards the LGBTQ+ community, and their responses were not included in the analyses presented here. The Queerantine survey asked respondents about their sociodemographic characteristics, their physical and mental health, health behaviours, and experiences and anxieties relating to the pandemic and their identity. Ethical approval was obtained from the ethics board of the University of Sussex (ER/LB516/4) and University College London (REC 1335).

Patient and Public Involvement

Expert input from a representative of a national LGBT umbrella organisation broadened the focus of the survey to consider how respondents had experienced changes in support from LGBTQ+ service providers and organisations; this input also helped to shape the measures around gender. Community organisations also helped in the dissemination of the study

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through social media and inclusion of the study within newsletters. However, no further public involvement was sought in the design or analysis of the survey.

Outcome variables

In this analysis we focus on three outcomes: depressive symptoms, perceived stress, and experiences of discrimination. We assessed depression with the 10-item Center for Epidemiological Studies Depression Scale (CES-D-10), which asks respondents to consider how much in the past week they have experienced feelings of loneliness, happiness, and fear. [35] The CES-D-10 includes three items on depressed affect, five items on somatic symptoms, and two on positive affect. [36] Scores range between 0 and 30 with good levels of internal consistency in our analytical sample (Cronbach's α=0.87). Thresholds were used to denote significant depressive symptoms' based on a score of ten or over [35]. In the present study we mainly examine the CES-D-10 as a binary measure, with supplementary analyses presenting data on CES-D-10 in continuous models.

We measured stress with the 4-item Perceived Stress Scale (PSS-4), which assesses the extent to which situations in life are viewed as stressful. [37] The scale asks respondents about respondents' perceived ability to control important things in life, confidence in handling personal problems, the extent to which they felt things were going their way, and whether difficulties were piling up so high they were becoming insurmountable, using the past month as a frame of reference. Scores range between 0 and 15, and have good levels of internal consistency in our analytical sample (Cronbach's α=0.83).

We measured experiences of discrimination with a set of options that asked respondents whether, since the start of the coronavirus pandemic, they had experienced verbal harassment, physical harassment, sexual harassment, threats of violence, exclusion from

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events/activities, involuntary disclosure of LGBTQ+ identity, or other forms of inappropriate treatment because they were LGBTQ+ or were perceived as being LGBTQ+. Individual measures were combined into one summary variable of 'any discrimination.'

Sexual orientation and gender

Gender was assessed using the recommended two-step method [38] with two items: (1) the gender that participants felt best represented them (options included: Female (including trans woman); Male (including trans man); Non-binary; Other (free text category)), and (2) whether this gender was the same as assigned at birth (options included: Yes; No; Don't Know). The two items were cross-tabulated to categorise participants as either transgender and gender diverse (TGGD) or cisgender. Sexual orientation was captured with a question that asked participants to select their sexual orientation from the following categories: Bisexual; Gay/Lesbian; Heterosexual/Straight; Don't know; Prefer not to say; and an Other, free-text category. Using pre-defined response categories, respondents could only select one category, although those who identified with multiple categories (e.g. Queer and Bisexual or Male and Non-binary) could use the free-text option to state this, with respondents declaring more than one gender being categorised as transgender and gender diverse, and respondents selecting more than one sexual orientation categorised as having another non-heterosexual orientation.

We present data on sexual orientation and gender as different constructs in supplementary analyses, although the main analyses use a variable that examines the intersection of sexual orientation and gender using five categories: (i) cisgender female lesbian/gay; (2) cisgender female with another non-heterosexual orientation (including bisexual, other, don't know, and prefer not to say); (3) transgender and gender diverse; (4) cisgender male gay; (5) cisgender

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male with another non-heterosexual orientation (including bisexual, other, don't know, and prefer not to say).

Covariates

We adjusted for variables thought to confound the association between our exposure and outcome variables. Socioeconomic status was measured through a variable that asked respondents about their subjective social status (modelled on an approach used in general population surveys [39]), and how this had changed since the start of the pandemic, with categories reflecting no change, positive change, and negative change.

