Prevalence of health-related behaviours and associated factors in university students in Ireland: a 4-year repeated cross-sectional study

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ABSTRACT

Background Transitioning to higher education (HE) has been highlighted as a critical time to embed positive health-related behaviours (HRBs). However, there has been a long-standing association between student life and risk-taking. This study aimed to (1) identify the prevalence of HRBs over time in cohorts of HE students in Ireland, (2) establish an overall health index and analyse the health-related status of HE students and associated factors based on this index and (3) explore student perspectives towards public health interventions.

Methods Using an anonymous, repeated measures, cross-sectional study design, 4 years of data were gathered and analysed from a student sample (N (final)=3221). A series of Pearson's χ^2, t-tests and one-way analysis of variance tests followed by linear regression analysis were performed to determine the individual and combined associations between participant characteristics and health scores.

Results There were notable unfavourable patterns over time in all HRBs, except tobacco use, which indicated a declining trend. Factors associated with lower health index scores included identifying as female, living at home, higher socioeconomic status, studying in the arts humanities and social sciences field and having a higher body mass index. Most students reported they would avail of an intervention on drug use (78.1%, 95% CI 0.77% to 0.80%), alcohol consumption (75.7%, 95% CI 0.74% to 0.77%), tobacco use (67.3%, 95% CI 0.66% to 0.69%) and mental health (65.4%, 95% CI 0.64% to 0.67%) if they felt that they needed to.

Conclusions This study demonstrates a clear rationale for providing health-enhancing behavioural interventions for students in HE settings. Outcomes may be of interest to educationalists, policy-makers and health-promotion experts.

BACKGROUND

Non-communicable diseases (NCDs) including cardiovascular and respiratory diseases, certain cancers and diabetes account for 74% of all deaths globally and are the leading cause of premature morbidity and

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Transitioning to higher education (HE) is critical for establishing health-related behaviours (HRBs) but is often associated with increased risk-taking among students.
⇒ There is a need to determine the evolving status of HRBs in HE students to assist in identifying suitable interventions.

WHAT THIS STUDY ADDS

⇒ This study has outlined worsening trends in HRBs among HE students in Ireland; however, it has shown that many students are open to engaging in health interventions.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Findings support the need for targeted health interventions in HE settings which may guide policy-makers and health-promotion experts in improving the health of students.

mortality.[1] The risk of development of most NCDs is augmented by five key predisposing lifestyle-related factors which encompass physical inactivity, tobacco use, hazardous alcohol consumption, poor nutrition and environmental surroundings.[1] The co-occurrence of such factors has been highlighted to exacerbate the probability of developing an NCD.[2] Awareness of the prevalence of these risk factors can assist in informing targeted interventions and in turn, optimise overall health and well-being.[3]

Transitioning from second level to higher education (HE) is a time where a multitude of challenges including unmet prearrival expectations, shifts in boundaries and novel mechanisms of living and learning are experienced.[4] Accompanying this considerable psychological navigation, students have been found to struggle with adopting patterns of

healthy lifestyle behaviours thus elevating risks of NCD burden.[5] For example, in Ireland, it has been emphasised that 27% of male and 41% of female students fail to meet the nationally recognised physical activity guidelines.[6] Over half of both male and female students have reported previous incidents of engaging in hazardous alcohol consumption, while one-in-four students reported occasional or regular tobacco use.[7]

In a nationwide HE survey, over half of students reported previous use or current use of illicit drugs while over 1 in 20 reported a previous alcohol or drug problem.[8] Regarding nutritional intake, a cross-sectional study highlighted that 79% of students reported that they fail to meet the Irish recommended daily allowance of five fruit and vegetables.[9] The effect of transport choices on air pollution has also been highlighted as problematic with females, part-time students and students with permanent addresses reported as less likely to use active transport methods in the UK and Ireland.[10] Additionally, it is not uncommon for HE students in Ireland to experience mental health difficulties.[11]

Available evidence has illustrated demographic differences in terms of student's engagement in risky health-related behaviours (HRBs). A higher proportion of females are documented as physically inactive compared with males.[12] While hazardous alcohol consumption has been reported more frequently in males, less females reported themselves as non-drinkers.[13 14] Significant differences across courses have also been encountered with undergraduate students having a higher risk of making poor lifestyle behaviour choices.[14] In addition, students characterised as more financially deprived and living with roommates have been indicated as more prone to risky HRBs.[15]

While extensive research has been conducted, a recent umbrella review highlighted several research gaps which include the under-representation in European countries and in students in non-health-related academic disciplines.[5] The outbreak of the SARS-CoV-2 and the corresponding governmentally imposed COVID-19 pandemic-related restrictions has had a significant impact on the health and well-being of individuals internationally and in Ireland. Uniquely, HE students were confronted with many challenges and uncertainties both at an HE and governmental level.

