

Original Article

Demographic, history, university and lifestyle factors associated with university student mental health: cross-sectional analysis across five UK universities

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Background

The whole-university approach to mental health emphasises that well-being should be a strategic priority across all aspects of higher education. However, there is limited evidence on which aspects of university life institutions should target to maximise well-being.

Aim

To identify factors associated with student mental health and well-being and provide an evidence base for developing initiatives that protect and promote this.

Methods

The Nurture-U survey was conducted across five universities in the UK from 2022 to 2024. This cross-sectional sample of the survey data assessed student well-being and mental health at the start of the academic year. Hierarchical linear regression models examined the relative association between demographic, family history, university and lifestyle variables and self-reported depression, measured using the Patient Health Questionnaire-9 (PHQ-9), anxiety, measured using the Generalised Anxiety Disorder-7 (GAD-7) and well-being, measured using the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS).

Results

A total of 14 172 students completed the survey. Over a quarter self-reported probable anxiety or depression based on established screening thresholds. Regression analysis indicated that

younger age, identifying as female or lesbian, gay, bisexual, transgender, queer/questioning, intersex or asexual (LGBTQIA+) and reporting a disability were associated with poorer mental health. There was minimal evidence of mental health impact associated with university factors, such as course of study or university attended. There was a strong association with exercise and self-care.

Conclusions

We have provided evidence that exercise and self-care may be areas that universities can target when considering a whole-university approach to student mental health and well-being. Increasing opportunities for students from all backgrounds, means and abilities to adopt healthy behaviours is vital to supporting university students.

Keywords

Mental health; wellbeing; survey; healthy lifestyle; university students.

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Mental health challenges pose a significant barrier to success in higher education.¹ Students experiencing mental distress are less likely to perform well academically or graduate to professional employment.^{2,3} In the UK, the rate of students disclosing a mental health condition at university enrolment has tripled in 7 years.⁴ While this rise may be due to universities making it easier to disclose mental difficulties, there is also evidence of increasing complexity in needs and a challenge for support services to meet these within existing systems.⁵ It has been argued that universities must adopt proactive, public health approaches that encourage students to prioritise their mental health.⁶ However, the evidence base for what types of support are actually effective in protecting and promoting student mental health within diverse student populations is limited.⁷

One of the challenges of designing appropriate support is that risk factors are multifactorial: certain students are more at risk of mental health difficulties due to certain characteristics or life experiences, but there are also university cultures or environments, or student lifestyles, such as engaging in substance use, that are associated with worse mental health.^{1,8} There is initial evidence that proactive well-being or support services that target certain groups

could be beneficial.⁹ However, understanding university or lifestyle factors that affect student mental health allows universities to change policies or structures, or provide time and space for healthy behaviours, which will benefit not only the most at-risk students but also the wider student population.¹⁰ It is this aim that is central to the whole-university approach to student mental health: a framework at the heart of the UK University Mental Health Charter,¹¹ which champions not only more effective and individualised well-being services, but also structural changes that encourage connection and compassion. However, as of yet, evidence is scarce as to what changes may be most effective.⁷ While there have been other mental health surveys in the UK,^{12,13} there has not been a study specifically aiming to disentangle the differential associations of modifiable and non-modifiable factors on university student mental health.

Nurture-U is funded by UK Research and Innovation (UKRI) and is a research project aiming to provide evidence on which elements of a whole-university approach to student well-being are most beneficial to students. The Nurture-U survey, adapted from the Canadian U-Flourish Survey,¹⁴ is a longitudinal study, using standardised measures collected at the start and end of

3 consecutive academic years. This paper presents cross-sectional analysis of baseline survey data collected in the autumn terms from 2022 to 2024. We conducted hierarchical regression analyses to examine the relationships between demographic factors, family history, university factors and lifestyle with student mood, anxiety and well-being, thus providing evidence-based grounding for the development of initiatives to protect and improve student mental health.

Method

Data collection

The Nurture-U survey ran at the Universities of Exeter, Southampton, Cardiff, Oxford and Newcastle. Data collection methods are described in the Nurture-U protocol,¹⁵ and included email, in-person advertising and social media. One site targeted first years for recruitment; the rest targeted all current students. Students were recruited to the baseline survey at the start of each academic year from 2022–2024, and invited to take part in the follow-up survey in the autumn and spring for the rest of their studies. If students accidentally took the baseline survey more than once, the first survey was used as baseline, and subsequent surveys were recorded as follow-up surveys. Additionally, responses were linked to student numbers prior to cross-site anonymisation, ensuring identification and removal of duplicates. Written consent was obtained from all participants prior to survey completion.

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2013. All procedures were approved at each university site: Exeter (FHLS Psychology Research Ethics Committee, 519175), Cardiff (Wales Research Ethics Committee, IRAS reference: 155838, REC reference: 16/WA/0323), Newcastle (Faculty of Medical Sciences Research Ethics Committee, 24735/2022), Oxford (Medical Sciences Interdivisional Research Ethics Committee, Ref. R60998) and Southampton (Faculty of Medicine Ethics Board, ERGO 73178).

The measures (Table 1) included standardised questionnaires measuring mental health and well-being,^{16–20} items from the Wellbeing, Health and Mental Health International College Student questionnaire (WHM-ICS) adapted to align with UK census categories²¹ and single-item questions created by the team.

Analysis

Linearity and normality were evaluated using residual plots and Q-Q plots. No major violations were observed. Breusch–Pagan tests indicated heteroskedasticity. Missing data were addressed using multiple imputation by chained equations (MICE).²² Participants with >80% missing data were deleted prior to imputation. All described variables were included. A total of 20 imputed data-sets were generated, and analyses were performed on each data-set separately. Robust standard errors were calculated for each imputed data-set using heteroskedasticity-consistent covariance estimators and pooled using Rubin’s Rules.²³ All analyses were conducted in R v3.18.0 for Windows (version 4.5.0, R Foundation for Statistical Computing, Vienna, Austria; <https://www.r-project.org/>).

