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Mental health, social adversity, and health-related outcomes in sexual minority adolescents: a contemporary national cohort study

Rebekah Amos, Eric Julian Manalastas, Ross White, Henny Bos, Praveetha Patalay

Summary

Background Sexual minority adolescents are more likely to have mental health problems, adverse social environments, and negative health outcomes compared with their heterosexual counterparts. There is a paucity of up-to-date population-level estimates of the extent of risk across these domains in the UK. We analysed outcomes across mental health, social environment, and health-related domains in sexual minority adolescents compared with their heterosexual counterparts in a large, contemporary national cohort.

Methods The Millennium Cohort Study (MCS) is a birth cohort study in the UK following up children born between Sept 1, 2000, and Jan 11, 2002 across England, Wales, Scotland, and Northern Ireland. Children recruited from the MCS have been followed up over six recruitment sweeps to date at ages 9 months, 3 years, 5 years, 7 years, 11 years, and 14 years. We analysed mental health, social, and health-related outcomes in sexual minority versus heterosexual adolescents at age 14 years. Additionally, we estimated the accumulation of multiple adverse outcomes in both groups. The primary aim of the study was to assess whether sexual minority adolescents experienced more adverse outcomes than heterosexual adolescents.

Findings Between January, 2015, and April, 2016, 9885 adolescents provided a response about their sexual attraction. 629 (6%) of 9885 adolescents (481 female participants and 148 male participants) were identified as sexual minorities. 9256 (94%) of 9885 participants (4431 female and 4825 male) were attracted to the opposite sex or not attracted to the same sex and identified as heterosexual. Sexual minority adolescents were more likely to experience high depressive symptoms (odds ratio [OR] 5.43, 95% CI 4.32–6.83; $p < 0.0001$), self-harm (5.80, 4.55–7.41; $p < 0.0001$), lower life satisfaction (3.66, 2.92–4.58; $p < 0.0001$), lower self-esteem (β 1.83, 95% CI 1.47–2.19; $p < 0.0001$), and all forms of bullying and victimisation. Sexual minorities were more likely to have tried alcohol (OR 1.85, 95% CI 1.47–2.33; $p < 0.0001$), smoking (2.41, 1.92–3.03; $p < 0.0001$), and cannabis (3.22, 2.24–4.61; $p < 0.0001$), and also had increased odds of being less physically active (β 0.36, 95% CI 0.25–0.46; $p < 0.0001$), perceiving themselves as overweight (OR 1.73, 95% CI 1.40–2.14; $p < 0.0001$), and dieting to lose weight (1.98, 1.58–2.48; $p < 0.0001$). Sexual minority adolescents had more co-occurring mental health outcomes (mean 1.43 of 3 outcomes, 95% CI 1.34–1.52) compared with heterosexual adolescents (0.40 of 3 outcomes, 0.38–0.41), and more total cumulative difficulties (mean 9.43 of 28 outcomes, 95% CI 9.09–9.76 in sexual minority adolescents vs 6.16 of 28 outcomes, 6.08–6.23 in heterosexual adolescents).

Interpretation Sexual minority adolescents in the UK experience disparities in mental health, social, and health-related outcomes despite living in a time of substantial progress in rights for sexual minorities. These adverse outcomes co-occur, with implications for lifelong health and social outcomes. Health and educational practitioners should be aware of the increased risk for adverse outcomes in sexual minority adolescents.

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Introduction

Sexual minorities have consistently been found to be at an increased risk of a range of adverse outcomes compared with their heterosexual counterparts.¹ Despite modern advances in rights for sexual minorities in high-income countries, recent research shows that substantial disparities remain in mental health, social, and health-related domains. However, there is a paucity of contemporary population-level estimates of these outcomes in adolescents in the UK.

Adolescence is an important stage of human development, where rapid biological changes occur alongside increasing psychological and social demands.² Mental health difficulties and other health-related behaviours, such as smoking and alcohol use, are a leading cause of disability-adjusted life years lost globally and usually have their onset in adolescence.³ Adverse experiences in adolescence, including victimisation⁴ and engaging in antisocial behaviours,⁵ are also precursors to adversity and poorer health outcomes in later life, with multiple

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Research in context

Evidence before this study

We searched PubMed from inception to May 20, 2019, using the MeSH terms “sexual and gender minorities”, “adolescent”, “health”, and “population characteristic” to find relevant sexual minority research using population-based datasets (see appendix p 10). We found that many larger population-based cohort studies were done in the USA, focused on a sample with a large age range, and commonly focused on mental health outcomes. Only one study in Iceland used a large nationally representative adolescent sample and analysed multiple outcomes (between 2006–14). An additional search of the literature via Google Scholar identified another population-based study in New Zealand (between 2001–12). In both studies, sexual minority adolescents were more likely to experience adversity across multiple domains compared with heterosexuals. We did not identify any research that investigated outcomes for sexual minority adolescents using nationally representative samples in the UK and studies that have used unrepresentative samples in the UK have focused on past generations of adolescents.

Added value of this study

We extended previous research with a contemporary population-based UK sample and investigated 30 outcomes across mental health, social, and health-related domains and examined how they co-occur. To our knowledge, this is the first UK study that provides a nationally generalisable examination of adverse outcomes in mental health, social environment, and health-related domains in sexual minority adolescents born in the 21st century. We used a sample of adolescents born

between 2000 and 2002, who have experienced more socially progressive attitudes towards sexual minority individuals in their childhood compared with previous generations. Despite this, we found that sexual minority adolescents were many times more likely to experience depressive symptoms, self-harm, bullying, and victimisation. Furthermore, they were more likely to have difficulties with their weight (perception or actual) and have engaged in various forms of substance use. Additionally, we highlighted the accumulation of outcomes, whereby sexual minority adolescents had greater co-occurring difficulties overall.

