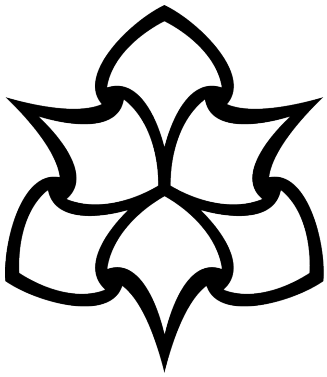

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Exploring potentials of an international, inter-university student health surveillance tool: Findings from "SuSy"

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Abstract

Background: University students are particularly susceptible to engage in health-risk behaviours. Among those, Public Health students represent a most vulnerable, yet poorly studied group, as their behaviour influences not only their academic performance but also their proactive role in health promotion in later work life. This research presents the results of a cross-university comparison of Public Health students' health behaviours.

Methods: A students' health behaviour surveillance system (SuSy) has been implemented in Hamburg and Manchester in 2014 and 2016. Trends and associations of six behaviours (fruit and vegetable intake, physical activity, stress perception, alcohol, tobacco and cannabis consumption) comparing both universities via cross-sectional assessment were analysed using descriptive statistics and multivariate regression analysis.

Results: After eight elicitations (n= 1366), an increasing trend in physical activity, but constant low intake of fruit and vegetable was observed among Hamburg students, as well as a decrease in tobacco smoking but increase in cannabis consumption. In comparison, Manchester students seem to smoke more (OR = 3.77, 95%CI 1.85-7.68), are less physically active (OR = 0.36, 95%CI 0.19-0.68), and more likely to engage in excessive alcohol consumption (OR = 5.08, 95%CI 2.34-11.01). In contrast, they tend to eat more fruit and vegetables per day (OR = 1.61, 95%CI 1.08-2.39) and consume less cannabis (OR = 0.29, 95%CI 0.15-0.61).

Conclusion: SuSy allows the provision of valuable, comparable information about students' health behaviours, following the example of Public Health students. These findings underline SuSy's potential in monitoring behavioural trends using cross-sectional and longitudinal designs.

Keywords
Health surveillance, Health Sciences, university students, health behaviour, surveillance systems

Introduction

Whilst university students are considered to be healthy or even privileged, there is an increasing trend in their health risk-behaviours like smoking, alcohol consumption, unhealthy diet, and drug use, which, among others, may affect students' physical and mental health in the long term [1,2]. Public Health and medical students represent a particularly vulnerable, yet poorly represented group, important as their health-related behaviour influences not only their academic performance but also their coping abilities in later work life [3,4]. Studies found that these students, albeit equipped with better health knowledge, show a greater risk of mental health problems and tend to exhibit health-risk behaviours to cope with higher levels of stress, insomnia or lacking social support compared to other students or their non-student peers [4–8]. However, data about this group are scarce with mostly cross-sectional rather than longitudinal investigations carried out in Europe, largely neglecting Public Health and Health Sciences students [9–13].

All this demands increased efforts to understand more about the health-related behaviour of this population in order to promote healthy lifestyles. Adequate tools to assess and evaluate students' health needs and exposure to health risks are the main prerequisite to create a healthy environment [14]. In 1998, the World Health Organization (WHO) pioneered one of the first frameworks of health-promoting universities aiming to enhance the contribution of universities to improve and maintain the health and wellbeing of student populations [15]. Today, evidence shows that this transitional period is an appropriate time to evaluate and address adolescents' health behaviours and health beliefs as these persist into later life having strong implications for future disease burden, and shaping professional work attitudes. However, international research shows that in most university settings accurate health data around risk factors in students, particularly health students, are lacking, whilst at the same time there is a pressing need for effective health prevention and promotion programmes [3–5,8,16]. Therefore, in future, longitudinal research monitoring students' health and health behaviours is necessary to gain valuable information for the design, implementation, and evaluation of effective university health promotion practices and policies [9,17,18].

The primary goal of this article is to present findings from a long-term health surveillance system of Health Sciences students (SuSy) from Germany and England with an intra- and inter-university comparison of trends of the most critical health-promoting and health-risk behaviours over time. Therefore, the authors' first aim was to describe the prevalence and temporal variations of health-promoting habits as well as health-risk factors and behaviours among Health Sciences students enrolled at Hamburg University of Applied Sciences (HAW-Hamburg) from 2014 to 2018. The second aim was to explore differences in the occurrence of the respective parameters following a cross-sectional, inter-university comparison between students of Manchester Metropolitan University (Manchester Met) and HAW-Hamburg based on data gathered during the winter term 2016/17.

Methods

SuSy Procedure and Participants

In 2014, the Department of Health Sciences at HAW-Hamburg designed and implemented a surveillance system for health behaviours of students, named SuSy [3]. Close collaboration of HAW-Hamburg and Manchester Met led to the administration of similar surveys, covering socio-demographic information, health and wellbeing as well as health-promoting and health-risk behaviours, in both universities in 2016. While HAW-Hamburg included exclusively students of the Department of Health Sciences and administered a paper-pencil questionnaire, Manchester Met distributed an online survey across the whole student population using Survey Monkey software package. At both universities, participation was voluntary and anonymous. Ethical approval for conducting and evaluating the SuSy survey was obtained from both ethics committees (reference number Manchester Met 1256, HAW-Hamburg [3]). A description of the variables investigated can be found in Supplementary Material SM.1.

Statistical Analysis

Only Health Sciences students enrolled at HAW-Hamburg and Manchester Met were included in the analysis to ensure comparability of the two study groups. Descriptive frequency analyses were performed for: (a) HAW-Hamburg: time series data for several indicators from 2014 to 2018; and (b) cross-sectional data comparing Manchester Met and HAW-Hamburg health indicators in winter term 2016/17.