Hierarchical linear regression models were used to assess the association of each set of variables – demographic (model 1), history (model 2), university (model 3) and lifestyle (model 4) – with continuous-scale totals for depression, measured using the Patient Health Questionnaire-9 (PHQ-9),¹⁹ anxiety, measured using the Generalised Anxiety Disorder-7 (GAD-7)²⁰ and well-being, measured using the Warwick–Edinburgh Mental Well-being

Table 1 Included measures

Group	Constructs
Outcomes: Current mental health	Depression ¹⁹ Anxiety ²⁰ Well-being ¹⁸
Demographics	Age in years Gender identity ²¹ Ethnicity ²¹ Sexual orientation ²¹ Disability ^a Parent education ^a
Personal history	Family history of mental health condition ^a Parent divorce ²¹ Parent death ²⁰ Foster care ²⁰ Advance childhood experiences ²⁰ Harsh treatment Bullying Physical abuse Sexual abuse
University	Year of baseline survey ^a University attended ^a Course ^a Student status ^a Level of study ^a Year of study ^a
Lifestyle	Exercise frequency ^a Self-care frequency ^a Caffeine frequency ^a Alcohol frequency ¹⁷ Smoking/Vaping ²¹ Drug use ²¹

a. Single-item questions created by the research team.

Scale (WEMWBS).¹⁸ The ordering and grouping for these models were theory-informed, based on previous work in this area on the Canadian sample, which included student-led research priorities and survey design.¹ Model performance was evaluated at each step using adjusted *R*² and pooled *F*-tests.

Hierarchical logistic regression models were used to assess the contribution of the same four sets of predictors to binary mental health outcomes using established clinical cut-off points, indicating moderate to severe depression (PHQ-9 > 9) and anxiety (GAD-7 > 9). McFadden’s pseudo-*R*² and likelihood ratio tests (LRTs) were used to compare model performance at each stage of stepwise regression.

Results

A total of 14 172 students consented to complete the survey. After deleting those with >80% missing data (1869 students; 13.2%), of the remaining 12 303 participants, 10 448 (84.9%) had <10% missing data; no participants had >50% missing data.

Participants were predominantly female (65.1%), White (61%) and heterosexual (71.4%) (Table 2). Over half (56.6%) had a family history of a mental health condition (Table 3). Just over a quarter of students reported moderate/severe depressive symptoms, with similar numbers for anxiety (Table 4).

Participants were primarily home students (63%) and undergraduates (64.5%). Three-quarters of participants were in their first year of study (Table 5). A quarter of students reported never exercising, and a fifth reported never or less than weekly putting time aside for self-care (Table 6). A third of students reported drinking alcohol more than once a week, 9.5% reported smoking or vaping daily. Approximately 16% of the sample reported recent drug use.

Table 2 Demographics

Demographic variable	N (missing, %)	Overall = 14 172 n (% valid data)
Age	13 186 (986, 7)	Mean = 22.3 (s.d. = 6.2) Median = 20 Range = 17–67
Gender	13 578 (594, 4.6)	Female = 8836 (65.1) Gender diverse = 385 (2.8) Male = 4357 (32.1) No = 471 (3.5)
Gender matching sex at birth	13 515 (657, 4.6)	Yes = 13 044 (96.5)
Sexual orientation	12 935 (1237, 8.7)	Bisexual = 2133 (16.5) Heterosexual = 9239 (71.4) Homosexual = 705 (5.5) Other = 858 (6.6)
Ethnic group	13 429 (743, 5.2)	Asian Chinese = 1518 (11.3) Asian Other = 2049 (15.3) Black = 396 (2.9) Mixed or Other = 1232 (9.2) White = 8234 (61.3) No = 10 009 (86.2)
Disability	11 609 (2563, 18.1)	Yes = 1600 (13.8)
Parent education	12 813 (1359, 9.6)	Bachelor's degree = 3759 (29.3) Doctoral degree = 1100 (8.6) High school = 1947 (15.2) Less than high school = 368 (2.9) Master's degree = 2626 (20.5) Professional degree = 1158 (9.0) Some college education = 1536 (12.0) Trade school = 319 (2.5)

Table 3 History

History variable	N (missing, %)	Overall = 14 172 n (% valid data)
Family history of mental health condition	11 662 (2510, 17.7)	6605 (56.6)
Parents divorced	13 111 (1061, 7.5)	No = 10 510 (80.2) Yes = 2601 (19.8)
Parent(s) died	13 059 (1113, 7.9)	No = 12 538 (96.0) Yes = 521 (4.0)
Experience of foster care	12 814 (1358, 9.6)	No = 12 433 (97.0) Yes = 381 (3.0)
Childhood adverse experience: Harsh treatment	11 837 (2335, 16.5)	No = 8740 (73.8) Yes = 3097 (26.2)
Childhood adverse experience: Physical abuse	11 820 (2352, 16.6)	No = 10 456 (88.5) Yes = 1364 (11.5)
Childhood adverse experience: Bullied	11 835 (2337, 16.5)	No = 8353 (70.6) Yes = 3482 (29.4)
Childhood adverse experience: Sexual abuse	11 088 (3084, 21.8)	No = 9106 (82.1) Yes = 1982 (17.9)

Regression results

Coefficients for the final linear regression models are presented in Table 7. For all three outcomes, each step of the hierarchical regression significantly improved model fit (all $p < 0.001$; see Supplementary Table 1 for full model comparisons). The findings of the hierarchical logistic regressions exploring associations with binary outcomes using established clinical cut-off points on the depression and anxiety scales were very similar to the linear regressions and hence will not be discussed in detail in this paper (see Supplementary Table 2 for details).

Table 4 Mental health

Mental health variable	N (missing, %)	Overall = 14 172 n (% valid data)
Mood scores (PHQ-9)	12 077 (2095, 14.8)	Mean = 6.7 (s.d. = 5.7)
Score ≥ 10 (clinically significant symptoms)		3207 (26.5)
Anxiety scores (GAD-7)	12 289 (1883, 13.3)	Mean = 6.7 (s.d. = 5.2)
Score ≥ 10 (clinically significant symptoms)		3275 (26.6)
Well-being scores (SWEMWBS)	12 383 (1789, 12.6)	Mean = 21.7 (s.d. = 4.1)

PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalised Anxiety Disorder-7; SWEMWBS, Short Warwick-Edinburgh Mental Well-being Scale.