Implications of all the available evidence

This study provides contemporary evidence of the extent of disparities faced by the current generation of sexual minority adolescents compared with their heterosexual counterparts on a range of outcomes. We found that sexual minorities are more likely to experience greater mental ill-health, interpersonal difficulties and poorer health related outcomes. Given that many mental health and health problems are comorbid and exacerbate one another over time, young people are likely to carry these adverse outcomes into adulthood with an associated social, health, and economic cost. We also found that sexual minorities were more likely to have adverse experiences cumulatively, with multiple mental health experiences constituting the most cumulative difficulty. As an adolescent’s social environment is likely to be a major factor involved in these disparities, universal interventions might need to more closely focus on reducing bullying and improving diversity and equality education.

negative outcomes in adolescence potentially increasing the effects on later life outcomes.

Throughout this Article, sexual minority is used as an umbrella term to include those attracted to the same or both sexes. Researchers commonly disaggregate bisexual, gay, and lesbian groups and inconsistent differences between these subgroups have been found.^{6,7} This disaggregation is usually based on identity or sexual behaviour, whereas measures of attraction are more developmentally appropriate for younger adolescents, who are the focus of the current study.⁸

Sexual minority adolescents are particularly at risk of negative outcomes during adolescence because of increased exposure to victimisation⁹ and having to navigate an understanding of their sexual identity.¹⁰ Previous estimates indicate that sexual minority adolescents are almost three times more likely to have suicidal ideation and depressive symptomology,¹¹ reduced wellbeing,¹² and are four times more likely to self-harm with suicidal intent⁶ compared with their heterosexual counterparts. In terms of health-related behaviours, sexual minority adolescents are more likely to be obese or have an eating disorder,¹³ engage in risky sexual behaviour,¹⁴ and use cigarettes and

other substances (eg, alcohol and cannabis)¹⁵ than are heterosexual adolescents. The increased exposure to negative societal attitudes that sexual minority adolescents experience has been implicated in more mental health¹⁶ and health-related behaviour problems.¹⁷ Sexual minority adolescents are more likely to experience social stressors such as fear of rejection based on sexuality status,¹ increased exposure to bullying and discrimination,⁹ have property stolen, be involved in physical altercations,¹⁸ and experience sexual abuse.¹⁹ Sexual minorities might also engage in antisocial behaviours as a response to social conflict or oppression.²⁰ These social contexts and interpersonal relationships are likely to heighten intrapersonal stress and thereby burden general psychopathological processes.¹⁶ Minority stress theory proposes that sexual minorities experience more general stressors (eg, bullying) and minority-specific stressors (eg, navigating identity) than do majority population groups.¹ Proximal (eg, internal processes) and distal factors (eg, prejudice) interact in the context of an adolescent’s environment, leading to adversity in mental (eg, rumination), social (eg, absence of support or family rejection), and health-related behaviour domains (eg, substance use).¹

For information regarding sampling and survey design of the MCS see <https://cls.ucl.ac.uk/cls-studies/millennium-cohort-study/>

In high-income countries, adolescents arguably now live in a more socially progressive environment towards sexual minorities.²¹ In the UK, same-sex marriage became legal on July 17, 2013, and a new curriculum that focuses on sexual diversity is being implemented in schools.²² However, the National LGBT Survey by the UK Government Equalities Office in 2018 revealed that more than two-thirds of participants avoided holding hands in public for fear of a negative reaction from others,²³ indicating that discrimination still exists at a societal level. Consequently, the UK government has developed an action plan to improve feelings of safety, experiences in educational settings, and health care for this group. As these government data focused on 16–65-year-olds, there is room for additional focus on younger age groups. Furthermore, given the shifting social climate in the UK, outcomes for more recent generations might be expected to differ from previous generations.

Although population-based research has been done in other countries,^{24–26} there is little representative population-based research in the UK investigating disparities on the basis of sexuality in mental health, social, and health-related domains in the current generation of adolescents. Studies that use population-based samples are scarce, focus on a narrow range of outcomes, and are based on generations born in the latter decades of the 20th century.⁶ Assessing a small number of outcomes in different samples limits the comparability of effects because of unaccounted participant variation (eg, different age ranges or ethnic profiles). Additionally, although increased odds of single outcomes have been studied (eg, suicidal ideation), mental health, socially adverse outcomes, and health-related behaviours tend to be associated and co-occur.²⁷ Sexual minority adolescents are more likely to experience multiple forms of victimisation simultaneously (polyvictimisation).²⁸ Co-occurrence of multiple risk factors is likely to have a larger impact on later life health and social outcomes; hence, examining the extent of accumulation of adverse outcomes in sexual minority adolescents compared with heterosexual adolescents has implications for policy and interventions in order to adequately support adolescents.

To address these research gaps, we analysed outcomes across mental health, social environment, and health-related domains in sexual minority adolescents compared with heterosexual adolescents in a large, contemporary national cohort. We used data from the Millennium Cohort Study (MCS), a nationally representative sample of adolescents born between 2000 and 2002. To our knowledge, this is the first study to use a population-based sample in the UK to estimate differences in multiple mental health (eg, depressive symptoms and self-harm), social (eg, relationships and victimisation), and health-related outcomes (eg, substance use and physical activity). We also investigated the co-occurrence of negative outcomes across these domains, to understand the cumulative difficulties that sexual minority adolescents

have compared with their heterosexual counterparts, which, to our knowledge, no previous study has done.

