Mental Health, Potential Minority Stressors And Resilience: Evidence From A Cross-Sectional Survey Of Gay, Bisexual And Other Men Who Have Sex With Men Within The Celtic Nations

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Abstract

**Background:** Gay, bisexual and other men who have sex with men (GBMSM) are at a greater risk of mental health problems, such as anxiety and depression, than heterosexual adults. Numerous factors and stressors have been reported to impact men's mental health, although it has been suggested that resilience could have a protective effect. The aim of this study is to explore mental health, minority stressors, and resilience among a large online cross-sectional survey of GBMSM in the Celtic nations.

**Methods:** Data for this cross-sectional study were collected from the Social Media, GBMSM and Sexual and Holistic Health (SMMASH2) self-report online survey. Participants (n=3077) were recruited via gay sociosexual media in Scotland, Wales, Northern Ireland, and the Republic of Ireland. Binary logistic regression analyses were conducted to identify factors that increased the odds of moderate-to-severe anxiety and depression. Potentially relevant variables (p<0.05) were carried forward in hierarchal logistic regression analyses.

**Results:** The prevalence of moderate-to-severe anxiety and depression was 19.9% and 14.4%, respectively. Having a disability (OR = 1.73) and having financial worries sometimes/all of the time (OR = 1.93) increased the odds of having moderate-to-severe depression and anxiety, respectively. No minority stressors were associated with depression, whereas experiencing any form of relationship abuse in the last 12 months significantly increased the odds of anxiety (OR = 1.50). Resilience, namely a sense of coherence, had a protective effect and significantly reduced the odds of moderate-to-severe depression (OR = 0.85) and anxiety (OR = 0.89).

**Discussion:** Disability and financial worries were associated with increased depression and anxiety, respectively, while resilience had a protective effect for GBMSM in the SMMASH2 study. Future research is needed to better understand the role of resilience and the challenges and stresses of everyday life and intersecting health problems. Future research is also needed that incorporates the perspectives of those most affected by mental ill-health to co-develop effective solutions that respond to their contextual surroundings.

Introduction

Mental health is a core component of overall health [1]. However, the prevalence of mental ill-health varies across the population, with sexual minorities, such as gay, bisexual and other men who have sex with men (GBMSM), at a greater risk of increased mental health problems than heterosexual men. The risk of depression and anxiety is 1.5 times higher in sexual minorities, compared to heterosexuals [2], with rates of depressive symptoms and disorders between sexual minorities and heterosexuals being greatest during adolescence (OR = 2.94) [3]. In the United Kingdom (UK), GBMSM have a higher prevalence of ill-health, including depression and substance use, and are more likely to report risky sexual behaviours than heterosexual men [4]. Depression and anxiety are common in GBMSM (21.3% and 17.1%, respectively), with age, education level, and income influencing mental health [5].

Factors impacting the mental health of GBMSM are varied, with numerous stressors promoting feelings of helplessness and hopelessness that can develop into depression and suicidality, including stigma, discrimination, social stress and exclusion, heterosexism, and the experience or threat of violence [2, 3, 6–9]. This aligns with the Minority Stress Theory, which suggests that socially determined stressors, such as discrimination and victimisation, and or concealing one's sexual identity, with levels of 'outness' to others impacting the association between syndemic conditions and sexual risk taking [10, 11].

Resilience refers to positive adaptation, whereby a person has or maintains positive mental health despite experiencing adversity [12, 13]. Various factors have been suggested as impacting resilience in GBMSM. For example, 'outness' may result in GBMSM experiencing less stress due to increased positive social support and stronger connections to the gay community, which could be associated with more resilience to negative/chaotic life experiences [10]. However, resilience is a complex construct and social phenomena, with theories of resilience highlighting that varying life circumstances can mean that individuals in a shared risk group (e.g. GBMSM) may not experience comparable levels of risk. For example, GBMSM who have strong and positive social networks and/or family relationships that report better mental health are not necessarily more resilient than GBMSM who report lower mental health, but instead they may face lower proximal risk due to their strong networks [14]. This relates to the construct of sense of coherence, which argues that the way a person views their life (i.e. as comprehensible, manageable, and meaningful) can impact their health, with a higher sense of coherence protecting against negative aspects of life [15–17]. Emotional competency is a further important aspect of resilience, which describes the positive response to emotion of oneself and others, with higher emotional competency demonstrating higher resilience [18].

The relationship between mental health, minority stress, and resilience among GBMSM has not been examined in the UK or Irish context. Despite the evidence base demonstrating poor mental health among GBMSM, mental health interventions with sexual minorities are limited [19]. There is a lack of evidence-based interventions that specifically target sexual minority mental health, particularly in adults, with there
still being many unknowns regarding prevention and treatment [3]. In addition, most of the existing evidence-base is North American, with limited UK and European studies [7]. This paper develops the existing evidence base by exploring mental health, minority stressors, and resilience among a large online cross-sectional survey of GBMSM in the Celtic nations - Scotland, Wales, Northern Ireland, and the Republic of Ireland - to inform future policy and intervention development. Our research questions are:

1. What is the prevalence of self-reported depression and anxiety in a sample of GBMSM in the Celtic nations?
2. What sociodemographic and behavioural factors are associated with self-reported depression and anxiety in a sample of GBMSM in the Celtic nations?
3. Are self-reported depression and anxiety associated with minority stressors?
4. Does resilience, measured as emotional competency and sense of coherence, have a protective effect on GBMSM's self-reported depression and anxiety?

Methods

Design

Data for this cross-sectional study were collected from The Social Media, MSM and Sexual and Holistic Health (SMMASH2) self-report online survey, administered between April and June 2016. Ethical approval was granted by Glasgow Caledonian University School of Health and Life Sciences Ethics Subcommittee (HLS id: HLS/NCH/15/26).

Population and recruitment

Adult men who identified as gay, bisexual, or sought sex with other men were recruited through gay-specific sociosexual media websites (Gaydar, Squirt, and Recon) and smartphone applications (apps; Hornet, Gaydar, Grindr, Growlr, and Recon). Men were eligible to participate if their profile location, computer IP address, or smartphone GPS coordinates were located in Scotland, Wales, the Republic of Ireland, or Northern Ireland. Recruitment involved sending each eligible profile two messages inviting participation in the survey, as well as banner advertisements on the participating websites/smartphone apps. The link in the messages and banners took participants to the survey webpage, which provided full details of the survey and specified that survey completion was taken as consent to participate.