Table 5 University factors

University variable	N (missing, %)	Overall = 14 172 n (% valid data)
Survey year	14 172	2022 = 4803 (33.9) 2023 = 4904 (34.6) 2024 = 4465 (31.5)
University attended	14 172	University A = 1040 (7.3) University B = 4217 (29.8) University C = 1278 (9.1) University D = 5336 (37.6) University E = 2301 (16.2)
Student status	13 687 (485, 3.4)	Domestic = 8596 (62.8) International = 5091 (37.2)
Education level	13 436 (736, 5.2)	Postgraduate = 4765 (35.5) Undergraduate = 8671 (64.5)
Course subject	13 054 (1118, 7.9)	Arts and humanities = 2844 (21.8) Business and law = 1624 (12.4) Education = 330 (2.5) Engineering and manufacturing = 1039 (8.0) Health and welfare = 1529 (11.7) Information and technology = 437 (3.3) Natural sciences and mathematics = 2548 (19.5) Other = 919 (7.0) Social sciences = 1787 (13.7) First = 10 009 (75.1) Second or higher = 3322 (24.9)

Depression

The final linear regression model explained the greatest proportion of variance for PHQ-9 total scores ($R^2 = 0.26$, adjusted $R^2 = 0.26$, $F(62, 12239) = 69.86$, $p < 0.001$). The hierarchical regression model was built with demographics entered first (model 1). When comparing adjusted R^2 across the models (Fig. 1 and Supplementary Table 1), demographic factors alone explained 11%. Adding history factors (model 2: +8%) and lifestyle factors (model 4: +6%) explained more variance than university factors (model 3: +0.01%).

Elevated depression scores were associated with younger age ($\beta = 0.069$, 95% CI $[-0.105$ to $-0.069]$, $p < 0.001$), female gender identity ($\beta = 0.773$, 95% CI $[0.562$ – $0.986]$, $p < 0.001$), bisexual ($\beta = 1.216$, 95% CI $[0.950$ – $1.482]$, $p < .001$), homosexual ($\beta = 0.582$, 95% CI $[0.176$ – $0.988]$, $p < 0.001$) and other sexual orientations ($\beta = 0.961$, 95% CI $[0.572$ – $1.351]$, $p < 0.001$), having a gender that did not match sex at birth ($\beta = 1.410$, 95% CI $[0.617$ – $2.203]$, $p < 0.001$) and reporting a disability ($\beta = 1.605$, 95% CI $[0.617$ – $2.203]$, $p < 0.001$). Compared with students reporting a White ethnic background, Asian students had elevated depression scores ($\beta = 0.388$, 95% CI $[0.074$ – $0.702]$, $p = 0.017$).

Table 6 Lifestyle		
Lifestyle variable	N (missing, %)	Overall = 14172 n (% valid data)
Exercise	11 533 (2639, 18.6)	
Never		2914 (25.2)
Less than once a week		2166 (18.7)
Once a week		2013 (17.4)
2–3 times a week		2815 (24.4)
4+ times a week		1625 (14.1)
Caffeine intake	9835 (4327, 30.6)	
Never		1656 (16.8)
Less than once a day		2916 (29.6)
Once a day		2649 (26.9)
2–3 times a day		2176 (22.1)
4+ times a day		448 (4.5)
Time for self-care	11 521 (2651, 18.7)	
Never		614 (5.3)
Less than once a week		1715 (14.9)
Once a week		2809 (24.4)
2–3 times a week		4091 (35.5)
4+ times a week		2292 (19.9)
Alcohol use	11 625 (2547, 18.0)	
Never		2450 (21.1)
Monthly or less		2290 (19.7)
2–4 times monthly		3201 (27.5)
2–3 times weekly		2993 (25.7)
4+ weekly		691 (5.9)
Smoker	11 527 (2645, 18.7)	
Never or rarely		10 432 (90.5)
Daily		1095 (9.5)
Used drugs in the past month	11 523 (2793, 19.7)	1863 (16.4)

Family history of mental health ($\beta=1.005$, 95% CI [0.803–1.206], $p < 0.001$) was associated with elevated depression scores, as was childhood experience of harsh treatment ($\beta=1.409$, 95% CI [1.156–1.661], $p < 0.001$), physical abuse ($\beta=0.597$, 95% CI [0.254–0.939], $p < 0.001$), bullying ($\beta=1.543$, 95% CI [1.310–1.777], $p < 0.001$) and sexual abuse ($\beta=1.149$, 95% CI [0.879–1.420], $p < 0.001$). Experience of foster care was associated with lower depression scores ($\beta=-0.830$, 95% CI [-1.427 to -0.234], $p = 0.006$).

International students had lower depression scores ($\beta=-0.488$, 95% CI [-0.744 to -0.232], $p < 0.001$). Being in the second year of study or above was associated with elevated depression scores ($\beta=0.345$, 95% CI [0.109–0.582], $p = 0.006$).

Higher frequencies of exercise ($\beta=-1.114$, 95% CI [-1.332 to -0.896], $p < 0.001$) and self-care ($\beta=-2.326$, 95% CI [-2.635 to -2.017], $p < 0.001$) had a linear association with lower depression scores. Higher caffeine intake ($\beta=1.382$, 95% CI [1.055–1.709], $p < 0.001$), smoking ($\beta=1.550$, 95% CI [1.221–1.879], $p < 0.001$) and drug use ($\beta=0.663$, 95% CI [0.400–0.925], $p < 0.001$) were associated with higher depression scores.

The final model explained the greatest proportion of variance for the logistic regression (McFadden’s pseudo $R^2=0.16$, $\chi^2(18, 49\ 623)=23.27$, $p < 0.001$). Again, when comparing pseudo R^2 in the logistic regression models, university factors had less of an impact than demographics, history or lifestyle.

The same associations were generally found for the logistic regression analyses (see Supplementary Table 2), except for drug use, which was not significantly associated with screening positive for moderate to severe depression on the PHQ-9.

Anxiety

The final linear regression explained the greatest proportion of variance for GAD-7 total scores ($R^2=0.22$, adjusted $R^2=0.22$,

$F(62, 12239)=55.82$, $p < 0.001$). When comparing adjusted R^2 across models for anxiety, adding history (model 2: +6.7% for anxiety) and lifestyle factors (model 4: +4%) had a greater impact on explaining observed variance than university factors (model 3: +0.4%) (Fig. 1).