Analytical plan

Data for the present analyses includes responses collected until 13 July 2020. The analysis mainly consisted of a complete case analysis of respondents, although a dummy category of no information (missing) for the harassment variable was created for models of mental health in order to preserve sample size. Summary statistics were calculated for baseline characteristics and associations between exposure variables and outcomes were tested in unadjusted analyses using the χ^2 test of association and ANOVA as appropriate. The modelling began with exploring selected predictors of discrimination before examining how discrimination itself predicted poorer mental health. Binary logistic regression models were constructed for harassment and high depressive symptomology; Ordinary Least Squares (OLS) regression models were constructed for continuous models of perceived stress and depressive symptoms. Results for both binary and continuous specifications of CES-D-10 are discussed, with the results for the continuous specification included in supplementary analyses, as a form of sensitivity analysis. For models where discrimination is the outcome of interest we only adjusted for sexual orientation and gender, age, ethnicity, and location. For

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models where depressive symptomology or perceived stress are the outcomes of interest, we used the measure of discrimination as the main exposure variable, and adjusted for the same covariates as above as well socioeconomic status and relationship status. A different set of controls was used between models as the potential confounders were theorised to differ slightly and due to the lower number of 'events' in the model of discrimination.

Additional analysis examining when in the pandemic harassment and discrimination occurred is also included to contextualise the discussion. Adjusted and unadjusted models are presented, and in line with suggested practice, estimates were evaluated based the exact p-value, the magnitude of the coefficients and the width of the confidence intervals, rather than on a single test statistic. [40] We conducted all analyses in Stata 14. [41] The decision on how to present the findings across diverse identities is challenging, particularly as we combined information on sexual orientation and gender in deriving categories. Our decisions reflected considerations of the conceptual similarities/differences between groups, the numbers across groups within our sample, as well as the decision to adopt an 'inclusive' or 'specific' approach [42] when analysing the data based on observed differences in key variables. Some preliminary analysis (not shown) was undertaken to explore the validity of bringing different groupings together before the decision was taken to use five main categories combining sexual orientation and gender.

Results

Between April 27th and July 13th we received a total of 426 responses. Of these 24 were excluded because they did not provide their age, and 4 were excluded because they were aged under 18. Of the remaining 398, we were able to calculate PSS-4 and CES-D-10 scores for 325 and 324 respondents respectively. Once we had accounted for missingness on other

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covariates, the analytical sample consisted of 310 respondents for models of mental health, excluding one further cisgender heterosexual respondent.

TABLE 1 HERE

Participants identified their sexual orientation and gender in a number of different ways. The largest group identified as cisgender gay males (30.0%); almost a quarter of the sample (23.5%) were categorised as TGGD (of different sexual orientations); cisgender gay and lesbian females comprised 22.9% of the respondents; while cisgender females with another non-heterosexual orientation accounted for 19.4% of respondents, and cisgender males with another non-heterosexual orientation accounted for 4.2% of respondents. A further breakdown of respondents' identities is available in the supplementary file, with descriptive information on key variables. Respondents aged 18-24 accounted for less than a fifth of the sample (15.1%), while those aged 55+ accounted for less than a tenth of the sample (7.1%), with a greater representation of respondents aged 25-54 years old.

Descriptively, the mean scores for PSS-4 suggested that the sample had high levels of perceived stress (Mean (M): 7.67; Standard Deviation (SD): 3.22). Using the recommended threshold of 10 or more to identify significant depressive symptomatology, we observed that the majority of respondents fell into this category (71.9%). Cis-female respondents who identify as gay or lesbian had the lowest scores for perceived stress or depressive symptoms (see Table 1); conversely transgender and gender diverse individuals had the highest scores (83.6%).

One-in-six respondents reported some form of harassment since the start of the pandemic because they were LGBTQ+ (16.7%); the most common forms being verbal harassment

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including insults or other hurtful comments (8.7%), exclusion from events or activities (5.6%), and involuntary disclosure of LGBTQ+ identity (3.5%). Perceived stress was markedly higher for those who had experienced discrimination (PSS-4 M: 9.44 SD: 2.99) compared to those who had not (PSS-4 M: 7.35 SD: 3.16). Respondents who had experienced discrimination also had higher depressive symptomology scores (CES-D-10 M: 17.87 SD: 6.21) compared to those who had not (CES-D-10 M: 13.43 SD: 6.97).

TABLE 2 HERE

We examined the relationship between gender and sexual orientation and discrimination in logistic regression models (see Table 2). Based on the association observed in Table 1, we used TGGD as the reference category and explored whether the higher risk of TGGD people to experience discrimination remained after controlling for basic sociodemographic covariates. The results from adjusted models showed that the odds of experiencing discrimination were lower for all other groups, and significantly lower in the case of cisgender gay males (OR: 0.237, 95% Confidence Interval (CI):0.091-0.617) and cisgender females who identified with a sexual minority orientation other than gay/lesbian (OR: 0.361, CI: 0.141-0.921). Within the sample, the results were suggestive of a u-shaped trend in terms of age, with the youngest and the oldest LGBTQ+ respondents in the sample being at greatest risk of experiencing discrimination, although differences by age were generally not statistically significant.