Methods

Study design and participants

The MCS is a birth cohort study in the UK following children born between Sept 1, 2000, and Jan 11, 2002. 19 519 children were recruited from across England, Wales, Scotland, and Northern Ireland to the MCS and have been followed up over six recruitment sweeps to date, at ages 9 months, 3 years, 5 years, 7 years, 11 years, and 14 years. Children were eligible for the study if they were listed on the child benefit register at the first recruitment sweep. Participants were excluded from the study if a cohort member had died or emigrated outside of the UK.

In the sixth sweep at 14 years, 15 415 families were selected for interview. 11 726 (76%) of 15 415 families were successfully interviewed, giving a total sample of 11 884 adolescents. Attrition at this sweep was predicted by single-parent families, lower-income occupation and lower educational level, black ethnicity, and male sex.²⁹

Ethics approval for the MCS study was obtained from the National Research Ethics Service Committee London—Central (reference 13/LO/1786). Collected data are anonymised and available to researchers via the UK Data Service. All parents gave consent for their children to participate and young people also provided verbal consent.

Procedures

We obtained binary or continuous scale scores via multiple questionnaires that were administered to adolescents. For mental health difficulties, we measured self-harm (“In the past year have you hurt yourself on purpose in any way?”), self-esteem (assessed via a 5-item shortened version of the Rosenberg self-esteem scale),³⁰ subjective wellbeing (6-item measure assessing happiness with schoolwork, appearance, family, friends, school, and life as a whole), life satisfaction (widely used single-item measure of life satisfaction; “how do you feel about your life as a whole?”),³¹ and depressive symptoms (measured via the short moods and feelings questionnaire total;³² established cutoff for high levels of depressive symptoms is a score of 12 or above; see appendix p 2 for all variable transformations and measures used). We also measured the relative frequency of interpersonal difficulties such as bullying (“how often are you bullied by peers, by siblings, and online?”; eg, “never”, “everyday”, etc; those bullied most days or everyday were coded as often bullied in binary transformations), victimisation (eg, experience of verbal, physical, or sexual assault over the past 12 months), antisocial behaviours (ie, had the young person stolen, hit someone, or hit someone with a weapon in the past 12 months?), parental relationships (ie, how close they felt to their parents—not very close to extremely close—and how often they argued with parents—on a scale from most days to never [more than once a week was classed as often]), and friendships (“Do you have any close friends?”). For health-related behaviours, we used measures of smoking

See Online for appendix

	Heterosexual (n=9256)	Sexual minority (n=629)	No attraction data (n=1999)
Sex			
Female	4431 (47.9%; 46.9–48.9)	481 (76.5%; 73.0–79.6)	1019 (51.0%; 48.8–53.2)
Male	4825 (52.1%; 51.1–53.2)	148 (23.5%; 20.4–27.0)	980 (49.0%; 46.8–51.2)
Ethnicity			
Minority ethnic group	1578 (17.0%; 15.3–19.0)	82 (13.0%; 8.3–20.8)	666 (33.3%; 28.6–38.8)
White	7601 (82.1%; 81.3–82.9)	542 (86.2%; 83.2–88.7)	953 (47.7%; 45.5–49.9)
Missing	77 (0.8%; 0.6–1.0)	5 (0.8%; 0.3–1.9)	380 (19.0%; 17.3–20.8)
Housing			
Homeowner	6214 (67.1%; 65.5–68.8)	382 (60.7%; 54.7–67.2)	1198 (59.9%; 47.43–56.1)
Renting	2733 (29.5%; 27.7–31.5)	227 (36.1%; 29.1–44.4)	678 (33.9%; 39.27–52.7)
Other	309 (3.3%; 2.7–4.2)	20 (3.2%; 1.4–8.5)	123 (6.2%; 4.7–11.1)
Parent education			
NVQ5	1048 (11.3%; 10.7–12.0)	88 (14.0%; 11.5–16.9)	127 (6.4%; 5.4–7.5)
NVQ4	3135 (33.9%; 32.9–34.8)	231 (36.7%; 33.0–40.6)	476 (23.8%; 22.0–25.7)
NVQ3	1302 (14.1%; 13.4–14.8)	72 (11.4%; 9.2–14.2)	271 (13.6%; 12.1–15.1)
NVQ2	2052 (22.2%; 21.3–23.0)	126 (20.0%; 17.1–23.4)	407 (20.4%; 18.7–22.2)
NVQ1	456 (4.9%; 4.5–5.4)	33 (5.2%; 3.8–7.3)	141 (7.1%; 6.0–8.3)
Overseas qualification	223 (2.4%; 2.1–2.1)	8 (1.3%; 0.6–2.5)	112 (5.6%; 4.7–6.7)
No qualifications	650 (7.0%; 6.5–7.6)	37 (5.9%; 4.3–8.0)	368 (18.4%; 16.8–20.2)
Missing	390 (4.2%; 3.8–4.6)	34 (5.4%; 3.9–7.5)	97 (4.9%; 4.0–5.9)
Single parent or guardian*	2270 (24.5%; 23.6–25.4)	179 (28.5%; 25.1–32.1)	489 (24.5%; 22.6–26.4)
Unemployed household†	2109 (22.8%; 21.9–23.7)	159 (25.3%; 22.0–28.8)	840 (42.0%; 39.9–44.2)
Number of siblings in household	2.5 (2.4–2.5)	2.2 (2.2–2.4)	2.8 (2.8–2.9)
Disadvantaged stratum‡	4156 (44.9%; 42.6–47.4)	312 (49.6%; 41.0–60.1)	841 (42.1%; 37.4–47.4)
Income quintiles§			
Lowest	1323 (14.3%; 13.6–15.0)	80 (12.7%; 10.3–15.6)	635 (31.8%; 29.8–33.8)
Second	1510 (16.3%; 15.6–17.1)	113 (18.0%; 15.2–21.2)	385 (19.3%; 17.6–21.1)
Third	1952 (21.1%; 20.3–21.9)	130 (20.7%; 17.7–24.0)	332 (16.6%; 15.0–18.3)
Fourth	2249 (24.3%; 23.4–25.2)	132 (21.0%; 18.0–24.4)	346 (17.3%; 15.7–19.0)
Highest	2213 (23.9%; 23.1–24.8)	174 (27.7%; 24.3–31.3)	298 (14.9%; 13.4–16.5)
Missing	9 (0.1%; 0.1–0.2)	0	3 (0.2%; 0.1–0.5)