Findings vary in terms of the impact of the recent pandemic and the imposed spatial distancing on the HRBs of HE students. Some studies have found no major lifestyle changes in students during the pandemic.[16] However, other studies have found unfavourable changes such as reduced physical movement and poorer sleep quality.[17 18] While a small number of studies in Ireland have been conducted in relation to students during the COVID-19 pandemic, it has been asserted that the long-term effects of the pandemic and its associated restrictions on the overall health of students remain largely unknown.[19]

To identify the aggregated HRB patterns of students in Ireland, we established an overall health index score based on the five modifiable health behaviours that directly contribute to NCD risk.[1] This scoring system was based on previous scoring systems.[20 21] However, it was adapted to more closely align with the WHO risk factors and to HE settings. Hence, our objectives are as follows: (1) determine the prevalence of HRBs and associated factors in HE students before, during and after the COVID-19 pandemic; (2) establish a health index and assess the health-related status of students based on this index and (3) identify student preferences to guide future initiatives for positive behavioural change.

METHODS
Study setting
A healthy university campus initiative (Healthy University of Limerick (UL)) was launched in 2018 in response to, and aligning with, the government's Healthy Ireland Framework.[22] It was a leading ambition of UL to advocate for health and well-being to support its 16000 students. The methods and results outlined in this paper discuss a subset of the questions from the first 4 years of the survey which were distributed in the 2019/2020, 2020/2021, 2021/2022 and 2022/2023 academic years. The checklist for strengthening the reporting of cross-sectional studies was used (see online supplemental appendix A).

Recruitment and sampling
All registered students were eligible to participate. To optimise representativeness, undergraduates, postgraduates, Erasmus and study-abroad students were included. Participants were excluded if they were <18 years or if they did not complete at least one of the primary outcome variables of interest (ie, at least 37% of the survey). The principal data collection method for the survey was face to face in classrooms by providing an electronically developed questionnaire which was generated on Qualtrics survey software (Qualtrics, Provo, Utah, USA). The research team initially contacted course directors and identified the largest cohorts of students. The purpose of this was to minimise data collection, minimise classroom interference and avoid the possibility of participant duplication. When large cohorts were identified, module leaders were contacted to request permission to access their class group either before or after a lecture. Following 4 weeks of in-person data collection and to avoid the potential of selection bias, the survey was distributed to all students via email and was advertised on the social media platforms associated with the university. The survey was open for completion for the remainder of the autumn semester for each annual iteration.

As a result of COVID-19 pandemic-related restrictions, student participant recruitment in 2020 and 2021 was conducted exclusively online for the semester. Participation was anonymous and voluntary with no course credit awarded. The opportunity to enter a raffle on

survey completion was arranged. The survey duration was approximately 20 min.

Survey instrument

Demographic questions

Demographic information included age, gender, field of study and location of residence. Other demographic factors included socioeconomic status (SES) which was adapted from a pre-existing survey and measured by income of family household.[23] These categories were collapsed into 'lower SES' (below €35 000), 'middle SES' (€35 000–€70 000) and 'upper SES' (above €70 001). Age was dichotomised to 'below 25 years' and '25 years or above'. Self-reported weight and height were used to calculate body mass index (BMI) {weight (kg)÷(height^2(m^2)} whereby participants were categorised into 'underweight' (<18.5), 'normal weight' (18.5≤BMI<25), 'overweight' (25≤BMI<30) and 'obese' (≥30) based on WHO reference guidelines.[24]

Mental health

Participants' mental health was measured using the Mental Health Inventory (MHI-5) from the 36-item short form survey (SF-36) questionnaire.[25] The MHI-5 has five items on a 5-point scale indicating mental health in the past month. Following scoring guidelines, participant totals were multiplied by four and an MHI score was calculated. Scores equal to or below 52/100 were indicated as probable mental health problem (poor) and above 52/100 were indicated as having positive (good) mental health and well-being.[26] The MHI-5 has been cited as having high specificity and sensitivity in detecting anxiety and depression disorders in general populations.[27]