Elevated anxiety scores were associated with younger age ($\beta=-0.072$, 95% CI [-0.090 to -0.054], $p < 0.001$), identifying as female ($\beta=1.195$, 95% CI [0.993–1.396], $p < 0.001$), gender diverse ($\beta=1.001$, 95% CI [0.195–1.807], $p = 0.024$), bisexual ($\beta=1.014$, 95% CI [0.765–1.262], $p < 0.001$), homosexual ($\beta=0.592$, 95% CI [0.209–0.974], $p < 0.001$) and other orientations ($\beta=0.543$, 95% CI [0.177–0.909], $p < 0.035$), having a gender that did not match sex at birth ($\beta=0.835$, 95% CI [0.125–1.545], $p = 0.035$) and reporting a disability ($\beta=1.525$, 95% CI [1.240–1.809], $p < 0.001$). Students from Chinese ethnic backgrounds reported lower anxiety scores compared with students from White backgrounds ($\beta=-0.406$, 95% CI [-0.743 to -0.068], $p = 0.013$).

Family history of mental health ($\beta=0.990$, 95% CI [0.799–1.181], $p < 0.001$) and experiencing harsh treatment ($\beta=1.146$, 95% CI [0.905–1.386], $p < 0.001$), bullying ($\beta=1.478$, 95% CI [1.260–1.695], $p < 0.001$) and sexual abuse ($\beta=0.896$, 95% CI [0.636–1.156], $p < 0.001$) in childhood were associated with higher anxiety scores. Experiences of foster care predicted lower anxiety scores ($\beta=-0.962$, 95% CI [-1.498 to -0.426], $p < 0.001$).

Students who started the survey in 2024 had lower anxiety scores than those in 2022 ($\beta=-0.215$, 95% CI [-0.464 to -0.039], $p = 0.021$). Students at University A ($\beta=0.574$, 95% CI [0.219–0.928], $p = 0.002$) and C ($\beta=0.376$, 95% CI [0.047–0.705], $p = 0.026$) had higher anxiety scores than those at the reference University D. Those studying engineering and manufacturing ($\beta=-0.388$, 95% CI [-0.766 to -0.010], $p = 0.042$) or health and welfare ($\beta=-0.444$, 95% CI [-0.755 to -0.133], $p = 0.006$) had lower anxiety scores than the referent arts and humanities. Being in the second year of study or above was associated with higher anxiety scores ($\beta=-0.570$, 95% CI [0.348–0.792], $p < 0.001$).

Higher frequencies of exercise ($\beta=-0.563$, 95% CI [-0.767 to -0.358], $p < 0.001$) and self-care ($\beta=-1.993$, 95% CI [-2.283 to -1.703], $p < 0.001$) were associated with lower anxiety scores. For self-care, there was some evidence of threshold effects. Higher caffeine intake ($\beta=1.166$, 95% CI [0.858–1.475], $p < 0.001$), smoking ($\beta=0.162$, 95% CI [0.344–0.962], $p < 0.001$) and drug use ($\beta=0.258$, 95% CI [0.010–0.505], $p = 0.045$) were associated with higher anxiety scores.

The final model explained the greatest proportion of variance for the logistic regression (McFadden’s pseudo $R^2=0.13$, $\chi^2(18, 58780)=19.98$, $p < 0.001$). Again, when comparing pseudo R^2 in the logistic regression models, university factors had less of an impact than demographics, history or lifestyle.

The same associations were generally found for the logistic regression analyses (see Supplementary Table 2), except for engineering and manufacturing students, who were not more likely to have scores over the established clinical threshold for moderate to severe anxiety than the referent arts and humanities students. Additionally, those who drink alcohol more regularly were less likely to have scores over the established clinical threshold for moderate to severe anxiety (odds ratio = 0.829, $t = -2.385$, 95% CI [0.711–0.967], $p = 0.017$).

Well-being

Model 4 explained the greatest proportion of variance for the linear regression predicting WEMWBS total scores ($R^2=0.17$, adjusted $R^2=0.17$, $F(62, 12889)=40.91$, $p < 0.001$). Adjusted R^2 shows that demographic (4.8%), history (+2.6%) and university (+0.4%) factors explained far less of the variance in well-being scores than for