Measures

Predictor variables

The self-report questionnaire developed by Frankis, Flowers and McDaid [20] surveyed sociodemographic [age, country, ethnicity, sexual orientation, education, employment status, relationship status, disability or long term condition (excluding mental health for the purpose of these analyses), financial worries, proximity to the gay scene, frequency of gay scene use, frequency of gay social media website / app use, and HIV-status] and behavioural variables [high risk condomless anal sex (CAI; defined here as reporting CAI with \( \geq 2 \) partners or with casual/HIV-status unknown/serodiscordant partners in the last year. This measure does not adjust for either PrEP or TasP, though in 2016 PrEP use was very low in these Celtic countries). The questionnaire also assessed hazardous alcohol use (using the Fast Alcohol Screening Tool), party drug use (defined here as using speed, crystal methamphetamine, cocaine, ecstasy, GHB/GBL, ketamine, or mephedrone in the last year) and chemsex (defined here as reporting sex while using at least one of the 4 main UK chemsex drugs: crystal methamphetamine, mephedrone, GHB/GBL or ketamine in the last year). Minority stress was measured as gay-related stigma, reported ‘outness’ and any reported relationship abuse in the past year. The Gay-Related Stigma Scale, a 10-item adaptation of the HIV stigma scale [21, 22], measures personalised stigma and concealment stigma (range 0–80), with higher scores suggesting higher gay-related stigma. A single item assessed ‘outness’ from 1 (not out to anyone) to 5 (out to everyone) [20]. Relationship abuse was measured using a modified version of the ‘Sex and Relationships Problems Scale’ [23], which investigated experiences of sexual, physical, and emotional abuse from a partner or ex-partner in the previous 12 months [20]. Resilience was measured as sense of coherence and emotional competency using the 13-item Sense of Coherence – Orientation to Life questionnaire, a reliable (Cronbach's \( \alpha = 0.88 \)) measure of sense of coherence, based on Antonovsky's [16] 29-item scale [20]. It measures resilience to stressful life situations that may negatively impact health (range 0–78), with higher scores indicating higher levels of sense of coherence. Emotional competency was measured using the 30-item Trait Emotional Intelligence Questionnaire, which is a reliable (Cronbach's \( \alpha = 0.93 \)) measure of a person's ability to understand and regulate emotions to improve health, with scores ranging from 1 (low emotional competency) to 7 (high emotional competency) [18, 20]. For each scale, higher scores indicated higher resilience.

Outcome variables
The nine-item Patient Health Questionnaire-9 (PHQ-9) measures depression-related feelings and problems (e.g., low mood, sleep problems, or changes in appetite) experienced in the previous 2 weeks. Results are scored between 0 (not affected by any issue at all) and 27 (affected by every issue nearly every day), with depression severity categorised as: none (score 0–4), mild (score 5–9), moderate (score 10–14), moderately severe (score 15–19) or severe (score 20–27). Anxiety was measured using the seven-item Generalized Anxiety Disorder-7 questionnaire (GAD-7). This tool measures anxiety-related feelings and problems (e.g., feeling nervous, trouble relaxing, or irritable) experienced over the previous 2 weeks, with results categorised as: none (score 0–4), mild (score 5–9), moderate (score 10–14), or severe (score 15–21) anxiety. Although these are not diagnostic tools, both are frequently used to assess current depression and anxiety respectively in cross-sectional studies and intervention evaluations.

Analysis

A total of $n = 4690$ GBMSM completed the questionnaire. Data from participants not living in the Celtic nations ($n = 767$) and those missing over 75% of data on the variables listed in Table 1 ($n = 706$) were excluded from the analysis. This resulted in an overall sample size of $n = 3077$. 

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| Variable                        | N       | Percentage (%) |
|--------------------------------|---------|----------------|
| **Mental health**              |         |                |
| Anxiety                        |         |                |
| None/Mild (≤ 14)               | 1829    | 80.1%          |
| Moderate/Severe (> 14)         | 454     | 19.9%          |
| Depression                     |         |                |
| None/Mild (< 10)               | 1985    | 85.6%          |
| Moderate/Severe (≥ 10)         | 334     | 14.4%          |
| **Sociodemographic**           |         |                |
| Age                            |         |                |
| 18–25                          | 538     | 17.5%          |
| 26–35                          | 713     | 23.2%          |
| 36–45                          | 695     | 22.6%          |
| 46+                            | 1124    | 36.6%          |
| Gender identity                |         |                |
| Transgender                    | 191     | 6.3%           |
| Not transgender                | 2846    | 93.7%          |
| Country                        |         |                |
| Scotland                       | 1474    | 47.9%          |
| Wales                          | 491     | 16.0%          |
| Northern Ireland               | 232     | 7.5%           |
| Republic of Ireland            | 880     | 28.6%          |
| Ethnicity                      |         |                |
| White                          | 2974    | 97.0%          |
| Black                          | 5       | 0.2%           |
| Asian                          | 38      | 1.2%           |
| Mixed / other                  | 48      | 1.6%           |
| Sexual Orientation             |         |                |
| Gay                            | 2443    | 80.1%          |
| Bisexual                       | 575     | 18.8%          |
| Straight/other                 | 33      | 1.1%           |
| Educated post-secondary         |         |                |
| No                             | 1165    | 38.9%          |
| Yes                            | 1831    | 61.1%          |
| Employment                     |         |                |
| Employed/ self employed        | 2137    | 73.9%          |
| Other                          | 755     | 26.1%          |
| Relationship status            |         |                |
| Single                         | 1869    | 61.0%          |
| Regular Male Partner           | 643     | 21.0%          |
| Civil Partnership / Married Man| 247     | 10.0%          |
| Regular Female Partner         | 306     | 10.0%          |
| Any Disability                 |         |                |
| No                             | 1848    | 67.6%          |
| Yes                            | 887     | 32.4%          |
| Any financial worries          |         |                |
| Occasionally/Never             | 1659    | 57.0%          |
| Sometimes - All of the time    | 1249    | 43.0%          |
| Nearest gay venue with easy reach|         |                |
| Too far                        | 494     | 17.0%          |
| Variable                          | N    | Percentage (%) |
|----------------------------------|------|----------------|
| **HIV status**                   |      |                |
| HIV positive                     | 222  | 8.3%           |
| HIV negative                     | 2100 | 78.1%          |
| Untested                         | 367  | 13.6%          |
| **Behavioural**                  |      |                |
| Frequency of gay website use     |      |                |
| At least once a day              | 959  | 41.4%          |
| Every few days / weekly         | 764  | 33.0%          |
| Monthly or less                  | 274  | 11.8%          |
| Never / stopped using            | 319  | 13.8%          |
| Frequency of gay App use         |      |                |
| At least once a day              | 1107 | 48.0%          |
| Every few days / weekly         | 464  | 20.1%          |
| Monthly or less                  | 149  | 6.5%           |
| Never / stopped using            | 587  | 25.4%          |
| Frequency of gay scene use       |      |                |
| 4–5 times a week                 | 23   | 0.8%           |
| 2–3 times per week               | 335  | 11.5%          |
| 1–2 times per week               | 145  | 5.0%           |
| Once a month or less             | 903  | 31.1%          |
| Never                            | 1497 | 51.6%          |
| Condomless sex                   |      |                |
| No                               | 1734 | 64.1%          |
| Yes                              | 972  | 35.9%          |
| Alcohol use                      |      |                |
| Safe                             | 1398 | 65.3%          |
| Hazardous                        | 743  | 34.7%          |
| Chemsex use in last 12 months    |      |                |
| No                               | 2035 | 87.6%          |
| Yes                              | 289  | 12.4%          |
| **Minority stressors**           |      |                |
| Stigma (higher score = higher stigma) 0–80 | Mean (SD) | 23.4 (11.2) |
| Outness                          |      |                |
| Out to no one                    | 410  | 14.1%          |
| Out to some or all               | 2501 | 85.9%          |
| Any experience of relationship abuse in last 12 months | No 2176 | 1708 78.5% |
| Yes                              | 468  | 21.5%          |
| **Resilience**                   |      |                |
| Emotional competency             | Mean (SD) | 3.3 (0.9)     |
| Sense of coherence               | Mean (SD) | 40.4 (13.4)   |
All analyses were conducted in SPSS version 24. First, descriptive statistics were calculated for sociodemographic, behavioural, minority stressor, and resilience variables, alongside depression (PHQ-9) and anxiety (GAD-7), and all percentages were calculated based on the number of participants who responded to each variable. Next, relationships between sociodemographic and behavioural variables, and depression and anxiety [categorised as; no/mild symptoms (GAD-7 score ≤ 14; PHQ-9 score < 10) and moderate-to-severe symptoms (GAD-7 score > 14; PHQ-9 score ≥ 10)] were investigated using binary logistic regression.