For the time series analysis, temporal variations of the above-outlined variables were explored graphically using the statistics programme R version 1.0.136, package *ggplot2* [19]. The authors explored potential university group differences by performing multifactorial binary logistic regression analyses (model 2) compared to uni-factorial binary logistic regression analyses (model 1), looking at the outlined health behaviours (a total of eight dependent variables). Prior to the binary logistic regression analyses, bivariate analyses were performed to test for significant associations between the health behaviour variables to be studied and potential influencing variables, respectively. Independent variables indicating a significant association (p-values<0.05) were included in the regression model. Results of the bivariate analyses can be found in Supplementary Material 3. For each health behaviour indicator, odds ratios (ORs) with 95% confidence intervals (CI) were computed to identify university group differences. In the second model, the following independent variables were included in addition to the selected health behaviour variables: University group, gender, age, time spent at university, monthly budget available as well as the intake of painkillers and psychoactive substances other than cannabis (p-values < 0.05) using IBM SPSS Statistics 24.

Results

By 2018, SuSy Hamburg has been administered eight times. The total sample size was 1366. On average, the response rate was 99.4%. 83.7% of the participants were female, 16.0% were male. The average age of the respondents was 24.5 years (SD=5.7).

Temporal variation 2014-2018

During the study period, different trends in health behaviours among HAW-Hamburg students were observed. Figure 1 describes the temporal variations of the studied health-promoting behaviours (figures a and b) and health-risk behaviours (figures c-f) by imaging the temporal sequences of each semester's proportion of HAW students surveyed. Small changes were observed in health-promoting behaviours (fig. 1a-b). The share of students consuming at least three servings of fruit and vegetables per day was constantly below 50% (average 47%) over the four-year study period, with considerably less students fulfilling WHO's recommendation of at least five servings a day (mean 12.7%). The proportion of students who engage in at least 2.5 hours physical activity per week slightly increased from 71.4% in 2014 to over 80% in 2018.

Changing trends were seen with respect to health-risks (fig. 1c-f). The most prevalent health risk was a high stress level (≥ 6). On average, 53.4% were highly stressed, with no clear trend over time.

Slightly increasing trends were seen in alcohol consumption and cannabis consumption, whereas a declining trend was observed in tobacco consumption. In summer 2014, 25% of the Hamburg students consumed alcohol on at least five days during the last 30 days, with the highest proportion of 38.5% in winter 2017. In summer 2018, the share decreased to 29.2%. The mean proportion of students who reported to have drunk more than five drinks on one occasion on more than five days during the past 30 days was 7%. The highest share of 10.8% was reported in winter 2016. Since then, the proportion decreased to 3.3% in 2018. The proportion of students who reported having consumed cannabis during the last 30 days was 9.8% in summer 2014 and followed an increasing trend up to 16.3% in 2018. After an initial increase in the proportion of students who smoked cigarettes on 21 or more days during the last 30 days (maximum 16.4%), the number of smokers is steadily decreasing among HAW-Hamburg students. In 2018, only 6.7% of the students were smokers.

Inter-university comparison of health-promoting and health-risk behaviours

The winter term 2016 surveys had a total sample size of 474 participants, encompassing 271 Manchester Met students and 203 HAW-Hamburg students. Table 1 summarises demographic characteristics of the student participants from Manchester and Hamburg.

The descriptive output shows differences in the health-related behaviours across HAW-Hamburg and Manchester Met students (available as Supplementary Materials 2). These differences were then assessed using binary logistic regression models with a total of eight behavioural outcomes as the dependent variables, respectively (Supplementary Materials 4). Figure 2 summarises the results of the logistic regression models (model 2).

Students differed significantly concerning their health-promoting behaviours according to the results of the logistic regression model. Manchester Met students had higher chances to eat at least three servings of fruit and vegetables per day (OR=1.61, 95%CI 1.08-2.39), whereas no difference between the two student populations could be found regarding the recommended five servings of fruit and vegetables per day, with low proportions in both groups. Contrastingly, Manchester Met students' odds of meeting the recommendation of being physically active for at least 2.5 hours per week were lower than those of HAW-Hamburg students (OR=0.36, 95%CI 0.19-0.68), with available financial budget and daily fruit and vegetable intake as relevant influences.

With regard to health-risk factors and behaviours, results of the regression model revealed differences in stress perception, drinking and smoking behaviour. While the odds of perceiving a high stress level and consuming alcohol at least five days per month were similar across both SuSy settings, Manchester Met students' odds of binge drinking at least 5 days per month were 5.08 times higher compared to HAW-Hamburg students (95%CI 2.34-11.01). Moreover, the perception of high stress levels might have been associated with an increased intake of painkillers (OR=2.09, 95%CI 1.09-4.01). For drinking-behavioural outcomes, cannabis consumption and intake of psychoactive substances seemed interrelated with an increased level of alcohol consumption. Considering tobacco and cannabis consumption, Manchester Met students had lower odds of consuming cannabis at least once per month than HAW-Hamburg students (OR=0.30, 95%CI 0.15-0.0.61), whereas smoking behaviour

significantly differed among both universities, with Manchester Met students' odds 3.77-fold higher than those of HAW-Hamburg students (95%CI 1.85-7.68). Again, the consumption of alcohol and other substances might have influenced the behavioural outcomes among both university groups.

Discussion

This study presents an intra- and inter-university comparison of students in the field of Health Sciences and Public Health from Germany and England, exploring the most critical health-promoting and health-risk behaviours among university students. To the authors' best knowledge, this is the first study to show relevant differences of selected health behaviours among Health Sciences students from Germany and England, considering trends in young adults' health behaviours in a European context.

The two samples of Manchester Met and HAW-Hamburg students are very similar in terms of sample size, mean age, gender balance and average years spent at university and hence comparable. Within both university groups, the most prevalent health-risk behaviours are a low intake of fruit and vegetables (< 5 servings/day), high-level stress (≥ 6) and alcohol consumption on more than 5 days during the last month, which is in line with previous studies from different European countries [1,2,4,8].