Data are n (%; 95% CI) or mean (95% CI). NVQ=National Vocational Qualification. *Biological mother or father or guardian responsible for the young person. †Household with no working parent(s). ‡The proportion of children living in areas which were the poorest 25% according to the Child Poverty Index for England and Wales. §Derived using a modified Organisation for Economic Cooperation and Development equivalence scale.

Table 1: Adolescent demographic characteristics

use (ever smoked) and frequency (regular smoking: smoke 1–6 cigarettes per day or >6 per day), alcohol use (ever drunk alcohol) and frequency (regular drinking: drank alcohol 10–>40 times in the past 4 weeks), other drug use (such as ecstasy, cocaine, speed), cannabis use (ever used cannabis) and frequency (regular cannabis use: used cannabis three to more than ten times ever), sexual activity (sexual intercourse), risky sex (ie, did not use any contraception), obesity (overweight or obese thresholds determined using the International Obesity Task Force guidelines³³), weight control via exercise (ever exercised to lose weight or control current weight?), and dieting (ever restricted food or calorie intake to lose weight or avoid gaining weight?), and rates of physical activity (how many days in the last week was vigorous exercise done, eg, every day or not at all).

Finally, using binary variables, we created cumulative index scores for each domain. We summed outcomes

within each domain to calculate an average and proportional cumulative score of mental health, anti-social behaviour, interpersonal difficulties, health-related behaviours, and an overall cumulative score. For specific outcomes where two versions of severity were examined in this study (eg, ever drinking alcohol and frequent drinking), we only included the lower severity outcome (hence excluding frequent drinking, smoking, cannabis use, and risky sex) in this score to avoid counting these outcomes twice.

Outcomes

The primary aim of the study was to assess whether sexual minorities had more adverse outcomes than did heterosexual adolescents. Additionally, we aimed to test whether sexual minority adolescents had more cumulative difficulties than did heterosexuals.

Statistical analysis

We used logistic and linear regressions to examine outcomes in sexual minority adolescents compared with their heterosexual counterparts. All models controlled for parental income, parent composition in household (single parent or carer vs two parents or carers), housing tenure (ie, rented or owned), number of siblings in the household, ethnicity, and sex.

To account for the testing of multiple models, we calculated a false discovery rate via the *multproc* command in Stata, generating a corrected p value that was applied to all models. Because of the stratified cluster design of the MCS and to account for attrition over time, all analyses were weighted with combined sampling and attrition weights to obtain nationally representative estimates using the Stata *svy* prefix for all models. Analyses were done using Stata version 14.1.

Role of the funding source

There was no funding source for this study.

Results

Between January, 2015, and April, 2016, 9885 (83%) of 11884 adolescents provided a response about their sexual

attraction. 629 (6%) of 9885 adolescents (481 female participants and 148 male participants) were coded as sexual minorities. Within this group, 50 participants (29 female and 21 male) reported same-sex attraction only and 576 participants (451 female and 125 male) reported bisexual attraction. 9256 (94%) of 9885 participants (4431 female and 4825 male) were attracted to the opposite sex or not attracted to the same sex and coded as heterosexual. The remaining 1999 (17%) of 11884 participants did not answer both questions about attraction or had not experienced attraction yet and were not included in our analysis. Participant demographic characteristics are reported in table 1.

We observed significantly more female sexual minority adolescents than male sexual minority adolescents (table 1). For all regression models, we examined whether any associations observed between sexuality and outcomes were moderated by sex, and found they were not. All correlations between outcome variables were moderate to small (appendix p 6). The strongest correlation was between self-esteem and depressive symptoms and the weakest was between arguing often with the mother and being overweight or obese.