Experiences of discrimination were clear predictors of poorer mental health. The average score for perceived stress increased by 1.44 points (CI: 0.517-2.354) for those who had experienced discrimination, compared to those who had not. Similarly, the odds of exhibiting

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significant depressive symptomology (CES-D-10 scores of 10 or more) increased three-fold among those who had experienced discrimination based on their gender or sexuality compared to those who had not (OR: 3.251; 95% CI: 1.168-9.052). These marked associations remained after adjusting for potential confounders (see Models 1 to 4 in Table 3).

TABLE 3 HERE

Cisgender female lesbian or gay respondents had lower perceived stress levels than other LGBTQ+ groups. TGGD respondents and non-heterosexual cisgender males who didn't identify as gay had among the highest average perceived stress scores in adjusted models. Although similar trends were observed in the odds of experiencing depressive symptomatology, the evidence was ultimately inconclusive for these groups, although cisgender females with another non-heterosexual orientation besides lesbian or gay had a higher risk of significant depressive symptoms relative lesbian/gay cisgender women. Further sensitivity analysis of the CES-D-10 as a continuous measure (see supplementary file) shows that TGGD people had substantially higher CES-D-10 scores than cisgender lesbian or gay females, with an average score 3.38 points (95% CI: 1.172-5.595) higher after adjusting for other covariates. A clear trend by age was observed in models 3 and 4 (see Table 3), with younger respondents having significantly poorer mental health than older individuals, both for perceived stress and significant depressive symptomology, after adjusting for other covariates.

Discussion

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In this study we present data on the levels of depressive symptoms, perceived stress, and experiences of discrimination of LGBTQ+ people during the COVID-19 pandemic collected through a web-based survey. Respondent characteristics broadly mirrored the sociodemographic characteristics of the recent UK government National LGBT Survey. [43] The distribution of respondents by sexual orientation was very similar, albeit with a higher share of respondents who identified as Queer in the Queerantine survey (8% vs approximately 1%). The proportion of respondents aged 18-24 was lower at 15.1% (compared with approximately 37.4%), with higher proportions at older age groups in line with the UK population as a whole. The Queerantine survey had a larger proportion of participants who were TGGD than the UK National LGBT Survey (23.5% vs 15%). [43]

We find that scores for perceived stress and depressive symptoms among our LGBTQ+ sample are high, and higher than observed in community samples and vulnerable populations in the recent past (for example [44 45]). Furthermore, we find that the pandemic may not be impacting the LGBTQ+ community evenly, with TGGD individuals having particularly high scores for perceived stress and depressive symptoms relative to cisgender gay and lesbian individuals. Non-heterosexual respondents who are cisgender but do not identify as lesbian or gay also had elevated scores for perceived stress and depressive symptoms. Similarly, there was a clear age gradient with younger LGBTQ+ people having much higher risks of showing symptoms of stress and depression. This is in line with findings elsewhere that suggest younger people were at elevated risk of experiencing stress, anxiety and depression during the pandemic. [46] An important caveat to these results is that because of our cross-sectional design, we are unable to definitively state that mental health status *deteriorated* as a result of the pandemic and whether any deterioration in mental health was concentrated among TGGD respondents or younger respondents; our study design also means we are unable to make

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direct comparisons to ascertain whether LGBTQ+ people are faring worse during the pandemic than heterosexual cisgender people. However, the underlying pathways through which LGBTQ+ people may have experienced greater and specific challenges during the pandemic and lockdown are becoming evident, [22 26-30] providing a basis for an assumption that LGBTQ+ people may have experienced greater stressors, with TGGD people facing particular sets of stressors, albeit on a theoretical basis and in need of further exploration and verification. Furthermore the very high levels of mental health issues uncovered here make it challenging to simply attribute such stark levels of mental health issues as the status quo pre-pandemic, although this assumption again needs further exploration and verification using a different study design. Regardless, the data definitively show that the pandemic has had a pernicious effect on the mental health of the LGBTQ+ community.