In Europe, a low daily intake of fruit and vegetables was observed and students' food consumption was characterised by unhealthy choices, often cohering with weight gain [2,20]. These trends could also be seen among medical and Public Health students [4–6]. According to SuSy findings, less than 15% of both university groups meet the WHO recommendation, whereas no changes over time were observed in Hamburg. Barely half of the students consume more than three servings, which is in line with the European level [1,6,20], although Manchester Met students tend to eat more often at least three servings per day compared to their Hamburg peers. Such differences between university students from Germany and England coincide with previous studies [21–23]. In contrast, the

prevalence of the recommended level of physical activity per week high in both university groups, which is consistent with medical and Public Health students as well as students from other subjects from other European countries [1,6,7,24]. Among those, males tend to be more physically active than females, whereas in the SuSy cohort a higher level of physical activity seems associated with a higher intake of fruit and vegetables.

Among medical students, high-level stress experiences and increased vulnerability for mental health disorders were seen, which were often greater among female students [6,17,25]. The same holds true for Health Sciences students from Germany and England, with similar chances of experiencing high distress across both SuSy settings. However, gender was no significant predictor following the results of the logistic regression model. Based on the results of Lamberti et al. [26], substance use, including tobacco and alcohol consumption, seems to be a conventional method to reduce high stress levels among medical students. In Europe, frequent alcohol consumption as well as problem drinking, often resulting in heavy episodic drinking, is a severe public health concern among university students [27,28]. In Hamburg and Manchester, about one-third of Health Sciences students drank alcohol on at least five days during the last 30 days, which is less compared to their peers, for example from Hungary and Italy [6,26]. A slightly increasing trend in general alcohol consumption could be seen in Hamburg over the past years, and no differences were identified between both university populations. However, Manchester Met students significantly binge-drank more often. Similar differences were previously reported elsewhere [13,27,29].

According to the results of a European comparison (Germany, Italy, Poland and Spain) [30], the overall prevalence of smoking among medical students is approximately 30%. Similar results could be found among Health Sciences and Public Health students from Hungary, Greece and Spain [6,7,31]. However, the prevalence of smoking was lower when compared with other young adult populations [10,31]. These findings coincide with the trends seen here, with the prevalence of smoking among Health Sciences students below the countries' average. At HAW-Hamburg, the smoking prevalence was steadily decreasing. In contrast, the prevalence of cannabis use shows opposing trends. HAW-Hamburg

Health Sciences students have a significantly higher level of cannabis consumption when compared with their Manchester peers, and indicate an increasing trend in cannabis use. Contrastingly, previous reports have shown a slightly lower prevalence in German adults (6.1%) compared to English adults (6.5%) [32]. Among both SuSy populations, consumption of tobacco, cannabis and alcohol seem associated with each other.

Limitations

Although the analysis of descriptive indicators showed that both study populations are very similar, there might be other factors influencing comparability. For example, the mode of administration differed considerably (online survey design at Manchester Met, pencil-paper design at HAW-Hamburg). Through an online survey design which provides more privacy, the bias of social desirability might be of less concern compared to the pencil-paper design. Different selection biases, however, can be assumed for both university settings, one exclusively reaching students responding to the email invitation, the other exclusively reaching students attending lectures. Relating to both samples, subjects' responses might diverge from reality through recall bias, especially with regard to questions reaching back further in time, and social desirability [33]. Finally, results of the multivariate analyses have to be regarded with care. Some of the regression models display a rather limited model fit (Nagelkerke R^2=0.078 for dependent: ≥ 3 servings of fruit and vegetables; Nagelkerke R^2=0.032 for dependent: high stress level).

The study results need to be interpreted accordingly, alongside the strengths of the SuSy tool. First, SuSy provides comprehensive and useful data concerning the university setting, students' demographic characteristics, as well as their health and health-related behaviours. Because of its standardised administration, the SuSy tool allows for systematic collection of comparable data over time. In turn, behavioural trends can be interpreted, taking into account the effects of potential biases. Secondly, the SuSy tool can easily be adapted into new university contexts, as described by Holt et al 2019. Its transferability is a significant advantage, especially for the implementation of SuSy at other

European universities, facilitating collaborative efforts in international university health promotion. Thirdly, SuSy constitutes a particularly useful health monitoring and educational tool in university settings. Students' health and health choices can be monitored and evaluated regularly using a standardised method across universities and study programmes. Conversely, it can easily be implemented as an educational tool, so that students themselves engage in real-life health surveillance of their peers. In this regard, SuSy can contribute substantially to university health promotion.

Implications of the study and directions for future research

Riemenschneider and colleagues [4] described medical sciences students as facing a higher risk of high-level stress, tobacco smoking, unhealthy diet, harmful alcohol consumption and drug use, similar to Health Sciences and Public Health students, for example from Germany [3], England, Iran [8], Saudi Arabia [16], Greece [7] and Hungary [6]. However, a paucity in research was identified regarding the health needs and behaviours of Health Sciences students when compared with medical students. Unlike students of other subjects or their non-university peers, medical and Health Sciences students show significant differences in the experience of severe stress and vulnerability to psychological disorders but a lower prevalence of tobacco smoking [10,17]. The results derived from SuSy corroborate these findings, for Health Sciences students from Germany and England.

This demonstrates that student health surveillance systems can play a fundamental role in the health promotion of university students, in which Health Sciences and Public Health students have been largely neglected. In this respect, international cross-university comparison is imperative to better understand variations in behavioural risks in different cultures, study subject groups and university settings [1,3,8], aiming to improve health professionals' interaction and coping skills, and in later work-life responsibilities.

SuSy presents a useful tool to effectively establish a student health surveillance system, allowing for intra- and inter-university comparison of health-promoting and health-risk behaviours among Health

Sciences and Public Health students. Such instruments are crucial to recognise behavioural clusters and their associated university and demographic aspects to adequately design, implement and evaluate university health promotion programmes, such as counselling services, intervention measures and policy development [6,8]. A systematic harmonisation of university health surveillance systems and standardised evaluation concepts of students' health information from different European countries may help to enhance international comparability, to develop a multi-country health databank of students' risk factors as well as to identify and support vulnerable groups of Health Sciences and Public Health students at an early stage during their career.