Table 7 Linear regression outputs

Variable	Total PHQ-9 score	Total GAD-7 score	Total SWEMWBS score
	Estimates (robust s.e.) [95% CI] Model 4	Estimates (robust s.e.) [95% CI] Model 4	Estimates (robust s.e.) [95% CI] Model 4
Constant	6.724*** (0.277) [6.238 to 7.350]	6.322*** (0.274) [5.783 to 6.861]	20.780*** (0.221) [20.352 to 21.208]
Demographic variables			
Age in year	−0.087*** (0.009) [−0.105 to −0.069]	−0.072*** (0.009) [−0.090 to −0.054]	0.069*** (0.008) [0.054–0.083]
Gender			
Male (ref.)	–	–	–
Female	0.773*** (0.107) [0.562 to 0.986]	1.195*** (0.101) [0.993 to 1.396]	−0.476*** (0.084) [−0.638 to −0.314]
Gender diverse	0.816 (0.513) [−0.085 to 1.716]	1.001* (0.443) [0.195 to 1.807]	−0.571 (0.364) [−1.228 to 0.087]
Sexual orientation			
Heterosexual (ref.)	–	–	–
Bisexual	1.216*** (0.144) [0.950 to 1.482]	1.014*** (0.131) [0.765 to 1.262]	−0.425*** (0.099) [−0.630 to −0.221]
Homosexual	0.582*** (0.218) [0.176 to 0.988]	0.592*** (0.203) [0.209 to 0.974]	−0.427*** (0.145) [−0.732 to −0.122]
Other	0.961*** (0.211) [0.572 to 1.351]	0.543*** (0.196) [0.177 to 0.909]	−0.542*** (0.149) [−0.844 to −0.240]
Gender matching sex at birth			
Yes (ref.)	–	–	–
No	1.410*** (0.455) [0.617 to 2.203]	0.835* (0.396) [0.125 to 1.545]	−0.416 (0.342) [−1.007 to 0.175]
Ethnic group			
White (ref.)	–	–	–
Chinese	0.055 (0.172) [−0.306 to 0.416]	−0.406* (0.163) [−0.743 to −0.068]	−0.186 (0.151) [−0.464 to 0.092]
Asian	0.388* (0.162) [0.074 to 0.702]	−0.203 (0.149) [−0.498 to 0.093]	−0.369** (0.124) [−0.610 to −0.127]
Black	0.195 (0.312) [−0.370 to 0.759]	−0.542 (0.279) [−1.073 to −0.011]	−0.300 (0.230) [−0.736 to 0.136]
Mixed/Other	0.133 (0.169) [−0.192 to 0.458]	−0.254 (0.159) [−0.549 to 0.059]	−0.023 (0.132) [−0.274 to 0.227]
Disability			
No (ref.)	–	–	–
Yes	1.605*** (0.160) [1.317 to 1.892]	1.525*** (0.155) [1.240 to 1.809]	−0.610*** (0.104) [−0.824 to −0.396]
Parent education			
Bachelor's degree (ref.)	–	–	–
Doctoral degree	−0.063 (0.176) [−0.412 to 0.286]	0.214 (0.170) [−0.114 to 0.543]	0.053 (0.133) [−0.215 to 0.321]
High school	0.022 (0.149) [−0.265 to 0.310]	0.234 (0.135) [−0.031 to 0.500]	0.107 (0.112) [−0.110 to 0.325]
Less than high school	−0.367 (0.306) [−0.946 to 0.213]	0.017 (0.278) [−0.525 to 0.559]	0.118 (0.270) [−0.355 to 0.590]
Master's degree	−0.165 (0.130) [−0.421 to 0.092]	0.125 (0.122) [−0.116 to 0.366]	0.137 (0.101) [−0.061 to 0.336]
Professional degree	−0.282 (0.166) [−0.624 to 0.060]	−0.038 (0.161) [−0.356 to 0.279]	0.282 (0.132) [0.018 to 0.546]
Some college education	−0.020 (0.157) [−0.323 to 0.284]	0.047 (0.143) [−0.236 to 0.330]	−0.014 (0.119) [−0.250 to 0.221]
Trade school	0.467 (0.321) [−0.130 to 1.065]	0.245 (0.303) [−0.305 to 0.794]	0.217 (0.246) [−0.245 to 0.680]
History variables			
Family history of mental health			
No (ref.)	–	–	–
Yes	1.005*** (0.0142) [0.803 to 1.206]	0.990*** (0.099) [0.799 to 1.181]	−0.431*** (0.074) [−0.580 to −0.281]
Parent divorce			
No (ref.)	–	–	–
Yes	0.014 (0.123) [−0.217 to 0.245]	−0.228* (0.113) [−0.446 to −0.010]	−0.028 (0.089) [−0.206 to 0.150]
Parent death			
No (ref.)	–	–	–
Yes	0.111 (0.255) [−0.349 to 0.572]	−0.044 (0.225) [−0.469 to 0.381]	−0.131 (0.1829) [−0.509 to 0.199]
Foster care			
No (ref.)	–	–	–
Yes	−0.830** (0.329) [−1.427 to −0.234]	−0.962*** (0.280) [−1.498 to −0.426]	−0.155 (0.185) [−0.060 to 0.839]
Childhood experience of harsh treatment			
No (ref.)	–	–	–
Yes	1.409*** (0.137) [1.156 to 1.661]	1.146*** (0.128) [0.905 to 1.386]	−0.666*** (0.093) [−0.853 to −0.478]
Childhood experience of physical abuse			
No (ref.)	–	–	–
Yes	0.597** (0.189) [0.254 to 0.939]	0.150 (0.160) [−0.154 to 0.454]	−0.247 (0.126) [−0.494 to 0.000]
Childhood experience of bullying			
No (ref.)	–	–	–
Yes	1.543*** (0.124) [1.310 to 1.777]	1.478*** (0.115) [1.260 to 1.695]	−0.658*** (0.083) [−0.828 to −0.487]
Childhood experience of sexual abuse			
No (ref.)	–	–	–
Yes	1.149*** (0.151) [0.879 to 1.420]	0.896*** (0.140) [0.636 to 1.156]	−0.658 (0.083) [−0.272 to 0.146]
University variables			
Survey year			
2022 (ref.)	–	–	–
2023	−0.229* (0.114) [−0.453 to −0.006]	−0.215* (0.107) [−0.426 to −0.005]	0.188 (0.086) [0.018 to 0.358]
2024	−0.415*** (0.116) [−0.640 to −0.189]	−0.251* (0.109) [−0.464 to −0.039]	0.171 (0.087) [−0.001 to 0.342]
Survey site			
1	0.831*** (0.196) [0.457–1.204]	0.574** (0.182) [0.219–0.928]	0.188 (0.144) [−0.101 to 0.477]
2	−0.127 (0.131) [−0.384 to 0.130]	−0.097 (0.123) [−0.339 to 0.146]	0.115 (0.103) [−0.083 to 0.312]
3	0.274 (0.185) [−0.077 to 0.624]	0.376* (0.168) [0.047 to 0.705]	−0.039 (0.134) [−0.307 to 0.229]

(Continued)

Table 7 (Continued)