Our analyses of discrimination reinforce the rationale for undertaking analyses of LGBTQ+ health and mental health, with LGBTQ+ people theorised at greater risk of health complications due to a unique set of internal and external homophobic, heteronormative, and transphobic stressors. [47] We found that almost one-in-six respondents reported experiencing some form of discrimination during the pandemic, with TGGD respondents again at heightened risk of experiencing discrimination relative to other LGBTQ+ groups. Our results show that experiencing discrimination was a risk factor for higher perceived stress and depressive symptomology; the odds of reporting depressive symptomatology among individuals who had experienced discrimination were three times higher than among individuals who had not experienced any discrimination. Open ended responses to the survey described various experiences of discrimination and inappropriate incidents including increased or excessive scrutiny, misgendering, exclusion, and online abuse.

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To further understand the results, we explored how mental health and discrimination varied over the course of the survey. We observed that mental health scores in the sample were poorer during the period April 27th-May 10th (the moment of 'maximum risk' as defined by the UK Prime Minister) and during the period between May 23rd-June 14th (coinciding with revelations of lockdown breaches by government officials in the UK, transphobic comments on social media made by high profile figures, and protests surrounding the murder of George Floyd), although these differences were not significant. Similarly, we observed non-statistically significant differences in the proportion of respondents reporting instances of discrimination, with the initial easing of the lockdown and particularly the period from June 15th onwards coinciding with increases in discrimination (see Figure 1), albeit based on a small sample in the latter period. These trends help contextualise the results and illuminate the hostile environments which LGBTQ+ people, and particularly TGGD respondents, were experiencing.

FIGURE 1 HERE

Limitations

Due to relatively small sample sizes, we have not been able to fully examine the diversity of the LGBTQ+ community, and fully examine how experiences vary according to social locations such as ethnicity, age, and gender. Studies in the US show that the highest levels of violence are reported among transgender women of colour, and among young and low-income transgender people, [31 32] suggesting that violence on the basis of transgender identity or expression often affects the most marginalised subpopulations. Although we have adjusted for these factors in our models, we have not been able to further disaggregate across social locations to examine the role of interlocking systems of oppression in patterning experiences of discrimination and adverse mental health.

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While our data collection efforts are limited by the inherent challenge of surveying a small, dispersed, diverse, and difficult to reach population, it is nonetheless critically important to study the lives and experiences of discrimination and mental health among LGBTQ+ communities because of the stark health and social inequalities they experienced before the pandemic. Our choice of mental health measures reflected the need to field short scales within a web-based survey where there was no incentive provided for respondents to complete the questions. However, other more comprehensive or alternative measures of mental health, and particularly mental wellbeing, may have yielded further nuance to the results presented here.

New purposeful data collection was deemed appropriate as although a number of large representative studies (e.g. the UK Household Longitudinal Study) are currently collecting data on COVID-19 experiences, they typically contain small numbers of LGBTQ+ people, [8] [12] often do not collect information on TGGD identities, and contain heteronormative measures that can be exclusionary to LGBTQ+ respondents. An online convenience sample was deemed appropriate due to the absence of robust data on LGBTQ+ people from large surveys that could help to determine the characteristics of a representative sample of LGBTQ+ people, as well as the risks inherent with any form of physical data collection during the pandemic. An online approach was particularly suitable for those respondents who may have been sheltering or shielding in households where their LGBTQ+ status was unknown to other members of the household. Furthermore, this approach is in line with other recent large scale efforts at understanding the health of LGBT people in the UK. [43] We do, nevertheless, acknowledge that an online convenience sample can introduce potential issues around sample selection, such as the omission of those without internet access, and the

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possibility that those living in stressful situations or with depressive symptoms were more likely to self-select into the survey. Although rudimentary checks for data patterns that could indicate that 'bots' completed the survey were implemented, focussed on identifying cases where the same response had been provided to all Likert scale type questions, or where the middle response had been consistently provided, there remains a possibility that some responses may be based on false or duplicate records. Further measures that could have been implemented, such as password protection or identity checking, were not congruent with a format that allowed respondents to complete the survey anonymously, or believe that they were doing so.