Author Contributions

Conceptualisation. RR, AK, MH, SP; Methodology. RR, AK, MH, SP; Investigation. RR, AK, MH, SP; Statistical analysis. RR, AK, JB; Writing – original draft preparation. RR, AK, JB; Writing – review and editing. RR, AK, JB, MH, SP; Visualisation and formatting. AK, JB; Supervision. RR, SP; Project administration. RR, SP; Funding acquisition. RR, SP

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Conflict of interest

The authors declare no conflict of interest.

Key points

- SuSy allows the provision of valuable, comparable information about students' health behaviours
- Reliable trends in risk behavior among Health Science students over time
- Low fruit and vegetable consumption in both Hamburg and Manchester students
- Smoking prevalence is decreasing, cannabis consumption is increasing

- Valuable intra- and inter-university comparisons

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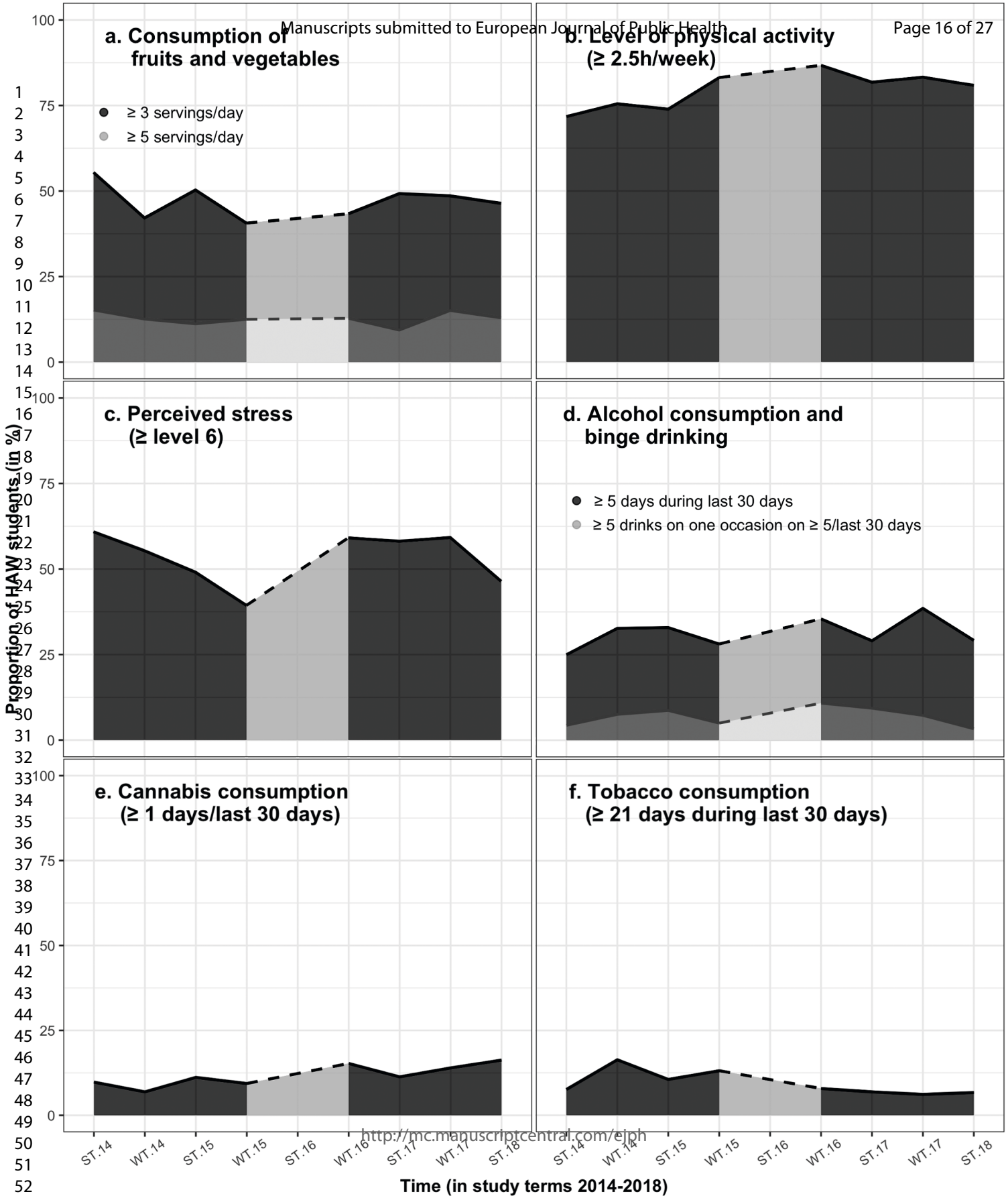
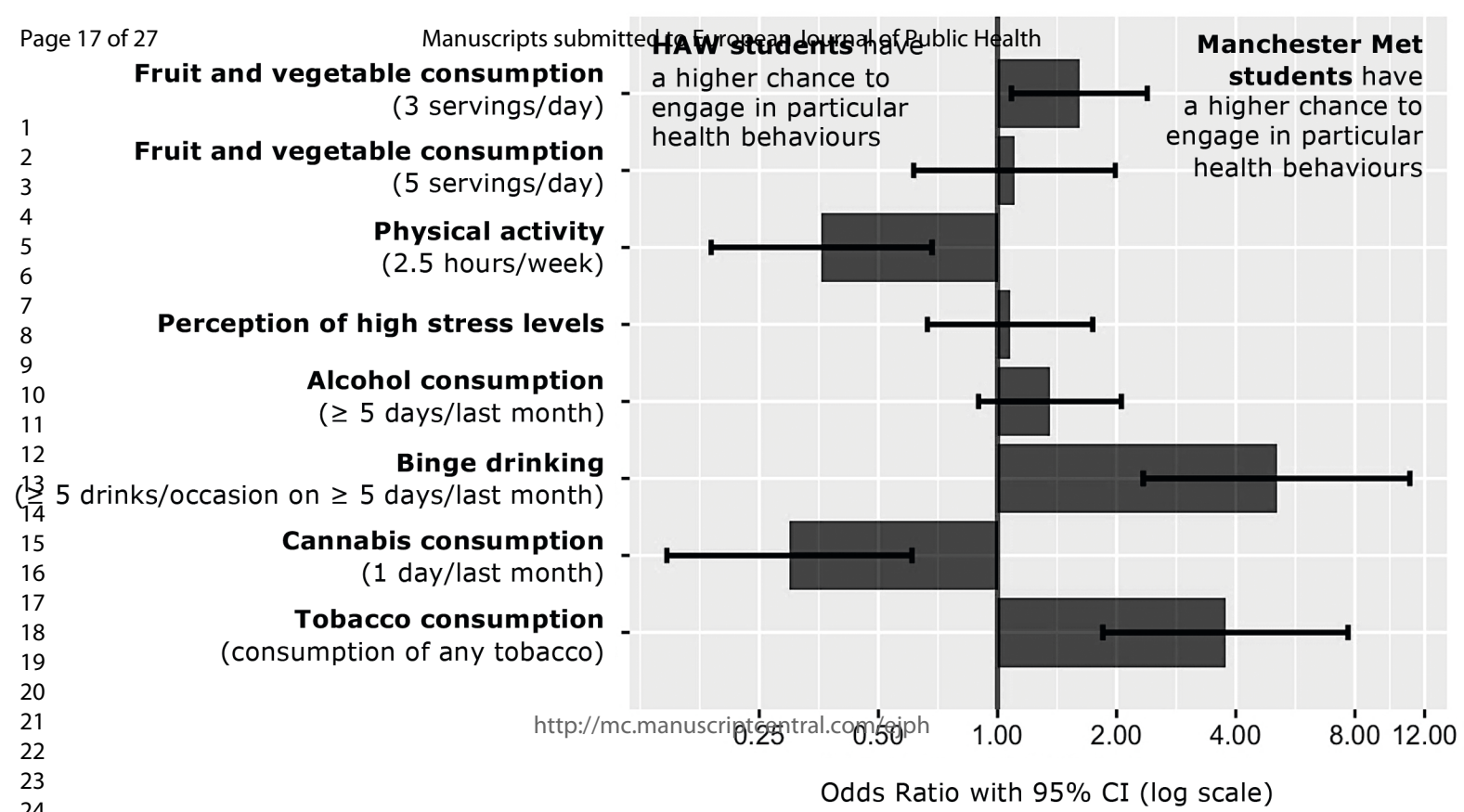