	Heterosexual adolescents (n=9256)	Sexual minority adolescents (n=629)	OR (95% CI)	Regression coefficient (95% CI)	p value*
Mental health					
Depressive symptoms score (score range 0–26)	9125, 5.53 (5.41–5.64)	622, 12.77 (12.16–13.38)	..	6.32 (5.51 to 7.13)	<0.0001
Above depressive symptoms cutoff	9125, 15.15% (14.19–16.15)	622, 54.27% (49.24–59.21)	5.43 (4.32 to 6.83)	..	<0.0001
Low subjective wellbeing	9163, 15.33 (15.20–15.47)	623, 20.30 (19.71–20.90)	..	4.18 (3.38 to 4.98)	<0.0001
Low life satisfaction	9204, 10.15% (9.33–11.04)	627, 34.40% (29.63–39.49)	3.66 (2.92 to 4.58)	..	<0.0001
Self-harm	9206, 14.20% (13.26–15.19)	624, 53.78% (48.73–58.74)	5.80 (4.55 to 7.41)	..	<0.0001
Self-esteem score† (score range 5–20)	9092, 9.46 (9.40–9.52)	621, 11.81 (11.53–12.10)	..	1.83 (1.47 to 2.19)	<0.0001
Antisocial behaviours					
Stole from another person	9225, 1.25% (0.98–1.61)	628, 3.09% (1.83–5.15)	3.36 (1.87 to 6.01)	..	<0.0001
Hit another person	9224, 33.76% (32.50–35.05)	629, 34.31% (29.78–39.16)	1.42 (1.12 to 1.79)	..	0.004
Hit someone with a weapon	9225, 1.17% (0.89–1.53)	629, 1.27% (0.55–2.94)	1.90 (0.73 to 4.97)	..	0.189
Health-related outcomes					
Ever drank alcohol	9227, 51.51% (50.17–52.84)	628, 67.45% (62.52–72.02)	1.85 (1.47 to 2.33)	..	<0.0001
Regular drinking‡	4048, 1.27% (0.94–1.72)	385, 1.07% (0.36–3.11)	0.50 (0.14 to 1.81)	..	0.288
Ever smoked	9203, 17.51% (16.47–18.60)	625, 34.73% (30.02–39.75)	2.41 (1.92 to 3.03)	..	<0.0001
Regular smoking‡	9201, 2.80% (2.33–3.37)	625, 6.18% (4.13–9.16)	1.84 (1.11 to 3.05)	..	0.018
Ever used cannabis	9226, 5.56% (4.92–6.28)	627, 15.87% (12.17–20.44)	3.22 (2.24 to 4.61)	..	<0.0001
Regular cannabis use‡	414, 49.90% (43.59–56.22)	76, 35.98% (23.43–50.80)	0.57 (0.27 to 1.18)	..	0.129
Other drug use	9224, 0.76% (0.55–1.06)	628, 1.94% (1.00–3.72)	2.70 (1.20 to 6.09)	..	0.017
Sexual activity	527, 31.42% (26.44–36.86)	82, 44.24% (31.69–57.56)	1.56 (0.81 to 3.00)	..	0.180
Risky sex	154, 20.59% (12.60–31.79)	33, 13.35% (4.34–34.34)	0.54 (0.14 to 2.07)	..	0.365
Overweight or obese	8890, 25.92% (24.71–27.18)	595, 33.04% (28.39–38.04)	1.35 (1.08 to 1.67)	..	0.007
Physically inactive	9231, 2.72 (2.70–2.74)	629, 3.20 (3.12–3.28)	..	0.36 (0.25 to 0.46)	<0.0001
Exercised to lose weight	9212, 61.35% (60.03–62.66)	629, 66.33% (61.31–71.02)	1.04 (0.82 to 1.32)	..	0.746
Dieted to lose weight	9204, 43.59% (42.28–44.92)	627, 65.55% (60.48–70.30)	1.98 (1.58 to 2.48)	..	<0.0001
Perceives self as overweight	9209, 32.59% (31.35–33.85)	629, 49.47% (44.49–54.47)	1.73 (1.40 to 2.14)	..	<0.0001

(Table 2 continues on next page)

	Heterosexual adolescents (n=9256)	Sexual minority adolescents (n=629)	OR (95% CI)	Regression coefficient (95% CI)	p value*
(Continued from previous page)					
Interpersonal difficulties					
Sibling bullying (victimised)	8620, 26.54% (25.35–27.77)	582, 37.27% (32.26–42.58)	1.62 (1.25 to 2.09)	..	<0.0001
Frequency of sibling bullying score (score range 1–6)	8620, 2.72 (2.68–2.76)	582, 3.24 (3.08–3.39)	..	0.48 (0.26 to 0.70)	<0.0001
Peer bullying (victimised)	9216, 10.37% (09.56–11.23)	628, 27.10% (22.89–31.76)	3.36 (2.56 to 4.40)	..	<0.0001
Frequency of peer bullying score (score range 1–6)	9216, 2.00 (1.97–2.03)	628, 2.91 (2.76–3.05)	..	0.92 (0.70 to 1.13)	<0.0001
Cyber bullying (victimised)	9220, 2.32% (1.93–2.79)	626, 7.56% (5.27–10.72)	2.62 (1.66 to 4.14)	..	<0.0001
Frequency of cyber bullying score (score range 1–6)	9220, 1.47 (1.45–1.49)	626, 2.00 (1.89–2.10)	..	0.42 (0.28 to 0.56)	<0.0001
Verbally assaulted	9223, 44.94% (43.62–46.27)	629, 65.86% (61.07–70.36)	2.25 (1.79 to 2.84)	..	<0.0001
Physically assaulted	9221, 24.22% (23.07–25.41)	627, 34.85% (30.21–39.81)	2.15 (1.69 to 2.74)	..	<0.0001
Hit with a weapon	9217, 3.70% (3.16–4.30)	628, 6.55% (4.19–10.09)	2.14 (1.28 to 3.58)	..	0.004
Been stolen from	9219, 7.94% (7.23–8.74)	628, 12.36% (9.51–15.91)	1.61 (1.14 to 2.28)	..	0.007
Sexually assaulted or harassed	9220, 2.53% (2.16–2.96)	627, 11.11% (8.46–14.47)	3.38 (2.36 to 4.85)	..	<0.0001
Has close friends	9230, 96.93% (96.37–97.40)	629, 96.41% (93.65–98.00)	0.64 (0.35 to 1.16)	..	0.142
Not close to mother	9131, 3.02% (2.56–3.55)	617, 8.74% (6.04–12.50)	2.42 (1.58 to 3.73)	..	<0.0001
Not close to father	8546, 11.05% (10.39–11.72)	568, 16.84% (13.75–19.93)	1.47 (1.05 to 2.07)	..	<0.0001
Close to mother score (score range 1–4)	9131, 3.20 (3.18–3.22)	617, 2.83 (2.76–2.90)	..	–0.35 (–0.45 to –0.25)	<0.0001
Close to father score (score range 1–4)	9546, 2.84 (2.82–2.86)	568, 2.49 (2.41–2.57)	..	–0.29 (–0.39 to –0.18)	0.026
Argues with mother often	9117, 26.37% (25.20–27.58)	615, 40.82% (35.85–45.98)	1.71 (1.33 to 2.21)	..	<0.0001
Argues with father often	8531, 16.06% (15.06–17.12)	568, 23.84% (19.73–28.50)	1.62 (1.25 to 2.11)	..	<0.0001