Variable	Total PHQ-9 score Estimates (robust s.e.) [95% CI] Model 4	Total GAD-7 score Estimates (robust s.e.) [95% CI] Model 4	Total SWEMWBS score Estimates (robust s.e.) [95% CI] Model 4
4 (ref.)	–	–	–
5	–0.553*** (0.143) [–0.840 to –0.265]	–0.246 (0.134) [–0.516 to 0.023]	0.393** (0.115) [0.173 to 0.612]
Student status			
Domestic (ref.)	–	–	–
International	–0.488*** (0.126) [–0.744 to –0.232]	–0.098 (0.123) [–0.341 to 0.144]	0.535*** (0.101) [0.336 to 0.733]
Level of study			
Undergraduate (ref.)	–	–	–
Postgraduate	–0.109 (0.131) [–0.373 to 0.155]	–0.017 (0.126) [–0.266 to 0.232]	–0.032 (0.107) [–0.237 to 0.173]
Course			
Arts and humanities (ref.)	–	–	–
Business and law	–0.174 (0.173) [–0.513 to 0.164]	–0.051 (0.163) [–0.372 to 0.269]	0.085 (0.138) [–0.175 to 0.345]
Education	–0.421 (0.298) [–1.037 to 0.194]	–0.402 (0.285) [–0.979 to 0.176]	0.560 (0.255) [0.097–1.024]
Engineering and manufacturing	–0.194 (0.203) [–0.593 to 0.206]	–0.388* (0.191) [–0.766 to –0.010]	0.044 (0.162) [–0.258 to 0.346]
Health and welfare	–0.274 (0.169) [–0.604 to 0.056]	–0.444** (0.160) [–0.755 to –0.133]	0.310* (0.127) [0.059 to 0.560]
Information and technology	–0.291 (0.270) [–0.819 to 0.236]	–0.285 (0.252) [–0.779 to 0.209]	–0.419* (0.207) [–0.824 to –0.015]
Natural sciences and mathematics	–0.051 (0.143) [–0.331 to 0.229]	–0.192 (0.134) [–0.455 to 0.072]	–0.181 (0.107) [–0.396 to 0.034]
Other	–0.153 (0.203) [–0.549 to 0.242]	–0.432* (0.187) [–0.803 to –0.060]	0.061 (0.156) [–0.241 to 0.363]
Social sciences	–0.070 (0.163) [–0.385 to 0.244]	–0.089 (0.154) [–0.389 to 0.210]	–0.166 (0.118) [–0.404 to 0.072]
Current year of study			
First year (ref.)	–	–	–
Second and above	0.345** (0.125) [0.109–0.582]	0.570*** (0.116) [0.348–0.792]	–0.241** (0.092) [–0.420 to –0.061]
Lifestyle variables			
Exercise frequency ^a			
Linear	–1.114*** (0.111) [–1.332 to –0.896]	–0.563*** (0.105) [–0.767 to –0.358]	1.204*** (0.090) [1.034 to 1.373]
Quadratic	0.033 (0.106) [–0.176 to 0.242]	–0.007 (0.103) [–0.207 to 0.193]	0.125 (0.086) [–0.040 to 0.290]
Cubic	0.022 (0.099) [–0.176 to 0.221]	–0.006 (0.093) [–0.191 to 0.179]	0.098 (0.076) [–0.054 to 0.250]
Quartic	–0.069 (0.103) [–0.273 to 0.136]	0.076 (0.100) [–0.122 to 0.274]	0.060 (0.079) [–0.099 to 0.219]
Self-care frequency ^a			
Linear	–2.326*** (0.180) [–2.635 to –2.017]	–1.993*** (0.158) [–2.283 to –1.703]	2.546*** (0.144) [2.309 to 2.784]
Quadratic	–0.173 (0.158) [–0.447 to 0.102]	–0.553** (0.141) [–0.814 to –0.291]	0.301* (0.126) [0.087 to 0.515]
Cubic	0.727*** (0.128) [0.500 to 0.954]	0.601*** (0.115) [0.388 to 0.815]	–0.294** (0.095) [–0.470 to –0.118]
Quartic	–0.460*** (0.157) [–0.618 to –0.224]	–0.343** (0.097) [–0.528 to –0.158]	0.205** (0.0717) [0.055 to 0.354]
Caffeine frequency ^a			
Linear	1.382*** (0.183) [1.055 to 1.709]	1.166*** (0.168) [0.858 to 1.475]	–0.619*** (0.139) [–0.872 to –0.366]
Quadratic	0.460* (0.157) [0.176 to 0.744]	0.324* (0.145) [0.058 to 0.589]	–0.144 (0.120) [–0.365 to 0.078]
Cubic	0.331 (0.118) [0.112 to 0.549]	–0.058 (0.109) [–0.264 to 0.148]	0.058 (0.089) [–0.111 to 0.228]
Quartic	–0.086 (0.094) [–0.270 to 0.098]	0.053 (0.089) [–0.121 to 0.226]	0.060 (0.072) [–0.083 to 0.203]
Alcohol frequency ^a			
Linear	0.027 (0.163) [–0.284 to 0.338]	–0.275 (0.153) [–0.572 to –0.021]	0.282* (0.126) [0.042 to 0.521]
Quadratic	0.174 (0.133) [–0.083 to 0.430]	0.094 (0.122) [–0.143 to 0.332]	0.105 (0.099) [–0.088 to 0.299]
Cubic	0.111 (0.110) [–0.104 to 0.326]	0.166 (0.102) [–0.035 to 0.367]	–0.023 (0.086) [–0.190 to 0.143]
Quartic	0.117 (0.093) [–0.068 to 0.303]	0.096 (0.088) [–0.078 to 0.270]	–0.001 (0.071) [–0.143 to 0.141]
Smokes or vapes daily			
No (ref.)	–	–	–
Yes	1.550*** (0.185) [1.221 to 1.879]	0.653*** (0.162) [0.344 to 0.962]	–0.549*** (0.127) [–0.802 to –0.297]
Drug use			
No (ref.)	–	–	–
Yes	0.663*** (0.141) [0.400 to 0.925]	0.258* (0.129) [0.010 to 0.505]	–0.421*** (0.099) [–0.619 to –0.222]
Mean R ²	0.26	0.22	0.17
Adjusted R ²	0.26	0.22	0.17
Likelihood ratio test (d.f.)	46.18*** (18, 48 253)	32.003*** (18, 51 460)	61.7*** (18, 37 318)
Relative increase in variance	0.092	0.089	0.106
F statistic (d.f.)	69.86*** (62, 12 239)	55.82*** (62, 12 239)	40.91*** (62, 12 239)

PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalised Anxiety Disorder-7; SWEMWBS, Short Warwick-Edinburgh Mental Well-being Scale.

a. Polynomial contrasts represent linear (L), quadratic (Q), cubic (C), and quartic (Q⁴) trends for ordinal variables.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

depression and anxiety. However, lifestyle factors contributed an additional 8.7%.

Younger ($\beta = 0.069$, 95% CI [0.054–0.083], $p < 0.001$), female ($\beta = -0.476$, 95% CI [–0.638 to –0.314], $p < 0.001$), bisexual ($\beta = -0.425$, 95% CI [–0.630 to –0.221], $p < 0.001$), homosexual ($\beta = -0.427$, 95% CI [–0.732 to –0.122], $p < 0.001$), other sexual orientation ($\beta = -0.542$, 95% CI [–0.844 to –0.240], $p < 0.001$), Asian ($\beta = -0.369$, s.e. = 0.124, 95% CI [–0.610 to –0.127],

$p = 0.003$) and disabled ($\beta = -0.610$, 95% CI [–0.824 to –0.396], $p < 0.001$) students had lower well-being scores than their counterparts.