a. Consumption of fruits and vegetables
≥ 3 servings/day
≥ 5 servings/day
b. Level of physical activity (≥ 2.5h/week)
c. Perceived stress (≥ level 6)
d. Alcohol consumption and binge drinking
≥ 5 days during last 30 days
≥ 5 drinks on one occasion on ≥ 5/last 30 days
e. Cannabis consumption (≥ 1 days/last 30 days)
f. Tobacco consumption (≥ 21 days during last 30 days)
Proportion of HAW students (in %)
100
75
50
25
0
ST.14
WT.14
ST.15
WT.15
ST.16
WT.16
ST.17
WT.17
ST.18
Time (in study terms 2014-2018)


Fruit and vegetable consumption (3 servings/day)
Fruit and vegetable consumption (5 servings/day)
Physical activity (2.5 hours/week)
Perception of high stress levels
Alcohol consumption (≥ 5 days/last month)
Binge drinking (≥ 5 drinks/occasion on ≥ 5 days/last month)
Cannabis consumption (1 day/last month)
Tobacco consumption (consumption of any tobacco)
HAW students have a higher chance to engage in particular health behaviours
Manchester Met students have a higher chance to engage in particular health behaviours
0.25
0.50
1.00
2.00
4.00
8.00
12.00
Odds Ratio with 95% CI (log scale)

SuSy baseline characteristics – Winter term 2016 (n=474)			
	Total	**MMU** n=271	**HAW** n=203
Gender	Female	228 (84.1%)	170 (83.7%)
	Male	43 (15.9%)	33 (16.3%)
	Others	0 (0%)	0 (0 %)
	Mean age (SD)	24.4 (7.6)	24.1 (0.3)
	Mean years spent at university (SD)	1.04 (1.2)	0.97 (1.0)

Exploring potentials of an international, inter-university student health surveillance tool: Findings from "SuSy"

Supplementary Materials

SM.1 Coding system for categorical variables

Variable	Description	Yes=1	No=0
'Fruit&Veg3' and 'Fruit&Veg5'	Servings of fruit and vegetables per day (examples of portion sizes are given in the questionnaires). Three servings are the median. 5 servings are recommended by WHO [34].	≥ 3 servings/day ≥ 5 servings/day	< 3 servings/day < servings/day
'Physical activity'	Mean hours of physical activity per week (any exercise leading to sweating or hard breathing). 2.5 hours/week are recommended by the WHO [35].	≥ 2.5 hours/week	< 2.5 hours/week
'High stress level'	Visual analogue scale of perceived stress (0 = not stressed, 10 = highly stressed)	≥ 6	< 6
'Alcohol'	Frequency of alcohol consumption during the last 30 days	≥ 5 days	< 5 days
'Binge drinking'	Frequency of binge drinking (= more than 5 drinks in a row) within the last 30 days of those who report to have drunk alcohol in the last 30 days	≥ 5 days	< 5 days
'Cannabis'	Frequency of cannabis consumption, ranging from 'last year' to 'within the last 30 days'	At least within the last 30 days	Not within the last 30 days
'Tobacco'	HAW: Cigarette smoking on at least 21 days within the last 30 days [36]. / Manchester Met: Smoking of at least one of the following substances: cigarettes, cigars, cannabis with tobacco or roll-ups.	Yes	No