Data are n, mean (95%CI) or n, % (95% CI), unless otherwise indicated. n is the participants with outcome data for that variable, and percentages indicate the number of people in each group experiencing that outcome. Sex, socioeconomic factors, parental income, number of siblings, housing tenure, and ethnicity variables were controlled for in all regression models in this table. *Falsediscovery rate corrected p value of 0.00879. †Higher scores indicate lower self-esteem. ‡On the basis of those who answered yes to drinking, smoking, and using cannabis.

Table 2: Descriptive statistics for all variables of interest

Sexual minority adolescents had increased odds of reporting clinical levels of depressive symptoms, had lower life satisfaction, and had increased odds of self-harming in the past year compared with heterosexual adolescents. Sexual minority adolescents were more likely to have lower self-esteem scores (table 2; figure 1). Sexual minority adolescents were at increased odds of antisocial behaviour such as hitting another person or stealing from another person, compared with their heterosexual counterparts. However, sexual minority adolescents were not at increased odds of hitting someone with a weapon (figure 1; table 2).

Sexual minority adolescents were at increased odds of having drunk alcohol, smoked, or used cannabis in the past compared with their heterosexual counterparts. However, we observed no differences in regular smoking, regular cannabis use, regular drinking, or other drug use. Sexual minority adolescents did not have increased odds of engaging in sexual activity or of engaging in risky sexual behaviour (figure 1; table 2).

Sexual minority adolescents were at increased odds of being overweight or obese compared with heterosexual adolescents and were also more likely to be physically

inactive. Sexual minority adolescents were not at increased odds of exercising to lose weight. However, sexual minority adolescents were at increased odds of eating less to lose weight and were more likely to perceive themselves as overweight or very overweight compared with heterosexual adolescents (figure 1; table 2).

Sexual minority adolescents were at increased odds of being bullied by siblings, peers, and online compared with their heterosexual counterparts. They were also at increased odds of experiencing verbal assault, physical assault, sexual assault, being hit with a weapon, and being stolen from. We observed no difference between sexual minority adolescents and heterosexual adolescents regarding whether they had close friendships. However, sexual minority adolescents reported being less close to and arguing more with their parents (figure 1; table 2).

Sexual minority adolescents had more total cumulative difficulties (mean 9.43 of 28 outcomes [only binary variables], 95% CI 9.09–9.76) versus heterosexual adolescents (6.16 of 28 outcomes, 6.08–6.23). In the mental health domain, sexual minorities had a mean of 1.43 (95% CI 1.34–1.52) cumulative difficulties of three outcomes versus 0.40 (0.38–0.41) of three outcomes