Finally, variables that were significant (p < 0.05) at the bivariate level were entered into a hierarchical logistic regression model used to estimate odds ratios and 95% confidence intervals for mental health outcomes. Model 1 included sociodemographic and behavioural variables; Model 2 added minority stress variables; Model 3 added resilience variables, and Model 4 added interactions between minority stressors and each of the resilience factors entered separately. Separate hierarchical logistic regression models were built for depression and anxiety.

Results

Sociodemographic, behavioural, and minority stress characteristics

Descriptive statistics for sociodemographic, behavioural, and minority stress characteristics are presented in Table 1. The mean age of participants was 39 years (range 16–78, SD = 13.5) with just under half of the sample living in Scotland (47.9%). Most (97.0%) identified as white and the majority (80.1%) identified as gay. Over half had at least post-secondary school level education (61.1%) and most were employed (73.9%). One in ten (10.0%) reported having a regular female partner; 31.0% reported a regular male partner (including civil partnerships and being married to a man) though the majority were single (61.0%). Almost one-third (32.4%) reported a disability (as defined by the UK census but excluding mental health issues) and 43.0% reported at least some financial worries. Most reported they were HIV negative (78.1%), 8.3% were HIV positive, and 13.6% said they do not know their HIV status. While our recruitment strategy meant that most participants reported frequent gay website (74.4% weekly) and app (68.1% weekly) use, 82.7% reported their frequency of gay scene use as only once a month or never. Over one third reported condomless sex in the last year (35.9%). Over one third also reported hazardous levels of drinking (34.7%) and 12.4% reported party drug use in the last 12 months. The majority of men (85.9%) were out to some or all people and 21.5% reported experience of relationship abuse in the last year. In relation to resilience, mean scores for emotional competency and sense of coherence were 3.3(SD = 0.9) and 40.4 (SD = 13.4), respectively.

What is the prevalence of self-reported depression and anxiety?