SM.2 Overall sample characteristics

SuSy baseline characteristics – Winter term 2016 (n=474)					
MMU	Total	271 (57.2%)	**HAW**	Total	203 (42.8%)
Gender	Female	228 (84.1%)		Female	170 (83.7%)
	Male	43 (15.9%)		Male	33 (16.3%)
	Others	0 (0%)		Others	0 (0 %)
	Mean age (SD)	24.4 (7.6)		Mean age (SD)	24.1 (0.3)
	Mean years spent at university (SD)	1.04 (1.2)		Mean years spent at university (SD)	0.97 (1.0)
Monthly	≤ £350/€400	211 (77.9%)		≤ £350/€400	40 (19.7%)
Budget	£351–500/€401–600	31 (11.4%)		£351–500/€401–600	39 (19.2%)
	£501–650/€601–800	15 (55.%)		£501–650/€601–800	44 (21.7%)
	£651–800/€801–1000	6 (2.2%)		£651–800/€801–1000	39 (19.2%)
	> £800/€1000	8 (3.0%)		> £800/€1000	40 (19.7%)
	Unknown	0 (0%)		Unknown	1 (0.5%)
Recommended fruit/vegetable consumption. n=474					
MMU	No consumption	16 (5.9%)	**HAW**	No consumption	7 (3.4%)
	1–2 servings/day	109 (40.2%)		1–2 servings/day	108 (53.2%)
	3–4 servings/day	104 (38.4%)		3–4 servings/day	62 (30.5%)
	5–6 servings/day	30 (11.1%)		5–6 servings/day	24 (11.8%)
	> 6 servings/day	12 (4.4%)		> 6 servings/day	2 (1.0%)
Level of physical activity (see section 2 "Measures" for definition). n=467					
MMU	Mean hours of physical activity/week (SD)	5.0 (6.9)	**HAW**	Mean hours of physical activity/week (SD)	7.4 (8.9)
	≥ 2.5	194 (71.6%)		≥ 2.5	177 (87.2%)
	< 2.5	73 (26.9%)		< 2.5	23 (11.3%)
	Unknown	4 (1.5%)		Unknown	3 (1.5%)
Perceived stress (see section 2 "Measures" for definition). n=474					
MMU	Mean stress level (SD)	6.31 (2.5)	**HAW**	Mean stress level (SD)	5.68 (2.3)
	Stress level ≥ 6	181 (66.8%)		Stress level ≥ 6	120 (59.1%)
	Stress level < 6	90 (33.2%)		Stress level < 6	83 (40.9%)
Alcohol consumption during last 30 days. n=467					
MMU	No consumption	75 (27.7%)	**HAW**	No consumption	46 (22.7%)
	1–4 days	81 (29.9%)		1–4 days	78 (38.4%)
	5–10 days	81 (29.9%)		5–10 days	55 (27. %)
	11–20 days	28 (10.3%)		11–20 days	16 (7.9%)
	≥ 21 days	6 (2.2%)		≥ 21 days	1 (0.5%)

	Unknown	0 (0%)		Unknown	7 (3.4%)
Binge drinking (of those who drank alcohol during last 30 days). n=382					
MMU	Number of students	163 (83.2%)	**HAW**	Number of students	98 (66.7%)
	Mean (SD) days/month	5.14 (4.78)		Mean (SD) days/month	3.36 (3.01)
	≥ 5 days	22 (11.8%)		≥ 5 days	72 (36.7%)
	< 5 days	164 (88.2%)		< 5 days	124 (63.3%)
Cannabis consumption (on at least one occasion during last 30 days). n=471					
MMU	Never	90 (70.1%)	**HAW**	Never	117 (58.5%)
	Not in the last year	37 (13.7%)		Not in the last year	31 (15.5%)
	Not in the last 30 days	19 (7.0%)		Not in the last 30 days	21 (10.5%)
	In the last 30 days	25 (9.2%)		In the last 30 days	31 (15.5%)
	Unknown	0 (0%)		Unknown	3 (1.5%)
Tobacco consumption (see section 2 "Measures" for definition). n=473					
MMU	Yes	48 (17.7%)	**HAW**	Yes	16 (7.9%)
	No	223 (82.3%)		No	186 (92.1%)
	Unknown	0 (0%)		Unknown	1 (0.5%)
Additional: Intake of other psychoactive substances. n=470					
MMU	Never	225 (83.0%)	**HAW**	Never	175 (86.2%)
	Not in the last year	23 (8.5%)		Not in the last year	13 (6.4%)
	Not in the last 30 days	7 (2.6%)		Not in the last 30 days	7 (3.4%)
	In the last 30 days	16 (5.9%)		In the last 30 days	4 (2.0%)
	Unknown	0 (0%)		Unknown	4 (2.0%)
Additional: Intake of painkillers. n=471					
MMU	Never	29 (10.7%)	**HAW**	Never	15 (7.4%)
	Not in the last year	20 (7.4%)		Not in the last year	30 (14.8%)
	Not in the last 30 days	58 (21.4%)		Not in the last 30 days	49 (24.1%)
	In the last 30 days	164 (60.5%)		In the last 30 days	106 (52.2%)
	Unknown	0 (0%)		Unknown	3 (1.5%)

SM.3 Results bivariate analysis

Figure SM.2 visualises the Spearman correlation coefficients for pairs of all study variables. The depth of colour indicates the strength of the association, whereas blank spaces correspond to insignificant associations ($p > 0.05$) (Kassambara, A. 2019. Ggcorrplot: Visualization of a Correlation Matrix using 'ggplot2'. http://www.sthda.com/english/wiki/ggcorrplot [accessed 11th June 2019]).