Physical activity

Physical activity was measured using the international physical activity questionnaire short form, with minor modifications in the 2022 survey iteration.[28] Based on a standard scoring protocol, physical activity levels were categorised as 'low', 'moderate' and 'high' with only 'high' meet requirements.[28 29] The instrument has been reported as reliable and valid in measuring physical activity in adults.[28]

Alcohol and smoking

Alcohol and smoking status were measured using items adapted from the Euro student survey, which is designed for comparisons of HE institutes.[23] Participants selected the average units of alcohol consumed from '1–10+'. Do you smoke was a single item with response options 'no', 'yes, but stopped' and 'yes and still do'. Recreational drug use was measured using a single item measure with response options 'no', 'yes, but stopped' and 'yes, and still do' and 'prefer not to say'.

Healthy eating

Diet-related behaviours were assessed using items derived from the survey of lifestyle, attitudes and nutrition, American College Health Association National College Health Assessment.[30] Participants reported their typical three main meals from an extensive drop-down menu (eg, fruit, soup and cheese). Safe food national guidelines were used to determine if students ate healthily.[31] These guidelines were chosen as opposed to the are specific to the food needs and national policies of Ireland. Scores ranged from 0 to 5, where 5 indicated adherence to all guidelines. Daily guidelines included (1) five or more portions of fruit/vegetables, three or more portions of carbohydrates, three or more portions of dairy, two or more portions of protein or alternatives and one or less portions of high fat/sugar/salt/ultraprocessed foods.

Sleep

Perceived sleep quality in the last month was measured using an item from Pittsburgh Sleep Quality Index (PSQI[32]). Responses were on a 5-point Likert scale whereby 'very good' and 'good' were collapsed into 'good' while 'average', 'poor' and 'very poor' were collapsed into 'poor'. The PSQI is recognised as an adequately reliable and valid tool for use in HE settings.[33] Self-reported physical and mental health were assessed using two items extracted from the short-form health survey where responses were similarly categorised as 'good' and 'poor'.[25]

Additional questions

To understand reasons for non-participation in sport or physical activity, two questions were drawn from the Sports Northern Ireland Physical Activity Survey.[34] Participants selected a response of (1) Nothing could encourage me to participate in sports or physical activity or (2) I could be encouraged to participate in sport or physical activity. Willingness to avail of public health interventions in various health domains was assessed with binary 'yes' or 'no' responses, followed by preferences of location 'on UL campus' or 'off UL campus'. Interest in learning about mental health and well-being was measured on a 5-point Likert scale from 'strongly agree' to 'strongly disagree'. Perspectives on healthy food availability on campus were measured on a 5-point Likert scale from 'strongly agree' to 'strongly disagree' while skipping meals in the last month due to financial constraints was measured on a 4-point scale with response items ranging from 'yes, almost every day' to 'no'.

Statistical analysis

To quantify the collective impact of key health behaviours on risks of NCD development (1) smoking status, alcohol consumption, nutrition, physical activity and sustainable mobility were merged to create a student healthy index score (HI-5 score). 'Higher-risk' and 'lower-risk' behaviours (assigned 0 and 1, respectively) were determined a priori based on associated national and internationally recognised guidelines. Smoking categorisation followed a previous Irish study where previous/current smokers were considered higher risk and never smoked were considered lower risk.[6] Higher-risk alcohol consumption

aligned with HSE guidelines and previous Irish studied defined as ≥60 grams of ethanol (or ≥6 standard units) on a single occasion.[35] Healthy eating scoring aligned with healthy eating guidelines.[31] Categories were collapsed into higher risk (<2 met) and lower risk (≥3 met). Sustainable mobility scores aligned with the National Sustainable Mobility Policy whereby walking, cycling or using public transport were assigned less risky. Following WHO guidelines, high physical activity levels were considered lower risk and both low and moderate levels were considered higher risk.[36]

Data were analysed by using IBM SPSS V.29.0 (IBM) and Jamovi statistical software project (V.2.4.11). Due to the over-representation of the female gender and an unbalanced representation across academic disciplines, poststratification weights were applied for gender and faculty. The weighted values were applied during all stages of analysis. Descriptive statistics were calculated, and Pearson's χ^2 tests were used to investigate if factors were associated with health behaviour engagement. Participants were assigned an HI-5 score and one-way analysis of variance (ANOVA) and t-tests were conducted to identify group differences.