Overall, 19.9% (n = 454) were categorised as having moderate-to-severe anxiety and 14.4% (n = 334) as having symptoms of moderate-to-severe depression (see Table 1) in the past 2 weeks.
| Predictor variables          | Depression |           |           | 95% CI          | p-value | Anxiety |           |           | 95% CI          | p-value |
|-----------------------------|------------|-----------|-----------|-----------------|---------|---------|-----------|-----------|-----------------|---------|
|                             | N          | Odds ratio| 95% CI    | p-value         |         | N       | Odds ratio| 95% CI    | p-value         |
| **Sociodemographic factors**|            |           |           |                 |         |          |           |           |                 |         |
| Age (years)* †              |            |           |           |                 |         |          |           |           |                 |         |
| 18–25                       | 408        | REF       | REF       | REF             |         | 395     | REF       | REF       | REF             | REF     |
| 26–35                       | 506        | 0.79      | 0.57, 1.11| 0.17            | 0.71    | 497     | 0.71      | 0.52, 0.96 | 0.03            |         |
| 36–45                       | 546        | 0.67      | 0.48, 0.95| 0.02            | 0.63    | 542     | 0.63      | 0.47, 0.86 | 0.00            |         |
| 46+                         | 855        | 0.46      | 0.33, 0.64| 0.00            | 0.38    | 844     | 0.38      | 0.28, 0.51 | 0.00            |         |
| Country*                    |            |           |           |                 |         |          |           |           |                 |         |
| Scotland                    | 1126       | REF       | REF       | REF             |         | 1112    | REF       | REF       | REF             | REF     |
| Wales                       | 381        | 1.12      | 0.82, 1.54| 0.48            | 0.94    | 377     | 0.94      | 0.70, 1.25 | 0.66            |         |
| Northern Ireland            | 174        | 1.18      | 0.77, 1.81| 0.45            | 0.99    | 166     | 0.99      | 0.67, 1.48 | 0.97            |         |
| Republic of Ireland         | 638        | 0.72      | 0.54, 0.97| 0.03            | 0.76    | 628     | 0.76      | 0.59, 0.98 | 0.04            |         |
| Ethnicity                   |            |           |           |                 |         |          |           |           |                 |         |
| White                       | 2247       | REF       | REF       | REF             |         | 2214    | REF       | REF       | REF             | REF     |
| Other                       | 66         | 0.81      | 0.39, 1.72| 0.59            | 1.38    | 63      | 1.38      | 0.78, 2.46 | 0.27            |         |
| Sexual Orientation†         |            |           |           |                 |         |          |           |           |                 |         |
| Gay                         | 1897       | REF       | REF       | REF             |         | 1854    | REF       | REF       | REF             | REF     |
| Bisexual                    | 380        | 0.74      | 0.52, 1.03| 0.07            | 0.70    | 388     | 0.70      | 0.52, 0.94 | 0.02            |         |
| Straight/other              | 22         | 0.56      | 0.13, 2.41| 0.44            | 0.63    | 21      | 0.63      | 0.18, 2.14 | 0.45            |         |
| Educated post- secondary**† |            |           |           |                 |         |          |           |           |                 |         |
| No                          | 865        | REF       | REF       | REF             |         | 853     | REF       | REF       | REF             | REF     |
| Yes                         | 1415       | 0.57      | 0.45, 0.72| 0.00            | 0.63    | 1389    | 0.63      | 0.51, 0.77 | 0.00            |         |
| Employment**†               |            |           |           |                 |         |          |           |           |                 |         |
| Other                       | 609        | REF       | REF       | REF             |         | 606     | REF       | REF       | REF             | REF     |
| Employed/ self employed     | 1691       | 0.44      | 0.34, 0.56| 0.00            | 0.46    | 1659    | 0.46      | 0.37, 0.58 | 0.00            |         |
| Relationship status**†      |            |           |           |                 |         |          |           |           |                 |         |
| Single                      | 1428       | REF       | REF       | REF             |         | 1396    | REF       | REF       | REF             | REF     |
| Regular Male Partner        | 480        | 0.52      | 0.37, 0.72| 0.00            | 0.74    | 484     | 0.74      | 0.57, 0.96 | 0.02            |         |
| Civil Partnership / Married Man | 191 | 0.48 | 0.29, 0.80 | 0.05 | 184 | 0.38 | 0.23, 0.62 | 0.00 |       |           |           |                 |         |
| Regular Female Partner      | 210        | 0.33      | 0.19, 0.58| 0.00            | 0.39    | 210     | 0.39      | 0.25, 0.61 | 0.00            |         |
| Any Disability**†           |            |           |           |                 |         |          |           |           |                 |         |
| No                          | 1447       | REF       | REF       | REF             |         | 1434    | REF       | REF       | REF             | REF     |
| Yes                         | 728        | 4.80      | 3.74, 6.16| 0.00            | 3.57    | 709     | 3.57      | 2.87, 4.44 | 0.00            |         |
| Any financial worries**†    |            |           |           |                 |         |          |           |           |                 |         |
| Occasionally / Never        | 1314       | REF       | REF       | REF             |         | 1298    | REF       | REF       | REF             | REF     |
| Sometimes / All of the time | 997        | 3.83      | 2.97, 4.93| 0.00            | 3.58    | 976     | 3.58      | 2.87, 4.45 | 0.00            |         |
| Nearest gay venue with easy reach | 166 | REF | REF | REF |         | 168 | REF | REF |         |         |   |
| Predictor variables | Depression | Anxiety |
|---------------------|------------|---------|
| Too far             | 401        | 0.90    | 389     | 1.41 |
|                     | 0.58, 1.50 | 0.68    | 0.87, 2.30 | 0.16 |
| 4                   | 263        | 1.04    | 262     | 1.45 |
|                     | 0.61, 1.79 | 0.88    | 0.87, 2.42 | 0.16 |
| 3                   | 414        | 1.03    | 409     | 1.52 |
|                     | 0.62, 1.70 | 0.90    | 9.40, 2.45 | 0.09 |
| 2                   | 547        | 1.00    | 538     | 1.31 |
|                     | 0.61, 1.62 | 0.98    | 0.82, 2.09 | 0.26 |
| Nearby              | 519        | 0.81    | 506     | 1.31 |
|                     | 0.49, 1.33 | 0.40    | 0.82, 2.12 | 0.26 |
| HIV status**†       | HIV positive | 193 | REF | REF | 192 | REF | REF | REF |
|                     | HIV negative | 1809 | 0.66 | 0.45, 0.97 | 0.34 | 1777 | 0.59 | 0.42, 0.83 | 0.00 |
|                     | Don’t know | 304 | 0.99 | 0.62, 1.57 | 0.95 | 302 | 0.79 | 0.52, 1.20 | 0.27 |
| **Behavioural factors** | | | | |
| Frequency of gay scene use | Never - 4/5 times a week (1–5) | 2312 | 0.97 | 0.85, 1.10 | 0.64 | 2274 | 0.92 | 0.82, 1.03 | 0.15 |
| Frequency of website use | Never - Daily use (1–4) | 2229 | 0.94 | 0.84, 1.05 | 0.29 | 2233 | 0.94 | 0.85, 1.04 | 0.23 |
| Frequency of App use**† | Never - Daily use (1–4) | 2222 | 1.18 | 1.07, 1.31 | 0.01 | 2226 | 1.18 | 1.08, 1.29 | 0.00 |
| Condomless sex *    | No | 1450 | REF | REF | REF | 1432 | REF | REF | REF |
|                     | Yes   | 842 | 1.31 | 1.03, 1.66 | 0.03 | 824 | 1.23 | 0.99, 1.51 | 0.06 |
| Problematic alcohol use**† | Safe | 1343 | REF | REF | REF | 1352 | REF | REF | REF |
|                     | Hazardous | 719 | 1.34 | 1.04, 1.73 | 0.03 | 716 | 1.38 | 1.11, 1.73 | 0.01 |
| Party drug use in last 12 months**† | No | 1933 | REF | REF | REF | 1898 | REF | REF | REF |
|                     | Yes   | 386 | 1.40 | 1.05, 1.87 | 0.02 | 385 | 1.33 | 1.03, 1.73 | 0.03 |
| **Minority stressors** | | | | |
| Stigma* †           | Low to high (0–80) | 1959 | 1.03 | 1.02, 1.05 | 0.00 | 1949 | 1.03 | 1.02, 1.04 | 0.00 |
| Outness* †          | Not out to anyone - Out to everyone (1–5) | 2314 | 1.15 | 1.06, 1.26 | 0.00 | 2278 | 1.15 | 1.07, 1.24 | 0.00 |
| Experienced any form of relationship abuse in last 12 months**† | No | 1611 | REF | REF | REF | 1589 | REF | REF | REF |
|                     | Yes   | 445 | 2.69 | 2.07, 3.51 | 0.00 | 439 | 3.16 | 2.49, 4.02 | 0.00 |
| **Resilience factors** | | | | |
| Emotional competency**† | Low - High (1–7) | 1810 | 6.86 | 5.42, 8.69 | 0.00 | 1816 | 5.11 | 4.21, 6.19 | 0.00 |
| Sense of coherence**† | Low - High (0–13) | 1835 | 0.86 | 0.85, 0.88 | 0.00 | 1837 | 0.87 | 0.86, 0.89 | 0.00 |

*Taken forward to depression hierarchical logistic regression analysis (p < 0.05)  
†Taken forward to anxiety hierarchical logistic regression analysis (p < 0.05)
What sociodemographic and behavioural factors are associated with self-reported depression and anxiety?