As the inferential analysis consisted of three regression models where we show the development of the model by including additional regressors, we did not implement additional correction for multiple hypotheses (e.g. Bonferroni). We do note that, given a scenario where 20 hypotheses were being tested at a 5% level, we would expect to see at least one such deviation where we would interpret a result as being 'statistically significant' inappropriately [48]; however, as discussed earlier, we also took a broader approach to evaluating estimates than interpreting p-values as being "significant" or "nonsignificant". [40]

Public Health Implications

Results from the Queerantine Study suggest that groups within LGBTQ+ acronym may be at differential risk of experiencing stress or depressive symptomology, although the sample as a whole may also be at higher risk than the general population of stress and depressive symptomology due to minority stress. Homophobic and transphobic harassment and exclusion experienced during the pandemic has a deleterious impact on LGBTQ+ mental health, demonstrated by the strong and consistent associations between harassment and

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poorer mental health in the models. Open-ended responses to survey questions emphasise the importance of LGBTQ+ social networks, often facilitated by the work of LGBTQ+ organisations, in supporting LGBTQ+ individuals. However, these are the very organisations that are facing financial challenges with many on the brink of closure. [49]

Globally, LGBT+ rights organisations have alerted policy-makers about the need to address the vulnerability of the LGBTQ+ community to the coronavirus pandemic, including collecting sexual orientation and gender data for COVID-19 cases, increased socioeconomic support for disadvantaged individuals, and support for organisations working with the community. [50] Our findings provide support to these demands given the documented high prevalence of depressive symptomology and stress, and the concerning reports of experiences of discrimination. Poor LGBTQ+ mental health may remain unchecked without substantial commitment and funding directed to ameliorating health inequalities exacerbated by the pandemic.

Contributors

DK and LB are equal contributors to this study. Both designed the Queerantine survey, developed the research focus, analysed the data, and drafted and edited the manuscript. DK and LB are the guarantors for this study and gave full approval of this version to be published.

Data sharing statement

No additional data are available.

Competing interests

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None to declare. Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting individual level data is not available.

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Ethical approval

Ethical approval was obtained from the ethics board of the University of Sussex (ER/LB516/4) and University College London (REC 1335).

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Figure 1 Proportion of respondents reporting discrimination by period in the pandemic

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Tables and Figures

Table 1: Mental health, experiences of discrimination, and sociodemographic characteristics of the Queerantine Study respondents

	Cis female Gay/Lesbian	Cis female of another non-heterosexual orientation	Trans-gender and Gender Diverse (TGGD)	Cis male Gay	Cis male of another non-heterosexual orientation	Total
	%	%	%	%	%	%
Mental health outcomes						
PSS-4 Score, M(SD)	6.44 (3.18)	8.33 (3.14)	8.96 (2.99)	7.03 (2.97)	9.00 (3.37)	7.672 (3.218)
CES-D-10 Score, M(SD)	12.0 (6.65)	15.0 (5.86)	17.15 (6.6)	12.75 (7.17)	16.15 (7.5)	14.174 (6.948)
Evidence of significant depressive Symptomology						
No evidence (<10)	36.62	18.33	16.44	38.71	15.38	28.06
Evidence of significant depressive symptomology (≥10)	63.38	81.67	83.56	61.29	84.62	71.94
Any LGBTQ+ related harassment or inappropriate incidents						
None reported	74.65	81.67	64.38	87.10	84.62	77.81
Harassment reported[§]	19.72	13.33	28.77	7.53	15.38	16.72
No information (missing)	5.63	5.00	6.85	5.38	0	5.47
Age Group						
18-24	9.86	18.33	31.51	2.15	30.77	15.11
25-34	18.31	45.00	31.51	32.26	23.08	30.87
35-44	39.44	23.33	16.44	31.18	23.08	27.65
45-54	23.94	10.00	16.44	23.66	15.38	19.29
55+	8.45	3.33	4.11	10.75	7.69	7.07
Identify as ethnic minority						

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Not an ethnic minority	87.32	81.67	90.41	83.87	76.92	85.53
Ethnic minority	12.68	16.67	9.59	12.90	23.08	13.18
Prefer Not to Say	0	1.67	0	3.23	0	1.29
Location						
UK	81.69	80.00	82.19	90.32	76.92	83.60
Rest of the world	18.31	20.00	17.81	9.68	23.08	16.40
Change in perceived social status						
Negative change in status	25.35	26.67	36.99	23.66	23.08	27.65
No change	52.11	43.33	35.62	51.61	61.54	46.95
Positive change	22.54	30.00	27.40	24.73	15.38	25.40
Total						100.00
Relationship status						
Single	21.13	25.00	42.47	19.35	23.08	26.37
Dating or in a relationship but not living together	21.13	30.00	19.18	26.88	46.15	25.08
Cohabiting/Married/Civil Partnership	56.34	45.00	34.25	49.46	30.77	45.98
Divorced, Widowed or Prefer Not to Say	1.41	0	4.11	4.30	0	2.57
Total (%)	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Total (N)	**71**	**60**	**73**	**93**	**13**	**310**