Multiple linear regression was used to decipher the determinants of adhering to a healthy lifestyle. Initial independent variables included gender, SES, location of residence, employment status, faculty of study, year of completion, restricted movement. BMI, self-reported sleep and MHI index scores were also included as covariates which were decided a priori and informed by prior literature. Only the independent variables that demonstrated statistically significant values in the initial model were included in the final model.

RESULTS

Poststratification weights restored the imbalanced representations of students and accounted for varying response rates across iterations. The final sample comprised 3221 participants (2019: N=1004, 2020: N=697, 2021: N=504, 2022: N=1016). Response rates from years 1 to 4 were 5.9%, 4.0%, 2.8% and 5.6%, respectively. Age ranged from 18 to 74 years (M=21.7 years). There was no statistically significant difference in age (t (4876)=0.553, p=0.609, 95% CI 21.91 to 21.94) or gender (χ^2=8.989 (4), p=0.061) between included and excluded participants.

The sociodemographic characteristics of the final sample by gender are displayed in table 1. Most participants were undergraduates (89.3%) and under 25 years (86.6%). Over half (61.6%) lived away from home. The majority reported a middle-class SES (household income of €35 000–€70 000) while 62.1% were employed. Long-term illness and/or disability were reported in 7.7% of participants while 67.7% were a healthy weight. Faculty significantly differed between genders (p<0.001) where more males were in science and engineering-related courses (41.2%) compared with females (25.7%). Good self-rated physical and mental health was reported in

57.1% and 33.5% of individuals, respectively. For further weighted and unweighted demographics on isolated years, see online supplemental appendix B.

Frequency of health behaviours
Key health behaviours
Frequent hazardous alcohol consumption was reported in 44.8% of students across the 4 years, with significant differences across survey completion years (p<0.001) ranging from 2019 (38.2%) to 2022 (50.5%). Risky alcohol consumption was reported as highest in participants with higher SES (53.6%), living away from home (46.7%) and part-time employed (49.7%). No significant differences were found in the proportions across gender, faculty, course or perceived health.

Failing to meet national physical activity guidelines was found in 44.8% of the participants across the 4 years with highest physical inactivity reported in 2022 (51.8%) and lowest in 2019 (36.6%). Physical inactivity was found to be more frequent in females (49.5%) and postgraduates (55.5%) compared with their male and undergraduate counterparts. Participants studying arts, humanities and social sciences reported highest levels of physical inactivity (55.0%) compared with other areas of study. Unhealthy eating patterns were reported in 80% of participants with highest rates in 2022 (91.8%) and lowest in 2020 (70.1%). Unhealthy eating patterns were more prevalent among females, individuals living away from home (81.2%) and undergraduate students (80.6%).

Significant associations were found across faculties with individuals studying arts, humanities or social sciences reporting the least healthy eating patterns (83.8%). No significant differences in the proportions were found across SES, employment status or perceived health. Unsustainable transportation usage was reported in 33.8% of participants overall with highest levels reported in 2020 (45.3%) and lowest levels in 2019 (28.9%). A significantly greater proportion of participants who lived in their family home (60.6%), in postgraduate degrees (40%) and of higher perceived physical health (35.7%), opted for unsustainable mobility. This risky behaviour was also higher in those of higher SES (39.2%) and in full-time employment (67.4%).

Current/previous smoking was reported in 15.6% of individuals across the 4 years with rates highest in 2021 (21.1%) and lowest in 2022 (12.0%). Results from Pearson's χ^2 tests indicated that individuals of lower SES, in full-time employment and with poorer self-reported mental and physical health were more likely to smoke. No statistically significant differences in the proportions of participants smoking were found across gender, residence location, course or faculty of study.

Additional health behaviours
Lifetime use of unprescribed/recreational drugs was reported in approximately a quarter of students (24.5%) across the study. There was a statistically significant difference across years in relation to drug use (p=0.011).