The results of the bivariate analysis are shown in Table 2. Eight sociodemographic factors were significant. Being aged ≤ 25 years, no post-secondary school education, not being employed, being single, reporting a non-mental health disability, reporting financial worries, and being HIV positive significantly increased the odds of reporting moderate-to-severe depression, whereas living in the Republic of Ireland significantly reduced the odds. Four behavioural factors (more frequent gay sociosexual media app use, reporting condomless anal sex, problematic alcohol use, and using party drugs in last 12 months) significantly increased the odds of reporting moderate-to-severe depression.

The hierarchical regression analyses for depression are shown in Table 3. In Model 1, three sociodemographic factors (relationship status, disability, and financial worries) were significant predictors of moderate-to-severe depression. Specifically, having any disability (excluding mental health; OR 3.3; 95% CI 2.3, 4.7) and reporting financial worries sometimes/all of the time (OR 2.8; 95% CI 2.0, 4.1) increased the odds of moderate-to-severe depression, whereas having a regular male partner significantly decreased the odds of moderate-to-severe depression (OR 0.5; 95% CI 0.3, 0.9). No behavioural factors were significant in Model 1. In the final multivariate model, when all factors and interactions were included (Model 4), reporting a disability was the only sociodemographic or behavioural factor that increased the odds of moderate-to-severe depression (OR 1.7; 95% CI 1.1, 2.7).
### Table 3
Hierarchical binary logistic regression analysis for depression

| Variable                          | Model 1          | Model 2          | Model 3          | Model 4          |
|-----------------------------------|------------------|------------------|------------------|------------------|
|                                   | Odds ratio 95% CI | Odds ratio 95% CI | Odds ratio 95% CI | Odds ratio 95% CI |
| **Sociodemographic factors**      |                  |                  |                  |                  |
| Age (years)                       |                  |                  |                  |                  |
| 18–25                             | REF             | REF             | REF             | REF             |
| 26–35                             | 1.01 (0.61, 1.67) | 0.98 (0.98, 1.00) | 0.94 (0.58, 1.65) | 0.92 (1.03, 0.98) |
| 36–45                             | 0.86 (0.49, 1.51) | 0.59 (0.75, 0.42) | 0.32 (0.42, 1.33) | 0.56 (0.82, 0.52) |
| 46+                               | 0.60 (0.35, 1.02) | 0.06 (0.57, 0.33) | 0.05* (0.33, 0.99) | 0.56 (0.77, 0.42) |
| Country                           |                  |                  |                  |                  |
| Scotland                          | REF             | REF             | REF             | REF             |
| Wales                             | 1.05 (0.64, 1.72) | 0.85 (0.98, 0.94) | 0.48 (0.69, 0.48) | 0.49 (1.23, 0.49) |
| Northern Ireland                  | 0.80 (0.40, 1.61) | 0.53 (0.75, 0.37) | 0.42 (1.08, 0.50) | 0.85 (1.08, 0.85) |
| Republic of Ireland               | 0.77 (0.50, 1.19) | 0.24 (0.78, 0.50) | 0.28 (0.80, 0.48) | 0.36 (0.78, 0.46) |
| Educated post-secondary            |                  |                  |                  |                  |
| No                                | REF             | REF             | REF             | REF             |
| Yes                               | 0.76 (0.53, 1.09) | 0.14 (0.79, 0.22) | 0.95 (0.55, 0.62) | 0.82 (0.96, 0.82) |
| Employment                        |                  |                  |                  |                  |
| Other                             | REF             | REF             | REF             | REF             |
| Employed/self employed            | 0.75 (0.50, 1.12) | 0.16 (0.78, 0.23) | 0.81 (0.51, 0.39) | 0.43 (0.82, 0.43) |
| Relationship status               |                  |                  |                  |                  |
| Single                            | REF             | REF             | REF             | REF             |
| Regular Male Partner              | 0.54 (0.33, 0.89) | 0.02* (0.53, 0.02) | 0.01* (0.32, 0.01) | 0.12 (0.65, 0.12) |
| Civil Partnership/ Married Man    | 0.60 (0.28, 1.25) | 0.17 (0.56, 0.26) | 0.13 (1.20, 1.12) | 0.92 (1.05, 0.92) |
| Regular Female Partner            | 0.53 (0.22, 1.27) | 0.15 (0.69, 0.27) | 0.44 (1.77, 0.99) | 0.83 (0.99, 0.83) |
| Any Disability                    |                  |                  |                  |                  |
| No                                | REF             | REF             | REF             | REF             |
| Yes                               | 3.26 (2.27, 4.68) | 0.00* (3.05, 0.00) | 0.00* (2.10, 0.00) | 0.00* (1.67, 0.01) |
| Any financial worries             |                  |                  |                  |                  |
| Occasionally/ Never               | REF             | REF             | REF             | REF             |
| Sometimes/ All of the time        | 2.84 (1.96, 4.11) | 0.00* (2.38, 0.00) | 0.00* (1.62, 0.00) | 0.13 (1.42, 0.13) |
| HIV status                        |                  |                  |                  |                  |
| HIV positive                      | REF             | REF             | REF             | REF             |
| HIV negative                      | 1.08 (0.59, 1.97) | 0.81 (1.11, 0.81) | 0.75 (0.59, 0.75) | 0.13 (1.78, 0.13) |
| Variable                                      | Model 1  | Model 2  | Model 3  | Model 4  |
|----------------------------------------------|----------|----------|----------|----------|
| Don't know                                   | 1.23     | 0.59     | 0.58     | 1.71     | 0.69     | 0.24     | 1.74     | 0.70     | 0.23     |
| Behavioural factors                          |          |          |          |          |
| Frequency of App use                         | 0.99     | 0.84     | 0.94     | 0.97     | 0.82     | 0.75     | 1.01     | 0.83     | 0.93     | 1.01     | 0.83     | 0.94     |
| Condomless sex                               | No       | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      |
| Yes                                          | 1.37     | 0.95     | 0.10     | 1.42     | 0.97     | 0.07     | 1.11     | 0.73     | 0.63     | 1.13     | 0.74     | 1.74     | 0.57     |
| Problematic alcohol use                      | Safe     | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      |
| Hazardous                                    | 1.15     | 0.79     | 0.47     | 1.19     | 0.81     | 0.37     | 1.30     | 0.85     | 0.24     | 1.26     | 0.82     | 1.94     | 0.29     |
| Part drug use in last 12 months              | No       | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      | REF      |
| Yes                                          | 1.13     | 0.72     | 0.60     | 1.11     | 0.70     | 0.65     | 1.30     | 0.78     | 0.31     | 1.31     | 0.79     | 2.18     | 0.30     |
| Minority stressors                           |          |          |          |          |
| Stigma                                       | Low to high (0–80) | 1.05 | 1.03 | 0.00* | 1.01 | 0.99 | 0.00* | 1.01 | 0.99 | 0.00* | 0.44 |
| Outness                                      | Not out to anyone - Out to everyone (1–5) | 1.37 | 1.14 | 0.00* | 1.31 | 1.05 | 0.02* | 0.30 | 0.05 | 0.19 |
| Experienced any form of relationship abuse in last 12 months | No | REF | REF | REF | REF | REF | REF | REF | REF | REF | REF | REF | REF |
| Yes                                          | 1.43     | 0.96     | 0.08     | 1.13     | 0.71     | 0.60     | 1.15     | 0.72     | 0.56     |
| Resilience factors                           |          |          |          |          |
| Emotional competency                        | Low - High (1–7) | 3.02 | 2.06 | 0.00* | 1.23 | 0.32 | 0.00* | 0.76 |
| Sense of coherence                          | Low - High (0–13) | 0.92 | 0.90 | 0.00* | 0.85 | 0.76 | 0.00* |
| Interactions                                 |          |          |          |          |
| How out are you * Emotional Competency       | 1.25     | 0.91     | 0.18     |
| How out are you * Sense of Coherence         | 1.02     | 1.00     | 0.10     |
| Cox and Snell R square                       | 0.11     | 0.14     | 0.26     | 0.27     |
| Nagelkerke R Square                          | 0.20     | 0.24     | 0.47     | 0.47     |
| Percentage correct                          | 86.00%   | 86.40%   | 89.00%   | 89.40%   |