Notes: M = Mean; SD = Standard Deviation; $ see methods for types of incidents

Table 2: Logistic regression results for unadjusted and adjusted associations between gender identity/sexual orientation and discrimination during COVID-19 pandemic (Odds ratios and confidence intervals in brackets)

	Experiences of discrimination	
	Unadjusted	Adjusted
	O.R. (CI)	O.R. (CI)
Gender ID and Sex Orientation baseline: Transgender and gender diverse		
Cis female Gay/Lesbian	0.576 (0.265 - 1.252)	0.743 (0.320 - 1.727)
Cis female of another non-heterosexual orientation	0.364** (0.147 - 0.897)	0.361** (0.141 - 0.921)
Cis male gay	0.218*** (0.090 - 0.529)	0.237*** (0.091 - 0.617)
Cis male of another non-heterosexual orientation	0.364 (0.075 - 1.765)	0.334 (0.066 - 1.704)
Age group baseline: 18-24 years		
25-34 years		0.981 (0.411 - 2.347)
35-44 years		0.302**

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		(0.102 - 0.896)
45-54 years		0.409
		(0.139 - 1.205)
55+ years		1.567
		(0.474 - 5.188)
Ethnic minority (baseline: not an ethnic minority)		1.345
		(0.520 - 3.484)
Location: Rest of the world (baseline: UK)		0.530
		(0.204 - 1.375)
Observations	295	295

*** p<0.01, ** p<0.05, * p<0.1; O.R: Odds Ratio; CI: Confidence Interval

Table 3: Results of unadjusted and adjusted OLS Regression for PSS-4 score (Models 1 and 2; regression coefficients and confidence intervals in brackets) and unadjusted and adjusted logistic regression results for odds of significant depressive symptomology indicated by CES-D-10 scores ≥10 (Models 3 and 4; odds ratios and confidence intervals in brackets)

	PSS-4 score		CES-D-10 scores ≥10	
	Unadjusted	Adjusted	Unadjusted	Adjusted
	B(CI)	B(CI)	O.R. (CI)	O.R. (CI)
Any harassment or inappropriate incidents baseline: None				
Form of harassment reported	1.882***	1.436***	4.228***	3.252**
	(0.957 - 2.807)	(0.517 - 2.354)	(1.582 - 11.30)	(1.168 - 9.052)
No information	-0.378	-0.756	2.325	1.796
	(-1.863 - 1.108)	(-2.198 - 0.686)	(0.634 - 8.520)	(0.456 - 7.074)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian				
Cis female of another non-heterosexual orientation	2.014***	1.367***	2.881**	2.154*
	(0.977 - 3.052)	(0.345 - 2.389)	(1.257 - 6.604)	(0.890 - 5.210)
Transgender and gender diverse	2.357***	1.561***	2.748**	1.904
	(1.369 - 3.345)	(0.570 - 2.552)	(1.231 - 6.134)	(0.791 - 4.580)
Cis male gay	0.824*	0.769*	1.061	0.986
	(-0.113 - 1.761)	(-0.145 - 1.683)	(0.550 - 2.046)	(0.487 - 1.998)
Cis male of another non-heterosexual orientation	2.624***	1.982**	3.626	2.553
	(0.840 - 4.407)	(0.255 - 3.709)	(0.732 - 17.97)	(0.481 - 13.56)
Age group baseline: 18-24				

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years				
25-34 years		-1.070**		0.558
		(-2.127 - -0.0125)		(0.182 - 1.713)
35-44 years		-1.995***		0.480
		(-3.094 - -0.897)		(0.157 - 1.470)
45-54 years		-2.401***		0.309**
		(-3.574 - -1.228)		(0.098 - 0.974)
55+ years		-3.384***		0.361
		(-4.907 - -1.860)		(0.089 - 1.469)
Change in social status since pandemic baseline: positive change				
Negative change in status		1.375***		1.653
		(0.478 - 2.272)		(0.747 - 3.657)
No change		0.217		0.882
		(-0.590 - 1.025)		(0.452 - 1.719)
Relationship status baseline: Single				
Dating or in a relationship but not living together		0.225		0.953
		(-0.682 - 1.132)		(0.410 - 2.211)
Cohabiting/Married/Civil Partner		-0.332		0.499*
		(-1.159 - 0.496)		(0.244 - 1.018)
Divorced, Widowed or Prefer not to say		-0.328		0.625
		(-2.463 - 1.806)		(0.119 - 3.282)
Ethnicity baseline: not an ethnic minority				
Ethnic Minority		-0.378		1.525
		(-1.353 - 0.598)		(0.642 - 3.626)
Prefer not to say		1.621		1.778
		(-1.272 - 4.515)		(0.159 - 19.85)
Location: Rest of the world (baseline: UK)		-0.0235		1.076
		(-0.916 - 0.869)		(0.496 - 2.332)
Constant	6.087***	7.774***		
	(5.355 - 6.818)	(6.420 - 9.128)		
Observations	310	310	310	310
R-squared	0.147	0.263		