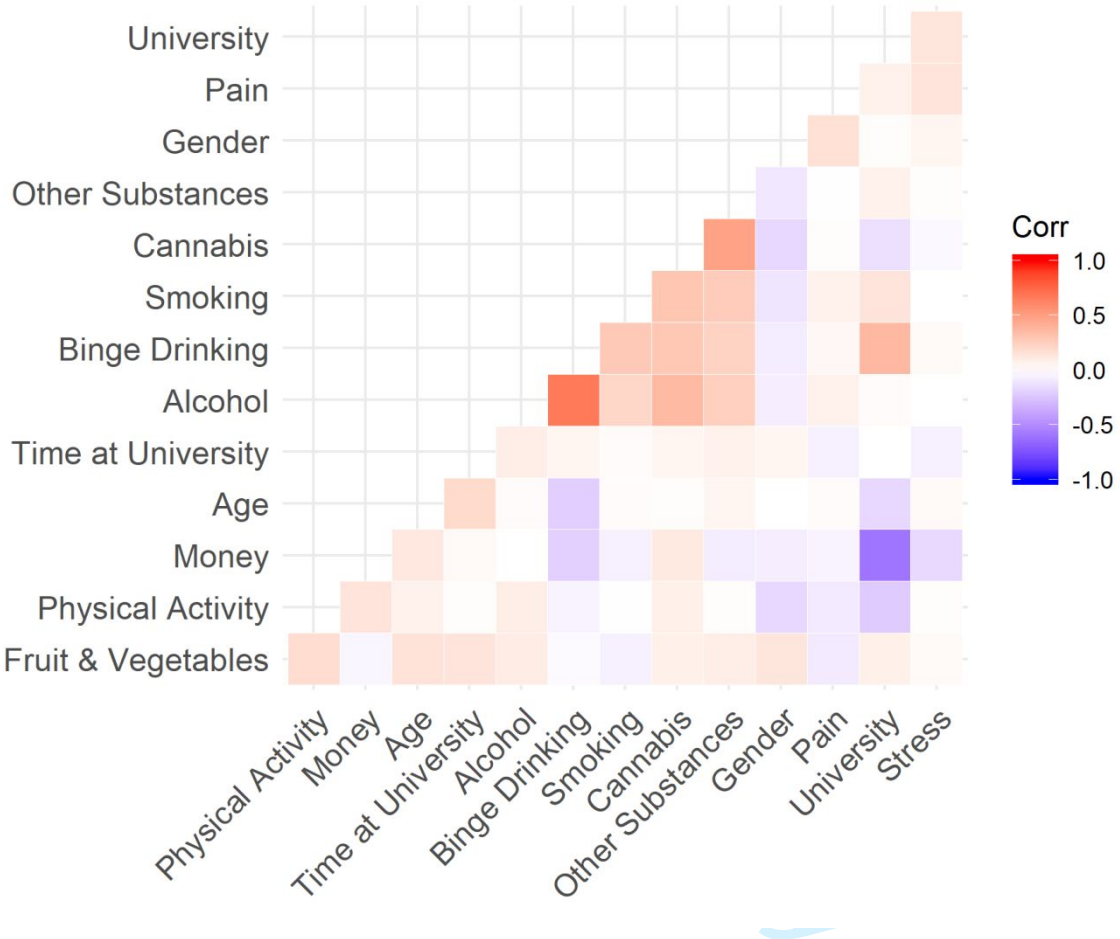


Figure SM.2. *Results of the bivariate correlation analysis describing the Spearman correlation coefficients for pairs of all study variables (14 variables).*

SM.4 Odds ratio and model comparison Manchester Met and HAW

Model 1 shows the simple association between university group and the eight outcome variables. Model 2 shows the results of the multifactorial regression analysis, including all influencing variables that were significantly correlated in the bivariate Spearman correlation analyses (cf. SM.2).
HAW students have been considered the reference group (HAW=0) and Manchester Met students the index group (MMU=1).

Table SM.3. *Logistic regression analysis for health-promoting and health-risk behaviors (n=8) among HAW and Manchester Met (MMU) students*

VARIABLE	MODEL 1	95 % CI for odds ratio			MODEL 2	95 % CI for odds ratio		
FRUIT AND VEGETABLES ≥ 3 (Model 1 n=474, Model 2 n=449)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-0.268 (0.142)*	-	*0.765*	-	*-2.046 (0.500)*	-	*0.129*	-
University (0=HAW, 1=MMU)	0.423 (0.187)	1.058	1.526	2.201	0.476 (0.202)	1.084	1.610	2.391
Gender (0=male, 1=female)					0.613 (0.272)	1.083	1.846	3.148
Age					0.035 (0.016)	1.004	1.035	1.068
Years spent at university					0.242 (0.089)	1.070	1.274	1.516
Physical activity					0.026 (0.016)	0.995	1.026	1.059
-2LL	651.873				595.461			
Model χ^2	5.155, df=1	p=0.033			26.965, df=5	p<0.001		
Nagelkerke R^2	0.014				0.078			
Hosmer & Lemeshow test	p<0.001				p=0.442			
Classification Accuracy	55.1%				61.7%			
FRUIT AND VEGETABLES ≥ 5 (Model 1 n=474, Model 2 n=444)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-1.918 (0.210)*	-	*0.147*	-	*-3.781 (0.692)*	-	*0.023*	-
University (0=HAW, 1=MMU)	0.222 (0.269)	0.737	1.249	2.115	0.098 (0.299)	0.614	1.103	1.984
Age					0.063 (0.019)	1.028	1.066	1.105
Years spent at university					0.205 (0.114)	0.981	1.227	1.536
Physical activity					0.013 (0.015)	0.983	1.013	1.043
Painkillers (Never)					-	-	-	-
Painkillers (1)					0.629 (0.582)	0.600	1.876	5.866
Painkillers (2)					0.173 (0.531)	0.420	1.189	3.366
Painkillers (3)					-0.477 (0.499)	0.233	0.621	1.652
Psychoactive substances (Never)					-	-	-	-
Psychoactive substances (1)					1.198 (0.416)	1.466	3.314	7.491
Psychoactive substances (2)					1.414 (0.598)	1.273	4.111	13.274
Psychoactive substances (3)					-0.099 (0.788)	0.193	0.906	4.241
-2LL	389.123				339.041			
Model χ^2	0.690, df=1	p=0.406			37.710, df=10	p<0.001		
Nagelkerke R^2	0.003				0.142			
Hosmer & Lemeshow test	p<0.001				p=0.481			
Classification Accuracy	85.7%				86.0%			