*Statistically significant at p < 0.05
In the bivariate analyses of sociodemographic factors associated with anxiety (see Table 2), being single, having any disability (excluding mental health), and having financial worries at least sometimes increased the odds of moderate-to-severe anxiety. Whereas being aged 18–25 years, living in the Republic of Ireland, being bisexual, educated post-secondary school, employed, and HIV negative reduced the odds of having moderate-to-severe anxiety. Problematic alcohol use and party drug use were the only significant behavioural factors.

In Model 1 of the hierarchical regression (Table 4), the odds of having moderate-to-severe anxiety were higher for men who reported having any disability (OR 2.6; 95% CI 1.9, 3.6) and financial worries sometimes/all of the time (OR 3.3; 95% CI 2.4, 4.6) and were significantly lower for men who were aged 46+ years (OR 0.5; 95% CI 0.3, 0.7), employed/self-employed (OR 0.7; 95% CI 0.5, 1.0), or married / in a civil partnership (OR 0.4; 95% CI 0.2, 0.9). No behavioural factors were statistically significant. In the final multivariate model when all variables and interactions were included (Model 4), having financial worries was the only sociodemographic or behavioural factor which increased the odds of having moderate-to-severe anxiety (OR 1.9; 95% CI 1.3, 2.8).
| Variable                        | Model 1 | Model 2 | Model 3 | Model 4 |
|--------------------------------|---------|---------|---------|---------|
|                                | Odds ratio | 95% CI | p-value | Odds ratio | 95% CI | p-value | Odds ratio | 95% CI | p-value | Odds ratio | 95% CI | p-value |
| Sociodemographic factors       |         |         |         |         |         |         |         |         |         |         |         |         |
| Age (years)                    | 18–25   | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | 26–35   | 0.81    | 0.51, 1.27 | 0.36   | 0.81    | 0.51, 1.30 | 0.38   | 0.88    | 0.52, 1.48 | 0.63   | 0.87    | 0.52, 1.47 | 0.61   |
|                                | 36–45   | 0.77    | 0.47, 1.27 | 0.31   | 0.70    | 0.42, 1.16 | 0.17   | 0.78    | 0.44, 1.36 | 0.38   | 0.77    | 0.44, 1.36 | 0.37   |
|                                | 46+     | 0.45    | 0.28, 0.73 | 0.00*  | 0.44    | 0.27, 0.72 | 0.00*  | 0.60    | 0.34, 1.04 | 0.07   | 0.60    | 0.34, 1.03 | 0.07   |
| Sexual orientation             | Gay     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Bisexual| 0.98    | 0.58, 1.64 | 0.93   | 1.13    | 0.65, 1.97 | 0.67   | 1.09    | 0.59, 2.00 | 0.80   | 1.06    | 0.57, 1.97 | 0.85   |
|                                | Straight | 0.60    | 0.06, 6.20 | 0.67   | 0.87    | 0.09, 8.63 | 0.91   | 0.77    | 0.06, 9.29 | 0.84   | 0.76    | 0.06, 9.48 | 0.83   |
|                                | Other   | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
| Educated post-secondary        | No      | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Yes     | 0.79    | 0.58, 1.09 | 0.15   | 0.84    | 0.61, 1.17 | 0.30   | 1.00    | 0.69, 1.44 | 0.99   | 1.00    | 0.69, 1.45 | 0.99   |
| Employment                     | Other   | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Employed/ | 0.68    | 0.47, 0.98 | 0.04*  | 0.71    | 0.49, 1.03 | 0.07   | 0.72    | 0.47, 1.10 | 0.13   | 0.72    | 0.48, 1.10 | 0.13   |
|                                | self employed |       |         |         |         |         |         |         |         |         |         |         |         |
| Relationship status            | Single  | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Regular Male Partner | 0.77    | 0.51, 1.15 | 0.20   | 0.73    | 0.48, 1.12 | 0.15   | 0.93    | 0.58, 1.50 | 0.78   | 0.93    | 0.58, 1.49 | 0.75   |
|                                | Civil Partnership / Married Man | 0.42    | 0.20, 0.89 | 0.02*  | 0.42    | 0.19, 0.91 | 0.03*  | 0.62    | 0.26, 1.46 | 0.27   | 0.61    | 0.26, 1.44 | 0.26   |
|                                | Regular Female Partner | 0.54    | 0.23, 1.29 | 0.16   | 0.62    | 0.25, 1.52 | 0.29   | 0.93    | 0.34, 2.57 | 0.89   | 0.99    | 0.35, 2.77 | 0.98   |
| Any Disability                 | No      | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Yes     | 2.63    | 1.90, 3.63 | 0.00*  | 2.38    | 1.70, 3.33 | 0.00*  | 1.33    | 0.91, 1.95 | 0.14   | 1.35    | 0.92, 1.98 | 0.13   |
| Any financial worries          | Occasionally / Never | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | Sometimes / All of the time | 3.28    | 2.37, 4.56 | 0.00*  | 2.82    | 2.02, 3.96 | 0.00*  | 1.93    | 1.33, 2.81 | 0.00*  | 1.93    | 1.32, 2.80 | 0.00*  |
| HIV status                     | HIV positive | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     | REF     |
|                                | HIV negative | 0.79    | 0.47, 1.36 | 0.40   | 0.85    | 0.49, 1.49 | 0.58   | 1.13    | 0.59, 2.16 | 0.72   | 1.12    | 0.59, 2.15 | 0.73   |
|                                | Don't know | 0.98    | 0.50, 1.90 | 0.94   | 1.05    | 0.53, 2.10 | 0.89   | 1.22    | 0.55, 2.71 | 0.62   | 1.22    | 0.55, 2.69 | 0.63   |
| Behavioural factors            | Frequency of App use | Never - Daily use (1–4) | 1.00    | 0.86, 1.15 | 0.95   | 0.99    | 0.85, 1.15 | 0.91   | 1.00    | 0.84, 1.18 | 0.99   | 1.00    | 0.84, 1.18 | 0.96   |
### Variable