Table 1 Demographic characteristics of participants (weighted)

Variables	Total N (%)	Male (%)	Female (%)	χ^2
Categories	**N=3221**	**1593 (49.5%)**	**1628 (50.5%)**	**P value**
SES (missing N=1210)				
Lower (<35 000)	578 (28.7)	267 (26.9)	311 (30.5)	
Midde (35 000–70 000)	865 (43.0)	442 (44.5)	423 (41.5)	
Higher (+70 000)	568 (28.3)	283 (28.5)	285 (28.0)	0.182
Residence (missing N=687)				
At family home	972 (38.4)	474 (38.0)	498 (38.8)	
Away from family home	1561 (61.6)	774 (62.0)	787 (61.2)	0.689
Employment status (missing N=552)				
Full time	229 (8.6)	116 (8.8)	113 (6.9)	
Part time	1429 (53.5)	718 (54.8)	711 (52.3)	
Unemployed	1012 (37.9)	477 (36.4)	535 (39.4)	0.281
Faculty				
Arts, humanities, social sciences	761 (23.6)	323 (20.8)	438 (26.9)	
Education and health sciences	711 (22.1)	317 (19.9)	394 (24.2)	
Business	674 (20.9)	296 (18.6)	378 (23.2)	
Science and engineering	1075 (33.4)	656 (41.2)	419 (25.7)	<0.001*
Course (missing N=4)				
Undergraduate	2872 (89.3)	1436 (90.4)	1436 (88.2)	
Postgraduate	344 (10.7)	153 (9.6)	191 (11.8)	0.053
Perceived physical health (missing N=374)				
Poor	1222 (42.9)	583 (41.7)	639 (44.2)	
Good	1624 (57.1)	817 (58.3)	807 (55.8)	0.170
Perceived mental health (missing N=378)				
Poor	1891 (66.5)	933 (66.7)	958 (66.3)	
Good	952 (33.5)	465 (33.3)	487 (33.7)	0.803
BMI				
Underweight	166 (6.7)	75 (6.1)	91 (7.3)	
Healthy weight	1682 (67.7)	838 (68.3)	844 (67.2)	
Overweight	547 (22.0)	270 (22.0)	278 (22.1)	
Obese	89 (3.6)	46 (3.7)	44 (3.5)	0.703
Age				
18–24	2768 (86.6)	1373 (86.9)	1395 (86.2)	
25+	430 (13.4)	206 (13.1)	224 (13.8)	0.513
Long-term illness/disability				
Yes	249 (7.7)	130 (8.2)	119 (7.3)	
No	2971 (92.3)	1462 (91.8)	1509 (92.7)	0.363

*Significance p<0.05.
BMI, body mass index; SES, socioeconomic status.

Previous and/or current illicit drug use was reported as lowest in 2019 (22.9%) and highest in 2021 (31.0%). Statistically significant differences were also found between drug use and location of residence (p=0.009), levels of SES (p=0.020) and employment status (p=0.006). Students living away from home (27.4%), of higher SES (31.2%) and working full-time (28.2%), demonstrated highest levels of drug use compared with students at home, of middle/lower SES and working part time/not at all. Overall, the mean mental health score of participants was 66.8 (SD±15.49). Based on the cut-off point of ≤52, a total of 632 (22.3%) participants were classified as having a 'probable mental health problem'.

Significant differences in mental health were found across survey iteration years (p<0.001), location of residence (p=0.021), age (p=0.011), SES (p<0.001) and course of study (p=0.033). Poor mental health scores were most frequent among those who completed the survey during 2020 (27.4%), lived at home (25.2%), over the age of 25 (27.5%), were of lower SES (27.3%) and pursuing postgraduate studies (27.1%). A total of 31.9% demonstrated that they perceived their sleep quality in the last month was poor. Rates of bad sleep were highest in 2022 (35.1%) and lowest in 2019 (29.2%) although differences across years did not reach statistical significance (p=0.061). Significant differences were found across employment status with full-time workers indicating the poorest sleep (38.6%) compared with part time workers (29.6%) and non-workers (35.0%). The frequency of risky HRBs each year and associated characteristics are displayed in online supplemental appendix C tables 1 and 2.

Distribution of health index scores and associated characteristics

HI-5 scores were assigned to participants based on their adherence to each of the five health behaviours where 0 indicated no healthy behaviours and 5 indicated all five health behaviours were adhered to (see table 2). The most frequent score overall was 3.0 (M=2.5, SD±1.1, 95% CI 2.50 to 2.58) with lowest scores reported in 2021 (M=2.4, SD=±1.1, 95% CI 2.23 to 2.48) and highest in 2019 (M=2.8, SD±1.1, 95% CI 2.72 to 2.86). Altogether 103 (3.2%, 95% CI 0.01% to 0.05%) participants had all five healthy behaviours while 94 (2.9%, 95% CI 0.01% to 0.05%) had none of them.