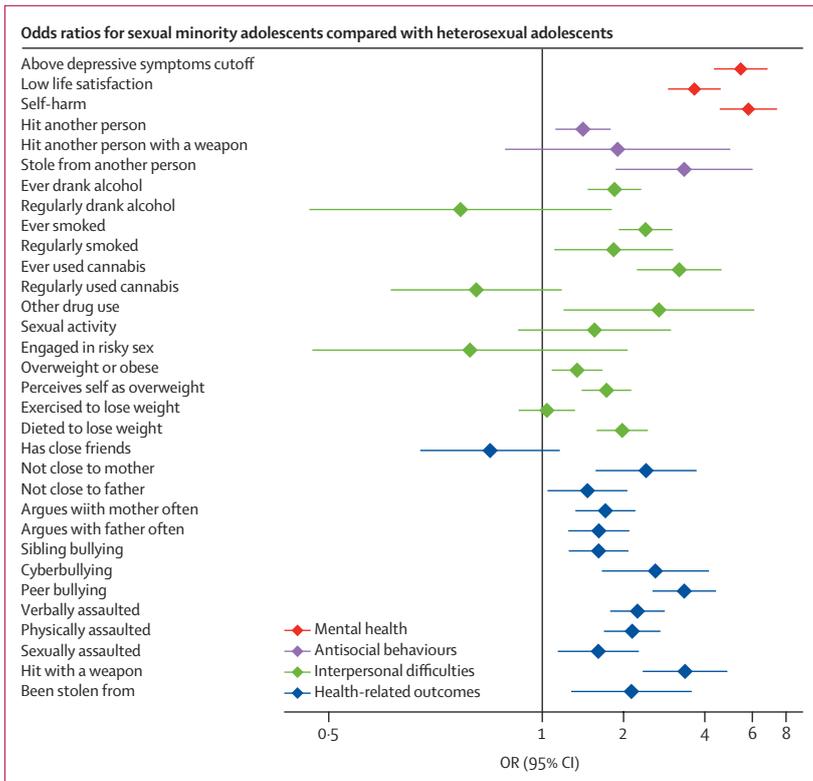


Figure 1: ORs for sexual minority adolescents compared with heterosexual adolescents
Sex, parental income, number of siblings, housing tenure & ethnicity variables were controlled for in all models. ORs greater than 1 indicate increased odds in sexual minority adolescents. OR=odds ratio.

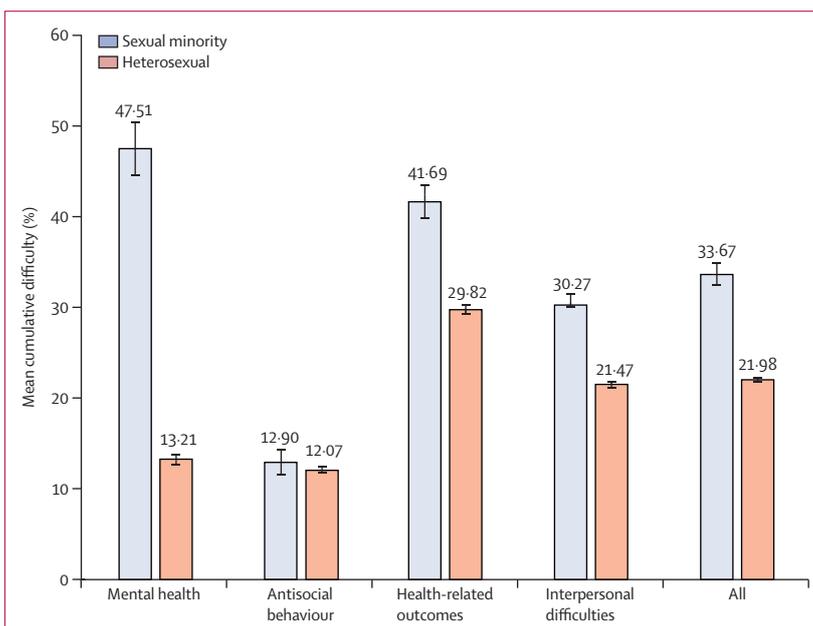


Figure 2: Percentage of cumulative difficulty across domains of adversity
Error bars represent 95% CIs.

for heterosexual adolescents. The mental health domain also showed the highest percentage of cumulative difficulty for sexual minority adolescents (figure 2). In the health-related domain, sexual minorities had a mean of 3.75 (3.59–3.92) cumulative difficulties of nine outcomes compared with 2.68 of nine outcomes (2.64–2.72) for heterosexual adolescents. For the interpersonal difficulties domain, sexual minority adolescents had mean 3.93 (3.77–4.10) cumulative difficulties of 13 outcomes versus 2.79 (2.76–2.83) of 13 outcomes for heterosexual adolescents. We found no difference in cumulative difficulty for the antisocial behaviour domain between sexual minority adolescents (0.39 out of three outcomes, 95% CI 0.34–0.43) and heterosexual adolescents (0.36 of three outcomes, 0.35–0.37).

We also reported descriptive statistics for bisexual versus same-sex attracted adolescents for all outcomes (appendix p 8). The only difference identified was for depressive symptoms (binary and continuous), for which bisexual adolescents were more likely to be above the depression cutoff.

Discussion

This study provides much needed population-based estimates of sexual minority adolescents' mental health, social environment, and health-related outcomes in the UK. Across all of our investigated domains, we generally found increased odds of more adverse outcomes for sexual minority adolescents. We also showed that adverse adolescent outcomes accumulate at higher levels in sexual minority adolescents, highlighting the potentially severe extent of negative lifetime consequences due to experiences and outcomes in adolescence.

Similar to previous research, we found that sexual minority adolescents had an increased likelihood of mental health problems such as depression, self-harm, lower self-esteem, and lower life satisfaction. We found that sexual minority adolescents were over five times more likely to have depression and self-harm compared with their heterosexual counterparts. Mental health difficulties also constituted the highest proportion of cumulative difficulty in sexual minorities. This pattern of mental health disparity is concerning given that depression is a leading cause of years lived with disability and carries a substantial health burden worldwide.³ There has been a call to prioritise preventive strategies that address the development of depression globally and for these strategies to also focus on at-risk groups and earlier stages of onset.^{2,27} Increased mental health problems have been linked with adversity in an adolescent's social environment.²⁷ In this study, we found that sexual minority adolescents were more likely to argue with and be less close to their parents and were also significantly more likely to experience all forms of bullying and victimisation, including sexual assault. In accordance with the minority stress theory, these patterns of social adversity are likely to impact the mental health

of sexual minority adolescents and the adverse health behaviours they engage in.¹ Our research highlights that sexual minority adolescents should be among the priority groups for interventions and that interventions should be targeted in various different contexts (eg, school and family settings).²⁰ The 2018 publication of the UK government's LGBT Action Plan recognises that social discrimination needs to be further reduced.³⁴