Family history of mental illness ($\beta = -0.431$, 95% CI [–0.580 to –0.281], $p < 0.001$) and experience of childhood harsh treatment ($\beta = -0.666$, 95% CI [–0.853 to –0.478], $p < 0.001$), bullying ($\beta = -0.658$, 95% CI [–0.828 to –0.487], $p < 0.001$) and sexual abuse ($\beta = -0.658$, 95% CI [–0.272 to 0.146], $p < 0.001$) were

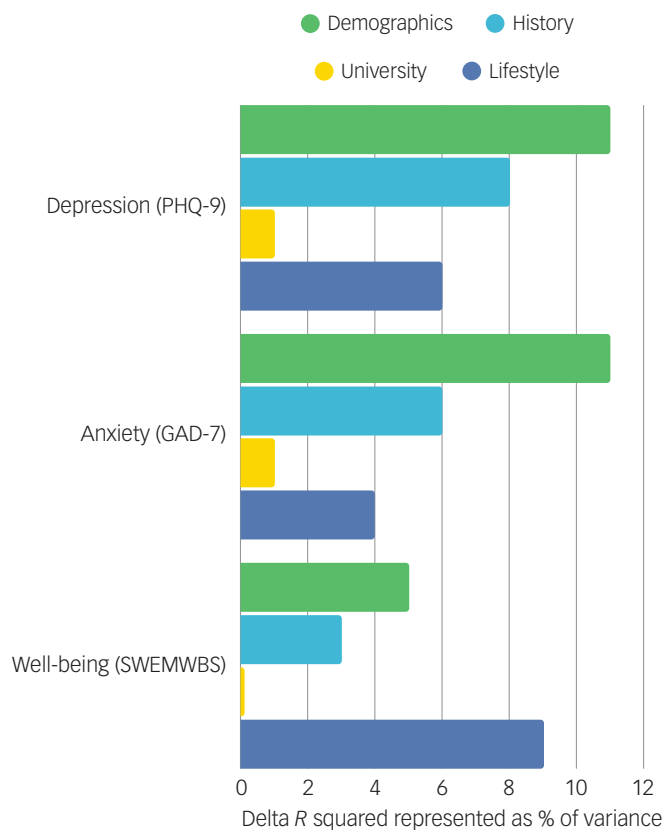


Fig. 1 Delta R^2 across models as %. PHQ-9, Patient Health Questionnaire-9; GAD-7, Generalised Anxiety Disorder-7; WEMWBS, Warwick-Edinburgh Mental Well-being Scale.

associated with lower well-being scores. Students in University E had higher well-being than those at the referent University D ($\beta = 0.393$, 95% CI [0.173–0.612], $p = 0.001$). International students reported higher well-being scores ($\beta = 0.535$, 95% CI [0.336–0.733], $p < 0.001$), and students in second year and above reported lower well-being scores ($\beta = -0.241$, 95% CI [–0.420 to –0.061], $p < 0.001$). Those studying health and welfare ($\beta = 0.310$, s.e. = 0.127, 95% CI [0.059–0.560], $p = 0.015$) had higher well-being scores, while those studying information and technology ($\beta = -0.419$, 95% CI [–0.824 to –0.015], $p = 0.043$) had lower well-being scores than those studying arts and humanities.

Higher frequencies of exercise ($\beta = 1.204$, 95% CI [1.034–1.373], $p < 0.001$) and self-care ($\beta = 2.546$, 95% CI [2.309–2.784], $p < 0.001$) were associated with higher well-being scores, and increased caffeine intake was associated with lower well-being scores ($\beta = -0.619$, 95% CI [–0.872 to –0.366], $p < 0.001$). Higher frequencies of alcohol use were associated with higher well-being scores ($\beta = 0.282$, 95% CI [0.042–0.521], $p = 0.025$). Smoking ($\beta = -0.549$, s.e. = 0.127, 95% CI [–0.802 to –0.297], $p < 0.001$) and drug use ($\beta = -0.421$, 95% CI [–0.619 to –0.222], $p < 0.001$) were associated with lower well-being scores.

Discussion

Over 25% of student participants scored above the standard cut-offs on self-report scales for anxiety and depression, comparable to findings from other student and age-matched general population surveys.^{12,24,25} A hierarchical regression analysis indicated a strong association between mental health and well-being and demographic and history variables, consistent with previous literature.^{12,24}

Additionally, there were large effect sizes indicating strong associations between both exercise and self-care and better mental health and well-being, while drug use, caffeine intake and smoking were associated with poorer mental health.

A key finding is the significant association of lifestyle factors with well-being and mental health, even after accounting for well-established predictors such as gender, disability, adverse childhood experiences and minority status.^{12,24} This has important implications for the whole-university approach, providing further support that universities should not only bolster well-being services but also consider environmental strategies to encourage general well-being. The cross-sectional nature of our study does not infer causation, and reduced engagement in exercise or self-care, or increased drug use or smoking, may in themselves be symptoms of depression and anxiety. However, other studies in the university population do show causation, indicating that even light exercise can reduce depression and anxiety.²⁶ Students want to adopt healthier behaviours but find it difficult to prioritise these without support.²⁷ Our qualitative work demonstrates that students' ability to engage in healthy lifestyle activities is shaped by environmental, financial and institutional constraints, and hence putting the onus on individuals to make these positive changes is likely to fail.¹⁰ Hence, universities should take proactive environmental measures to encourage healthy behaviours, focusing on providing accessible spaces and time within academic schedules.²⁸

When comparing models, the addition of university factors such as course of study and university provided the least explanatory power. However, being in the second year of study and above predicted poorer mental health, which has been attributed to intensification of academic pressure coupled with fewer support structures.²⁹ Given that our sample consisted of 75% first-year students, the lesser impact of university factors may be due to our sampling methods. It is worth noting that students in the second year and above will have started university during the COVID-19 pandemic, although evidence demonstrates that this had differing impacts on mental health among university students.³⁰ Those on humanities courses reported poorer mental health compared with those studying science, technology, engineering and mathematics (STEM), which has been found in other studies.³¹ Despite there being just five institutions, potentially constraining variability, there were some institutions where students consistently reported poorer mental health, and institutional variation has also been reported in the USA.³² Qualitative work conducted in Nurture-U indicates the importance of campus culture in mental health, which may explain these differences, although more exploration is needed.¹⁰

Disability had the biggest effect size of all the variables, but we did not differentiate those who declared a disability due to a mental health condition from those with other disabilities. Students are encouraged to disclose mental illness as a disability in order to access appropriate support from the outset at university, and hence may be more likely to see a mental health condition in terms of a disability than other populations.³³ However, with this caveat in mind, identifying as disabled or lesbian, gay, bisexual, transgender, queer, intersex, asexual or other (LGBTQIA+) was consistently associated with poorer mental health and well-being. These findings mirror findings in the general population and, in fact, evidence shows that the mental health of these populations is actually better for those attending university: positive university transitions with inclusive cultures and environments can provide opportunities for empowerment and freedom.³⁴ However, the extra energy taken to 'belong' can be detrimental to academic success.³⁵ A systemic approach, which does not examine the experiences of students in isolation but instead explores these in the context of other individual, peer, university and wider societal factors, is crucial for these communities.