A series of independent sample t-tests and one-way ANOVA tests were conducted to determine if significant differences existed between participant characteristics and HI-5 scores (see online supplemental appendix D table 1). The mean HI-5 scores for males (M=2.61, SD±1.13) was significantly higher than females (M=2.47, SD±1.09; p<0.001, g=0.131) and for undergraduate students (M=2.55, SD±1.12) than postgraduates (M=2.44, SD±1.05; p=0.04, g=0.098). Regarding location of residence, individuals living away from home indicated statistically significantly higher scores (M=2.81, SD±1.02) compared with those living in their family home (M=2.48, SD±1.02; p<0.001; g=0.021).

Predictors of HI-5 scores

For the linear regression analysis, only participants with no missing values across the five health domains were included. The independence of errors assumption was assessed using the Durbin-Watson test which yielded a statistic of 1.93 (p=0.102) indicating no significant autocorrelation in the residuals. Multicollinearity was assessed using variance inflation factors (VIFs) and tolerance values. The highest VIF was 1.02 with a corresponding tolerance value of 0.982. The assumption of homoscedasticity was deemed to be met based on inspection of a plot of the standardised residuals against the predicted values and normality of residuals was assessed using the Shapiro-Wilk test and a Q-Q plot. There were no significant deviations from normality (W=0.98, p=0.24) while the Q-Q plot demonstrated that residuals closely followed a diagonal line. Thus, all assumptions were satisfied supporting the validity of a regression analysis.

The linear regression model had an adjusted R^2 value of 0.066, accounting for 6.6% of the variance in HI-5 scores. For further details on the model, see table 3 and online supplemental appendix D.

Table 2 Percentage of participants engaging in healthy lifestyle behaviours and associations with year

HI-5 scores	Frequency (%)	χ^2
Frequency (%)	N=3221	P value
0 HBs	94 (2.9)	
2019	17 (1.7)	
2020	23 (3.3)	
2021	21 (4.1)	
2022	33 (3.3)	0.032*
1 HB	467 (14.5)	
2019	109 (10.8)	
2020	120 (17.2)	
2021	79 (15.6)	
2022	160 (15.7)	<0.001*
2 HBs	996 (30.9)	
2019	268 (26.7)	
2020	228 (32.7)	
2021	179 (35.5)	
2022	321 (31.6)	0.002*
3 HBs	1031 (32.0)	
2019	340 (33.9)	
2020	192 (27.6)	
2021	148 (29.4)	
2022	350 (34.5)	0.007*
4 HBs	529 (16.4)	
2019	212 (21.1)	
2020	110 (15.8)	
2021	67 (13.3)	
2022	140 (13.8)	<0.001*
5 HBs	103 (3.2)	
2019	57 (5.7)	
2020	24 (3.4)	
2021	10 (2.1)	
2022	11 (1.1)	<0.001*

*Significance p<0.05.

Table 3 Multiple linear regression with HI-5 scores as the DV

Predictor variable	Standardised β	P value	95% CI
Gender			−0.27, 0.09
Female–male	0.1763	<0.001*	
Location of residence			
Lives away—lives at home	0.2691	<0.001*	0.16, 0.34
Employment status			
Works part-time—works full time	0.1265	0.103	−0.22, 0.10
Unemployed—works full time	0.3293	<0.001*	−0.10, 0.24
Year of completion			
2020–2019	−0.0822	0.137	−0.20, 0.06
2021–2019	−0.1528	0.014*	−0.35, 0.08
2022–2019	−0.1843	<0.001*	−0.35, 0.12
BMI (continuous)	−0.0942	<0.001*	−0.11, 0.03
Faculty			
Business—arts and humanities	0.1863	0.002*	0.10, 0.36
Education and health—arts and humanities	0.2535	<0.001*	0.20, 0.46
Science and engineering—arts and humanities	0.1789	<0.001	0.09, 0.33

*Significance p<0.05.
BMI, body mass index; DV, dependent variable.

Student perspectives and preferences towards health interventions

Overall, over three-in-four participants communicated that they would avail of an intervention if they felt they had a problem relating to drug use (78.1%, 95% CI 0.77% to 0.80%), and/or alcohol consumption (75.7%, 95% CI 0.74% to 0.77%) and over two-thirds reported that they would avail of an intervention around tobacco use (67.3%, 95% CI 0.66% to 0.69%). More students reported a preference for a related intervention off the university campus (62.1%) compared with on-campus (37.9%). When prompted with the statement '*I would be interested in learning more about practices to maintain and develop my mental health and wellbeing*', almost two-thirds agreed that they would be interested (65.4%, 95% CI 0.64% to 0.67%). The majority (69.8%, 95% CI 0.67% to 0.71%) highlighted that they would prefer to attend a mental health and/or well-being intervention on the university campus over off campus (30.2%, 95% CI 0.29% to 0.33%).