| Variable | Model 1 | Model 2 | Model 3 | Model 4 |
|----------|---------|---------|---------|---------|
| Problematic alcohol use | Safe | REF | REF | REF |
| | Hazardous | 1.21 | 0.86 | 1.69 | 0.27 |
| Part drug use in last 12 months | No | REF | REF | REF |
| | Yes | 1.00 | 0.67 | 0.99 | 0.93 |
| Minorit stressors | Low to high (0–80) | 1.04 | 1.02 | 0.00* | 1.01 |
| Outness | Not out to anyone - Out to everyone (1–5) | 1.28 | 1.08 | 0.01* | 1.24 |
| Experienced any form of relationship abuse in last 12 months | No | REF | REF | REF |
| | Yes | 1.88 | 1.31 | 0.00* | 1.50 |
| Resilience factors | Low - High (1–7) | 2.00 | 1.44 | 0.00* | 1.52 |
| Sense of coherence | Low - High (0–13) | 0.92 | 0.90 | 0.00* | 0.89 |
| Interactions | How out are you * Emotional Competency | 1.07 | 0.83 | 1.59 | 1.38 |
| | How out are you * Sense of Coherence | 1.01 | 0.99 | 0.41 | 1.03 |
| Cox and Snell R square | 0.13 | 0.16 | 0.28 | 0.28 |
| Nagelkerke R Square | 0.21 | 0.26 | 0.45 | 0.45 |
| Percentage correct | 82.00% | 82.60% | 86.50% | 86.30% |

**Statistical significance set at p < 0.05**

### Are depression and anxiety associated with minority stressors?

At the bivariate level, all minority stressors were significant predictors of depression and anxiety (Table 2). Specifically, higher stigma, being out to more people and reporting relationship abuse increased the odds of both moderate-to-severe depression and anxiety. For depression, when minority stressors were entered into regression Model 2 (Table 3), higher levels of stigma (OR 1.1; 95% CI 1.0, 1.1) and being out to more people (OR 1.37; 95% CI 1.1, 1.7) remained significant and increased the odds of moderate-to-severe depression. However, in Model 4, when all factors and interactions were included, no minority stressors remained significant predictors of depression. For anxiety (Table 4), all minority stressors were significant in Model 2, with higher stigma (OR 1.0; 95% CI 1.0, 1.1), being out to more people (OR 1.3; 95% CI 1.1, 1.5), and reporting relationship abuse (OR 1.9; 95% CI 1.3, 2.7) increasing the odds of moderate-to-severe anxiety. In Model 4 of the
higher levels of intimate partner violence than heterosexual adults, this is an important area for future research.

**Does resilience have a protective effect on depression and anxiety?**

At the bivariate level, all resilience measures were significant predictors of depression and anxiety (Table 2). Specifically, higher emotional competency and lower sense of coherence increased the odds of reporting moderate-to-severe depression and anxiety.

For depression, when resilience variables were added into regression Model 3 (Table 3), both remained significant, with higher emotional competency (OR 3.0; 95% CI 2.1, 4.4) and lower sense of coherence (OR 0.9; 95% CI 0.9, 1.0) increasing the odds of moderate-to-severe depression. In Model 4, when all factors and interactions were included in the model, sense of coherence remained the only significant resilience variable, with lower sense of coherence increasing the odds of moderate to severe depression (OR 0.9; 95% CI 0.8, 0.9). The final model provided the highest predictive power (percentage correct = 89.4%, $R^2 = 0.5$; Table 3) with no statistically significant interactions.

For anxiety, both resilience factors were significant in regression Model 3, with higher emotional competency (OR 2.0; 95% CI 1.4, 2.8) and lower sense of coherence (OR 0.9; 95% CI 0.9, 0.9) increasing the odds of moderate-to-severe anxiety. In Model 4, sense of coherence remained the only significant resilience variable, with lower sense of coherence increasing the odds of anxiety (OR 0.9; 95% CI 0.8, 1.0). There were no significant interactions in this model. In the hierarchical anxiety model (Table 4), Model 3 of this regression provided a slightly higher predictive power (percentage correct = 86.50%, $R^2 = 0.5$) compared to the Model 4 when interactions were added (percentage correct = 86.3%, $R^2 = 0.5$).