Additionally, we found that sexual minority adolescents were more likely to have drunk alcohol, smoked tobacco, and used cannabis. They were also more likely to be physically inactive, perceive themselves as overweight, and restrict food intake to control their weight. These health-related behaviours are associated with increased mortality rates over the life course, having detrimental consequences for an individual's quality of life and increasing the likelihood of development of further comorbidities over time.³ In line with previous publications,¹³ we found that precursors of eating disorders (eg, restriction of food intake and perceiving the self as overweight) are elevated in sexual minority adolescents. At the age of 14 years, sexual minorities were not more likely to engage in regular alcohol consumption, use other drugs, have had sexual intercourse, or risky sex. The overall sample prevalence of some of these outcomes was low. Alcohol use in sexual minorities is generally elevated for several indicators—eg, younger age of initiation and heavy drinking.¹⁵ In this study, we found that sexual minority adolescents were more likely to try substances such as alcohol, but not to use them regularly. Social, physical, and mental health outcomes might interact in a multidirectional fashion and evidence suggests that social variables have a key role in the dynamic development of later adverse outcomes.^{12,20} However, because of the cross-sectional nature of our analysis we could not examine these potentially causal relationships over time.

To our knowledge, this is the first study to use a large UK population-based sample to estimate differences for a broad host of outcomes within the same sample. This approach permitted investigation of the relative increased odds of several outcomes and measurement of cumulative difficulty. We found that sexual minority adolescents were more likely to have negative outcomes in a range of domains, as well as multiple negative outcomes simultaneously, with nine co-occurring outcomes on average compared with six in heterosexual adolescents. Given the consequences of cumulative difficulties, the associated risk is likely to be additive. Mental health comorbidities are likely to perpetuate one another and increase in severity over time.³ Therefore, there are likely to be lifelong health and social repercussions associated with the cumulative difficulties observed in sexual minority adolescents. By contrast with previous research,³⁵ we did not observe sex differences in associations between sexuality and outcomes. A 2019 UK-based analysis of adolescents born in the 1990s also

did not find an association between sex and depressive symptoms and self-harm in sexual minority adolescents.⁶

The main strength of this study is that we utilised a probability-based sample allowing the findings to be generalised to the UK population. We used a sample of adolescents born in the 21st century, providing a much-needed overview of the experience of sexual minority adolescents who have lived in an era of sociopolitical change towards equality and diversity.²¹ By assessing multiple domains within the same sample, the relative likelihoods of multiple outcomes can be compared meaningfully, which is another strength of our study. For example, we can see that within this sample mental health factors, such as substantial depressive symptoms, were elevated by five times and most experiences of victimisation and assault elevated by two to three times in sexual minority compared with heterosexual adolescents. To date, most research in sexual minority adolescents has focused on these domains separately, making this relative understanding difficult.

Study limitations include the way in which sexual minority adolescents were identified. Sexuality was derived from responses about sexual attraction. Given the fluidity of sexuality at this age and the complexity of navigating one's identity during adolescence,¹⁰ attraction was considered an appropriate measure of sexual minority status at this age. Past research showed that across varying labels of sexual minority (ie, lesbian, gay, or bisexual), there are differences in levels of adversity experienced within the sexual minority group itself, specifically with bisexual individuals experiencing worse outcomes.⁷ In our sample, comparisons between bisexual and same-sex attracted adolescents were underpowered. Descriptive statistics revealed differences for depressive symptoms only, with bisexual youth being more depressed on average. With the available data, we cannot establish whether individuals with increased odds of poorer outcomes had yet disclosed attraction status at school or to family, and hence we could not examine whether the observed outcomes were different on the basis of disclosure status. Another limitation of our study is that our proxy of risky sex is derived from a question that assumes penile–vaginal intercourse; given that most of the sexual minority sample was female, this variable might underrepresent risky sex for female sexual minorities.

A range of disparities based on sexual attraction are visible as early as 14 years of age. Problems such as increased rates of depression, smoking tobacco, and cannabis use are likely to affect sexual minority adolescents throughout the course of their lives, making early intervention a public health priority. Schools provide an ideal infrastructure to implement effective public health change and social policies.⁹ In light of this, a new UK curriculum that teaches students about gender and relationship diversity has been developed, but the guidance around its implementation currently lacks clarity.²² Therefore, at the policy level clearer universal education

guidelines are needed. Parental tensions identified for sexual minority adolescents need further investigation to identify whether support can be offered at the family level and whether there is scope to develop interventions targeting families of sexual minority adolescents.

In conclusion, sexual minority adolescents had higher levels of mental health difficulties (eg, self-harm and depressive symptoms), social adversities (eg, more bullying, less parental closeness, and sexual assault), and health-related behaviours (eg, smoking and cannabis use). These results highlight the need for further prevention efforts and intervention at the school, community, and policy level to ensure that sexual minority adolescents do not face lifelong negative social, economic, and health outcomes. Despite high-profile UK policies, such as the legalisation of same sex marriage in 2013 and the introduction of sexual orientation as a protected characteristic during the lifetime of the adolescents in this study, the evidence presented here indicates that large inequalities in social and health outcomes still exist for sexual minority adolescents growing up in the 21st century.

Contributors

RA was responsible for and led the data analysis, data management, drafting of the manuscript, and literature review. PP substantially contributed to study conceptualisation, the analysis plan, and drafting of the manuscript. RA, EJM, RW, and PP contributed to the overall concept of the paper, study protocol, and drafting of the manuscript. All authors checked the work for intellectual content, read and revised the Article, and approved it for submission.

Declaration of interests

We declare no competing interests.

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