Of the participants who reported that they did not currently engage in regular sports or physical activity, almost all reported that they could be encouraged to participate (92.4%, 95% CI 0.91% to 0.94%). Regarding patterns of healthy eating, over one-third of participants reported that at least once a month they skip or cut their meals due to financial circumstances (34%, 95% CI 3.41% to 3.47%) while almost the same number (30.7%, 95% CI 2.78% to 2.86%) reported that they felt healthy food was not readily available in the university food outlets. No significant differences were found between males and females across any of the questions relating to health intervention preferences and perspectives (see online supplemental appendix E table 1).

DISCUSSION

There are currently over 255 000 students enrolled in HE institutes in the Ireland, with this number increasing by 22% in the last decade.[37] By examining the current health status and behaviours of HE students, targeted interventions can be informed for a significant proportion of the population. The University of Limerick endeavours to integrate health and well-being into all aspects of the university community in accordance with the Irish Higher Education Authority's healthy campus charter which is supported by Healthy Ireland.[38] Therefore, the primary objective of the current study was to ascertain the prevalence of HRBs and associated factors in university students over time.

The main finding of this study was that almost all students (97%) could improve on at least one HRB. We identified that gender, location of residence, employment status, BMI, year of completion and faculty were predictors of overall HI-5 scores. Although not directly comparable, previous studies have investigated the frequency of risky HRBs and associated demographic characteristics.[7,39] Aligning with the Student Activity and Sport Study Ireland (SASSI), 44% of students failed to meet physical activity guidelines. These studies also found males more likely to be active than females.[7,39] The mirroring of results from almost a decade prior suggests that future research is warranted regarding the efficacy of currently implemented policies and strategies in targeting the root

cause of physical inactivity. While recent modifications have been made to national physical activity guidelines, data collected for this survey were prior to this launch.[40]

Regarding changes over time, from prior to the onset of the COVID-19 pandemic, to after the lifting of the related restrictions, there were notable unfavourable patterns in all HRBs except tobacco usage, which indicated a declining trend. Similarly, young people in China were found to adopt more unhealthy eating habits, increase their alcohol and fat intake, increase their sedentary time and reduce their physical activity and sleep quality during the pandemic.[41] A longitudinal study conducted in Germany identified that the COVID-19 pandemic may have been influential to the means in which HRBs were carried out.[42] The limited opportunities for collaborative activities and more challenges with fulfilling their personal health expectations were described as likely influential factors towards engaging in healthy lifestyles.[42] This indicates that these unfavourable lifestyle patterns are not just localised but a global concern.

While higher prevalence of previous and current illicit drug use was found in the current study compared with the SASSI (24.5% vs 19.3%), lower prevalence of smoking behaviour (15.6% vs 19.0%) was reported.[39] However, drug use and smoking were lower than national averages reported in the Drug Use in Higher Education in Ireland study (55.3%) and in the Healthy Ireland survey (18%), respectively.[8 43] The variation in smoking behaviours could be partially explained by the recent implementation of smoke-free policy at the university.[44] This policy continually communicates to staff, students and visitors that the campus is smoking and vaping-free encouraging a healthier environment for all.

In the present study, only 20% met three of the five Safe Food meal composition recommendations.[31] There has been a long-established surveillance of eating habits among the Irish population.[30] The Survey on Lifestyle and Attitudes to Nutrition[30] reported that 86% of individuals ate more than 3 servings of high-fat, sugar and/or salty foods daily, 65% reported eating five servings of fruit and vegetables, 39% met protein guidelines, 20% met recommended daily intake and 26% met the recommended carbohydrate proportions daily.[30]

In terms of mental health, our study found that 22.3% of students were at risk of mental health problems, similar to 24% identified among 18–24 years in the Healthy Ireland study.[43] While the Healthy Ireland study found males more likely to smoke and slightly more likely to binge drink compared with females, no significant gender differences were found in the current study.[40] A previous systematic review in Ireland and the UK found that alcohol patterns between male and female HE students are converging, which may explain the findings of the current study.[14]