Non-Chinese Asian students reported elevated depression and lower well-being than White students. Students from India and Pakistan are now the highest proportion of international students to the UK and USA.^{36,37} One explanation could be a lack of culturally appropriate support: barriers to belonging and institutional racism affects mental health and academic success.³⁸ It is also important to note, however, that, while we did take into account whether students were domestic or international within the regression model, we did not separate Asian international students from Asian British students. Minoritised ethnic groups who study abroad will have completely different levels of social support from those who are studying in their home country, although it has been argued that the self-selection of those who choose to study abroad may in turn mean that international students have protective emotional coping mechanisms compared with other students.³⁹ This may explain why Chinese Asian students conversely reported lower anxiety levels compared with White students in our analysis, even though previous research reports that Chinese international students cite language barriers, novel learning systems and cultural differences in recreation as causing marginalisation.⁴⁰ However, there have been studies that demonstrate that the GAD-7 may not be sensitive for detecting mild anxiety in the Chinese student population.⁴¹ The impact of cultural differences and the intersectionality of ethnicity and nationality in the university student experience requires further exploration.

There was a positive relationship between frequency of alcohol use and higher well-being and being less likely to have clinically significant anxiety symptoms. Previous research explores students' perceived benefits of alcohol consumption, including increasing social encounters and stress relief.⁴² Relative benefits of alcohol use may relate to it being used in moderation, with current students drinking less alcohol than previous generations and reporting increased understanding of the negative consequences for both physical and mental health.⁴³ However, students who chose not to drink report finding it harder to engage in university social life, creating risks for loneliness and mental health problems.⁴⁴

The consistent association between foster care on better mental health scores runs contrary to previous findings.⁴⁵ Given the small group (3%), this finding should be interpreted with caution. This may reflect a form of 'survivor bias', in that individuals who achieved attendance at competitive universities despite childhood adversity are those with strong internal resources, but this also reflects the possibility that those with a combination of care experience and mental health difficulties do not have the support in place to enrol in higher education.⁴⁶ It is worth noting that there remain high levels of withdrawal from study among care leavers, alongside barriers to inclusion through stigma.⁴⁷

Strengths and limitations

This study was the first student well-being survey using validated instruments across multiple UK institutions. The hierarchical regression models provided a robust method for comparing the impact of different factors on student mental health, but we cannot infer causation from a cross-sectional study. Future analyses will examine which factors prospectively predict changes in student mental health over time. The number of comparisons employed in the analysis increases the risk of type 1 errors, and hence additional caution should be used in interpreting the results, especially in light of unexpected findings relating to alcohol use and foster care. Participating universities were research-intensive institutions requiring higher grades to enrol, raising questions about the generalisability of findings. Including additional non-Russell Group universities may have captured a broader range of student

experiences, although our findings are consistent with findings across the wider sector.⁴⁸ It is also worth noting the potential for participation bias: those with experience of mental health difficulties may be more likely to participate in a mental health survey, as evidenced by the fact that half the sample indicated family history of mental illness. While benchmark demographic comparisons indicate that our sample was broadly representative (see Supplementary Table 3), we remain mindful of potential biases when interpreting the results.

Implications and future research

While further work needs to be done to infer the directionality of the associations, we present initial evidence that supports the importance of a whole-university approach to student mental health and well-being. The significant associations between exercise, self-care and positive mental health outcomes, particularly after accounting for demographic and family history, highlights potential key areas for universities to target policies and intervention to improve student well-being. This project also adds further evidence of the difficulties encountered by university students from marginalised groups and the need for universities to provide systemic support that actively supports those from all backgrounds. However, more longitudinal work is needed to explore what predicts the maintenance or improvement of well-being.

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Supplementary material

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Data availability statement

The data that support the findings of this study will be stored on DATAMIND TRE (<https://data.mind.org.uk/datamind-tre/>) following an embargo. More details are available from the corresponding author. Research materials are available on reasonable request. Analytic code is not publicly available due to data governance restrictions associated with sensitive mental health data held across multiple institutions. The analytic approach is described in full, and code may be available from the corresponding author on reasonable request, subject to appropriate data access agreements.

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AI disclosure statement

Microsoft Copilot (GPT-5 chat model) assisted in generating example R code templates during the data analysis planning stage. All AI-generated code was subsequently reviewed, edited and adapted by the lead author (J.D.) to ensure accuracy, correct variable mappings and

suitability for the Nurture-U data-set. No AI system contributed to the conceptualisation, interpretation of results, writing of the manuscript text or any other intellectual content.

Author contributions

J.D. and E.W. conceptualised the study. J.D., K.F.M., N.B., S.C., E.D., G.D.S., L.D., L.F., K.A.M., T.M., E.M., A.N., S.J.R., L.R., K.S. and E.W. curated the data. J.D. and K.F.M. conducted the formal analysis. E.W., A.D., N.B., S.C. and L.R. acquired the funding. J.D., K.F.M., N.B., S.C., E.D., G.D.S., L.D., L.F., K.A.M., T.M., E.M., A.N., S.J.R., L.R., K.S. and E.W. conducted the investigation. J.D., K.F.M. and E.W. developed the methodology. J.D., K.F.M., N.B., S.C., E.D., G.D.S., L.D., L.F., K.A.M., T.M., E.M., A.N., S.J.R., L.R., K.S. and E.W. administered the project. J.D., K.F.M., N.B., S.C., A.D., E.D., G.D.S., L.D., L.F., K.A.M., T.M., E.M., A.N., S.J.R., L.R., K.S. and E.W. provided resources. E.W. supervised the study. K.F.M. conducted the validation. J.D., K.F.M. and E.W. wrote the original draft. J.D., K.F.M., N.B., S.C., E.D., G.D.S., A.D., L.D., L.F., K.A.M., T.M., E.M., A.N., S.J.R., L.R., K.S., A.W. and E.W. reviewed and edited the manuscript.

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Declaration of interest

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