**Discussion**

This paper is the first UK study to examine the association of minority stressors and resilience with depression and anxiety among GBMSM. We found that over one in seven men reported moderate-to-severe symptoms of depression and one in five reported moderate-to-severe symptoms of anxiety. Numerous social contextual and behavioural factors were associated with depression and anxiety in the bivariate analyses, including age, education, employment, relationship status, disabilities (excluding mental health), any financial worries, HIV status, and hazardous alcohol use. However, only disabilities and financial worries remained significant predictors of depression and anxiety in the final hierarchical models. A similar result was found for minority stressors, since higher stigma, outness, and experiencing relationship abuse increased the odds of moderate-to-severe depression and anxiety. None remained significant in the final hierarchical model for depression; however, having experienced abuse in a relationship was a significant predictor of anxiety. Regarding the protective effect of resilience, the odds of moderate-to-severe depression and anxiety decreased with higher sense of coherence but increased with higher emotional competency in the bivariate analyses. However, only sense of coherence showed a protective effect for anxiety and depression in the final model. The implications of these findings are discussed below.

The key sociodemographic factors associated with mental ill-health were more frequent financial worries and reporting any disability (excluding mental health). Clearly, financial worries can be experienced by all, regardless of sexual orientation, but this highlights the broader structural influences on the lives of GBMSM. With the impacts of austerity and more recently COVID-19, this could highlight further exclusion of GBMSM due to service cuts, which disproportionally impact the lesbian, gay, bisexual, and transgender (LGBT) populations and can impact anxiety [27]. This could also suggest impacts of employment status on financial worries, as GBMSM still experience discrimination in the workplace, including restricted job choice and career progression [28]. The association with disability highlights the potential impact of intersectionality on the lives and mental health of GBMSM, just as it does for the general population. This is an under-researched area; various factors could contribute to increased mental ill-health, such as desexualisation of disabled people [29], and deserves further research.

All minority stressors were significant in the bivariate analyses, which highlights their relevance to depression and anxiety, and almost all minority stressors were significant in the multivariate analyses. This corroborates previous research which has demonstrated that minority stressors increase the odds of anxiety and depression [3, 7]. However, in general, these variables were not significant in the final multivariate models, which suggests that resilience has an impact on the relationship between minority stressors and mental health. Experiencing any form of relationship abuse in the last 12 months was the only minority stressor that was significant in the final multivariate model and associated with significantly increased odds of anxiety. Experiencing relationship abuse was the only minority stressor not significant in any of the depression multivariate models, further highlighting that different factors are associated with anxiety and depression in GBMSM. These findings somewhat contrast with previous research which has demonstrated that experiencing relationship abuse, in particular physical abuse, significantly predicted depression but only marginally predicted anxiety [30]. However, as LGBT populations experience higher levels of intimate partner violence than heterosexual adults, this is an important area for future research [31].
We hypothesised that resilience would have a protective effect on anxiety and depression. Higher sense of coherence, indicative of greater resilience, was significantly associated with lower odds of depression and anxiety. However, higher emotional competency was associated with increased odds of anxiety and depression in the bivariate analyses and step 3 of the hierarchical regression analyses, but not statistically significant in the final model (Model 4) when interactions were included, even though no interactions were significant. This suggests the role of resilience is complex and not yet fully understood. It is possible that different aspects of resilience could influence mental health problems differently, which is an important consideration for future intervention development. For example, while high emotional competency suggests greater skill in regulating emotions, this enhanced awareness may be counter-productive to regulating mental health in the face of potentially pervasive stigma-related stressors [32]. Moreover, these results suggest that sense of coherence is a more important predictor of mental health than emotional competency, therefore potentially informing future intervention targets and identifying GBMSM who might benefit from intervention support. There is an ongoing need to better understand resilience in this population [33, 34].

**Strengths and limitations**

This study adds to the evidence base on the reported experience of mental health, minority stressors and resilience among GBMSM, particularly outside North America. It is specifically the first to investigate associations of resilience and mental health among sexual minority men in the UK context.

The primary weakness of this study is its reliance on self-report data from an online, non-probability sample of men. In addition, measuring recall on the previous 12 months may limit the accuracy of the data; however, there are limited methods available to measure our included variables objectively, and the increased burden of more objective measures would limit the feasibility of this design and recruitment. Moreover, the key measures of depression and anxiety are based on recent (< 2 weeks) reports and demonstrate good clinical accuracy. While we found few associations between minority stressors and mental health, we did not have data on all potential measures associated with Minority Stress Theory, so caution should be taken in interpreting these results. Future research is required to hypothesise, understand, and determine the role of minority stress on GBMSM in the UK Celtic nations.

**Conclusions**

This research adds to the evidence base on the need for mental health interventions focussed specifically with GBMSM. It highlights that the factors associated with depression and anxiety vary and a future need to better understand the role of minority stressors, resilience and the challenges and stresses of everyday life. For example, how financial pressure and intersecting health problems, such as disability, bring for men in the Celtic nations. It points to a need to work with the groups most affected by mental ill-health to co-develop more effective solutions and build a better evidence base for what works, with whom, and in what context. Taking account of the context in which people live is important when considering health inequalities within a complex adaptive systems model, and in the context of developing multi-level interventions that can take a synergistic, salutogenic effect to promote and sustain positive mental health among GBMSM [35, 36, 37].

**Abbreviations**

- Apps
- applications
- CI
- confidence intervals
- GAD-7
- Generalized Anxiety Disorder-7 questionnaire
- HIV
- human immunodeficiency viruses
- LGBT
- lesbian, gay, bisexual, and transgender
- GBMSM
- men who have sex with men
- OR
- odds ratio
- PHQ-9
- Patient Health Questionnaire-9
SMMASH2
The Social Media, GBMSM and Sexual and Holistic Health
SD
standard deviation.
UK
United Kingdom

Declarations

Ethics approval and consent to participate

Ethical approval was granted by Glasgow Caledonian University School of Health and Life Sciences Ethics Subcommittee (HLS id: HLS/NCH/15/26).

Consent for publication

Not applicable

Availability of data and materials

The data that support the findings of this study are available from the final author upon reasonable request, subject to agreeing to statements of intent, confidentiality and non-disclosure. The data are not publicly available nor stored in a repository since neither ethical approval nor participant consent were sought for these purposes.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

JF, LMcd and PF designed the SMMASH2 study and LMcd devised the paper. AMcg prepared the first draft. Data were analysed by JR, AMcg, and JF, with input from all authors into interpretation of the results. All authors contributed to drafting and revising the manuscript and approved the final version.

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