BMI was a predictor of overall health scores, whereby an increase in BMI was associated with a decrease in an HI-5 score. The mean BMI in the current study was 23.1 kg/m² with one in four (25.6%) classified as overweight/

obese. This was higher than previously reported global ranges with 22% reporting overweight/obese,[45] but lower than previous measurements on HE students in Ireland (28%).[39] The WHO continually emphasises the promotion and support of healthy lifestyle behaviours in the prevention of overweight and obesity.[24] There is an established association between entering first year in HE and weight gain with a meta-analysis identifying that almost two-thirds of students gain weight in their first year.[46]

In the current study, it was identified that people living away from home had significantly greater HI-5 scores then those at home. However, alcohol consumption and poor diets were more prevalent in students away from home, they were far more likely to use sustainable mobility (83%) on their commute to university compared with students at home (39.4%).

Researchers have found that students living away from home are more prone to engaging in risky HRBs.[47] A previous case-study analysis found that students with separate term-time and home addresses typically opt for more sustainable modes of transport or often select accommodation that makes sustainable mobility more feasible.[10] However, typically Ireland was reported to have less student accommodation compared with the UK, making it unfeasible to live near university thereby increasing emissions.[10] This may be something to consider in future interventions designed to promote overall physical activity mobility in students. Additionally, the location of residents of students across the COVID-19 pandemic-related restrictions was less divided than non-pandemic norms which may explain differing results.[42]

In the current study, the lower health scores among females may have been attributable to the widespread fear of COVID-19, which could have influenced HRBs and outcomes differently between genders. A systematic review of the impact of COVID-19 and the global restrictions outlined the physical, mental, social and economic strains of the pandemic identifying that the pooled fear of COVID-19 was greater in women.[48]

Contextual differences such as rates of virus contraction, medical facilities and governmental measures may have created different environments across populations.[48] This may explain that while some researchers have highlighted no substantial changes in the HRBs of students during the pandemic, others, including the current study, have identified unfavourable changes in multiple health-related domains.[16 18 19 49]

A key strength of this study is its repeated measures design and its use of multiple validated and reliable tools. This has allowed us to determine the overall HRBs of student cohorts across four academic years. This study also did not limit recruitment to specific academic disciplines. The inclusion of both students from health-related and non-health-related academic disciplines provided the ability to compare across fields while paying attention to students attending, HE in Ireland, an area of research that has previously been scarce. Furthermore, the design of this study has bridged a gap by increasing

our knowledge of the potential long-term effects of the COVID-19 pandemic on students' health and well-being. Improving HRBs and addressing lifestyle-related risk factors of health are core to Healthy Ireland's efforts towards NCD prevention.[43]

The HI-5 scoring established in this paper, while stemming from previous index scoring systems, was novel in considering university students and the five main lifestyle factors that contribute to the risk of NCD development.[1] While this score does not indicate causal links, it is a step towards standardising scoring across health behaviours and gives a guide towards the overall health of university students. It can also be assistive in determining large-scale changes over time in multitudinous cohorts of university students.

The outcomes of this study should be considered in the light of some limitations. Due to the repeated cross-sectional design, it is not possible to ascertain if associations were causal. Response rates were relatively low each year, while most participants identified as female. Despite efforts to balance the sample distribution via poststratification weights, the generalisability of our findings may be hindered. Furthermore, two of our surveys were launched at the height of the COVID-19 pandemic-related restrictions in Ireland. While the impact of the pandemic restrictions has been considered in our analysis, the level of restrictions differed across countries. Hence, generalising our findings to other countries presents challenges. It should also be acknowledged that a difference in a question in the fourth survey iteration may have led to a potential minor under-representation of physical activity levels in some participants (<20).

CONCLUSION

To conclude, it is evident that university settings are crucial locations for implementing health-promoting interventions and strategies. Although some students meet health-related guidelines in a variety of health domains, the vast majority fail to comply with at least one behaviour. While some characteristics were associated with worse adherence to a healthy lifestyle, results have indicated that a whole systems approach may be beneficial in comparison to targeting a specific group. From this study, most students would be interested in learning about their mental health and well-being and attending an addiction-related intervention if they felt they had a problem. Preferences towards on-campus and off-campus interventions differed across health behaviours thus suggesting an important factor when designing interventions in optimising adherence and prospects. While this study had some limitations, results may be of interest to policy-makers, educationalists and researchers in assisting to optimise the overall health and well-being of students and reducing the NCD burden.

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