*** p<0.01, ** p<0.05, * p<0.1; B: Regression coefficient; O.R: Odds Ratio; CI: Confidence Interval

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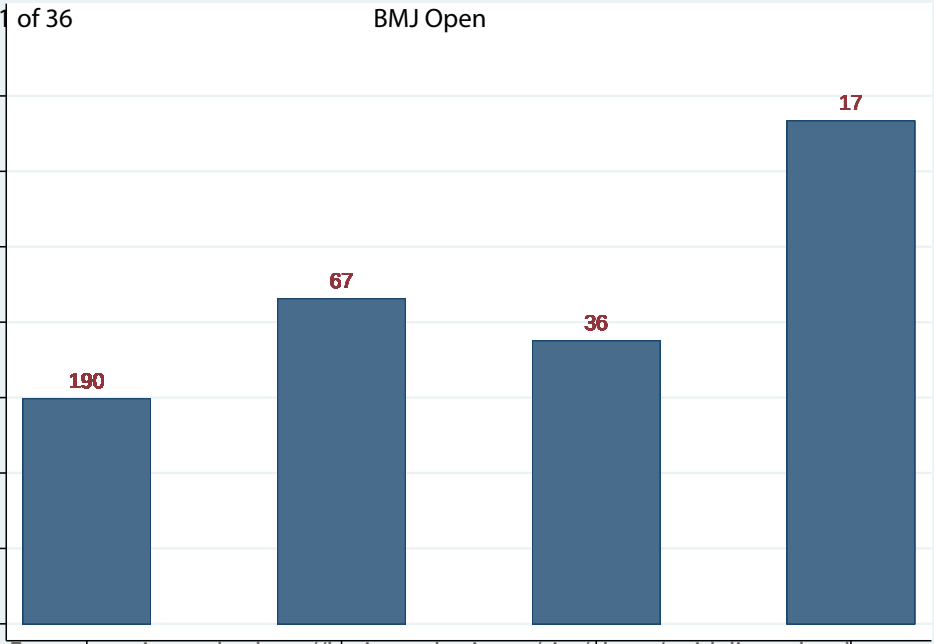

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Supplementary Materials

Supplementary Table 1 – Further breakdown of respondents' identities

	Cisgender Female	Cisgender Male	Transgender Female	Transgender Male	Non-binary or identify with another gender (e.g. agender)	Total
Straight-heterosexual	0	0	1	0	0	1
Gay/Lesbian	71	93	2	2	17	185
Bisexual	42	5	4	3	12	66
Queer	8	5	3	1	8	25
Asexual	3	0	0	1	5	9
Identify with another sexuality	6	1	2	0	8	17
Prefer not to say	0	2	1	0	3	6
Don't Know	1	0	0	0	0	1
Total	131	106	13	7	53	310

Supplementary Table 2 – Further breakdown of respondents' identities and mean PSS scores (standard deviation in brackets)

	Cisgender Female	Cisgender Male	Transgender Female	Transgender Male	Non-binary or identify with another gender (e.g. agender)	Total
Straight-heterosexual	/	/	/	/	/	/
Gay/Lesbian	6.43 (3.18)	7.03 (2.97)	/	/	7.71 (3.51)	6.92 (3.11)
Bisexual	8.36 (3.27)	9.20 (3.70)	/	/	9.33 (2.93)	6.00 (3.31)
Queer	9.00 (2.00)	8.8 (3.27)	/	/	10.38 (1.77)	9.36 (2.58)
Asexual	/	/	/	/	10.00 (2.24)	9.78 (1.92)
Identify with another sexuality	7.67 (3.33)	/	/	/	9.88 (2.59)	8.88 (2.85)

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Prefer not to say	/	/	/	/	/	9.00 (3.27)
Don't Know	/	/	/	/	/	/
Total	7.31 (3.29)	7.27 (3.07)	8.46 (3.31)	9.00 (2.94)	9.08 (2.97)	7.68 (3.22)

Notes: values for cells with less than 5 respondents suppressed

Supplementary Table 3 – Further breakdown of respondents' identities and proportion with CESD-D-10 scores suggesting significant depressive symptomology

	Cisgender Female	**Cisgender Male**	**Transgender Female**	**Transgender Male**	**Non-binary or identify with another gender (e.g. agender)**	**Total**
Straight-heterosexual	/	/	/	/	/	/
Gay/Lesbian	63.4%	61.3%	/	/	82.4%	64.3%
Bisexual	80.9%	80.0%	/	/	91.7%	80.3%
Queer	100.0%	100.0%	/	/	87.5%	96.0%
Asexual	/	/	/	/	100.0%	100.0%
Identify with another sexuality	66.7%	100.0%	/	/	75.0%	70.6%
Prefer not to say	/	/	/	/	/	83.3%
Don't Know	/	/	/	/	/	/
Total	71.8%	64.2%	76.9%	71.4%	86.8%	71.9%

Notes: values for cells with less than 5 respondents suppressed

Supplementary Table 4 – Continuous model estimates of CES-D-10

	Unadjusted	Adjusted
	B(SE)	B(SE)
Any harassment or inappropriate incidents baseline: None		

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Form of harassment reported	3.875***	2.700**
	(1.852 - 5.899)	(0.644 - 4.756)
No information	0.257	-0.623
	(-2.992 - 3.507)	(-3.852 - 2.606)
Gender ID and Sex Orientation baseline: Cis female Gay/Lesbian		
Cis female of another non-heterosexual orientation	3.249***	2.132*
	(0.981 - 5.518)	(-0.156 - 4.420)
Transgender and gender diverse	4.797***	3.383***
	(2.636 - 6.958)	(1.164 - 5.602)
Cis male gay	1.226	1.027
	(-0.824 - 3.276)	(-1.020 - 3.074)
Cis male of another non-heterosexual orientation	4.336**	2.781
	(0.435 - 8.238)	(-1.087 - 6.648)
Age group baseline: 18-24 years		
25-34 years		-1.932
		(-4.299 - 0.436)
35-44 years		-2.899**
		(-5.359 - -0.439)
45-54 years		-4.453***
		(-7.080 - -1.826)
55+ years		-3.974**
		(-7.385 - -0.564)
Change in social status since pandemic baseline: positive change		
Negative change in status		2.649***
		(0.641 - 4.658)
No change		0.746
		(-1.061 - 2.554)
Relationship status baseline: Single		
Dating or in a relationship but not living together		0.440
		(-1.591 - 2.472)
Cohabiting/Married/Civil Partner		-1.979**
		(-3.831 - -0.127)
Divorced, Widowed or Prefer not to say		0.416
		(-4.364 - 5.196)
Ethnicity baseline: not an ethnic minority		
Ethnic Minority		0.404
		(-1.780 - 2.587)
Prefer not to say		1.076
		(-5.403 - 7.556)
Location: Rest of the world (baseline: UK)		-0.0193
		(-2.018 - 1.980)
Constant	11.22***	14.31***
	(9.622 - 12.82)	(11.28 - 17.34)
Observations	310	310

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R-squared	0.126	0.208

*** p<0.01, ** p<0.05, * p<0.1

Supplementary materials – further notes on measures of harassment and discrimination

Respondents were asked:

Since the start of the coronavirus pandemic, have you experienced any of the following in your day-to-day life (going to the shops, walking around the neighbourhood, etc…) because you are LGBTQ+ or others thought you were LGBTQ+?

- verbal harassment, insults or other hurtful comments;
- physical harassment or violence;
- sexual harassment or violence;
- threat of physical or sexual harassment or violence;
- exclusion from events or activities;
- someone disclosing that you are LGBTQ+ to others without your permission;
- any other inappropriate comments or conduct not listed above (please state).
- None

Respondents were free to select multiple options in terms of forms of discrimination.

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STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-7
Objectives	3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	4	Present key elements of study design early in the paper	7-10
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7-8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	*8-10*
Bias	9	Describe any efforts to address potential sources of bias	10-12,19
Study size	10	Explain how the study size was arrived at	7-8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-12
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	10-12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	8
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	12
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12, 25-26
		(b) Indicate number of participants with missing data for each variable of interest	12
Outcome data	15*	Report numbers of outcome events or summary measures	12, 25-26

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12-15, 26-28
		(*b*) Report category boundaries when continuous variables were categorized	12-15, 26-28
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	15-17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17-20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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