PHYSICAL ACTIVITY (Model 1 n=467, Model 2 n=463)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*2.041 (0.222)*	-	*7.696*	-	*0.908 (0.711)*	-	*2.479*	-
University (0=HAW, 1=MMU)	-1.063 (0.261)	0.207	0.345	0.576	-1.023 (0.328)	0.189	0.359	0.683
Monthly budget (≤ £350/€400)					-	-	-	-
Monthly budget (1)					-0.260 (0.355)	0.385	0.771	1.546
Monthly budget (2)					0.804 (0.527)	0.795	2.234	6.280
Monthly budget (3)					0.033 (0.525)	0.369	1.033	2.891
Monthly budget (4)					0.121 (0.533)	0.397	1.129	3.210
Fruit/Vegetable consumption (None)					-	-	-	-
Fruit/Vegetable consumption (1)					1.070 (0.487)	1.124	2.917	7.572
Fruit/Vegetable consumption (2)					1.961 (0.513)	2.598	7.105	19.430
Fruit/Vegetable consumption (3)					2.059 (0.637)	2.245	7.820	27.241
Fruit/Vegetable consumption (4)					2.098 (0.900)	1.396	8.146	47.538
Painkillers (Never)					-	-	-	-
Painkillers (1)					-0.020 (0.649)	0.275	0.980	3.496
Painkillers (2)					-0.255 (0.503)	0.289	0.775	2.077
Painkillers (3)					-0.474 (0.451)	0.257	0.623	1.506
-2LL	455.992				423.628			
Model χ^2	18.503, df=1	p<0.001			49.016, df=12	p<0.001		
Nagelkerke R^2	0.061				0.157			
Hosmer & Lemeshow test	p<0.001				p=0.059			
Classification Accuracy	79.4%				80.1%			
PERCEIVED STRESS (Model 1 n=474, Model 2 n=470)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*0.369 (0.143)*	-	*1.446*	-	*0.103 (0.384)*	-	*1.108*	-
University (0=HAW, 1=MMU)	0.330 (0.192)	0.954	1.391	2.028	0.073 (0.245)	0.665	1.075	1.739
Monthly budget (≤ £350/€400)					-	-	-	-
Monthly budget (1)					-0.220 (0.301)	0.445	0.802	1.449
Monthly budget (2)					-0.367 (0.334)	0.360	0.693	1.333
Monthly budget (3)					-0.453 (0.379)	0.302	0.635	1.336
Monthly budget (4)					-0.408 (0.367)	0.324	0.665	1.364
Painkillers (Never)					-	-	-	-
Painkillers (1)					0.298 (0.426)	0.585	1.347	3.103
Painkillers (2)					0.619 (0.367)	0.905	1.857	3.810
Painkillers (3)					0.739 (0.331)	1.094	2.093	4.006
-2LL	619.163				603.978			
Model χ^2	2.942, df=1	p=0.086			11.150, df=8	p=0.193		
Nagelkerke R^2	0.008				0.032			
Hosmer & Lemeshow test	p<0.001				p=0.997			
Classification Accuracy	63.5%				64.0%			

ALCOHOL CONSUMPTION (Model 1 n=467, Model 2 n=464)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-0.544 (0.148)*	-	*0.581*	-	*-1.049*	-	*0.350*	-
University (0=HAW, 1=MMU)	0.239 (0.193)	0.871	1.270	1.852	0.305 (0.212)	0.895	1.356	2.056
Cannabis consumption (Never)					-	-	-	-
Cannabis consumption (1)					1.020 (0.311)	1.507	2.772	5.102
Cannabis consumption (2)					0.756 (0.372)	1.027	2.130	4.419
Cannabis consumption (3)					1.379 (0.359)	1.965	3.971	8.024
Tobacco consumption (0=No, 1=Yes)					0.320 (0.315)	0.743	1.377	2.554
Painkillers (Never)					-	-	-	-
Painkillers (1)					-0.203 (0.399)	0.373	0.816	1.784
Painkillers (2)					0.317 (0.623)	0.405	1.373	4.659
Painkillers (3)					1.441 (0.675)	1.125	4.226	15.880
-2LL	627.210				576.254			
Model χ^2	1.545, df=1	p=0.214			49.418, df=8	p<0.001		
Nagelkerke R^2	0.004				0.136			
Hosmer & Lemeshow test	p<0.001				p=0.937			
Classification Accuracy	60.0%				66.6%			
BINGE DRINKING (Model 1 n=382, Model 2 n=376)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-2.009 (0.227)*	-	*0.134*	-	*-1.821 (0.749)*	-	*0.162*	-
University (0=HAW, 1=MMU)	1.465 (0.271)	2.544	4.328	7.364	1.626 (0.395)	2.344	5.081	11.014
Gender (0=male, 1=female)					-0.549 (0.344)	0.294	0.577	1.134
Age					-0.014	0.944	0.986	1.029
Monthly budget (≤ £350/€400)					-	-	-	-
Monthly budget (1)					-0.189 (0.422)	0.362	0.828	1.894
Monthly budget (2)					0.688 (0.491)	0.760	1.989	5.205
Monthly budget (3)					-0.100 (0.586)	0.287	0.905	2.852
Monthly budget (4)					-0.583 (0.664)	0.152	0.558	2.051
Tobacco consumption (0=No, 1=Yes)					0.197 (0.383)	0.575	1.218	2.577
Cannabis consumption (Never)					-	-	-	-
Cannabis consumption (1)					0.648 (0.417)	0.844	1.913	4.332
Cannabis consumption (2)					1.558 (0.461)	1.924	4.750	11.728
Cannabis consumption (3)					1.363 (0.442)	1.645	3.909	9.288
Psychoactive substances (Never)					-	-	-	-
Psychoactive substances (1)					-1.049 (0.527)	0.125	0.350	0.983
Psychoactive substances (2)					-0.300 (0.724)	0.179	0.741	3.063
Psychoactive substances (3)					1.296 (0.712)	0.906	3.653	14.734
-2LL	392.967				346.983			
Model χ^2	33.330, df=1	p<0.001			75.893, df=14	p<0.001		
Nagelkerke R^2	0.124				0.271			
Hosmer & Lemeshow test	p<0.001				p=0.586			
Classification Accuracy	75.4%				79.5%			

CANNABIS CONSUMPTION (Model 1 n=471, Model 2 n=464)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-1.696 (0.195)*	-	*0.183*	-	*-3.557 (1.055)*	-	*0.029*	-
University (0=HAW, 1=MMU)	-0.591 (0.287)	0.316	0.554	0.972	-1.211 (0.363)	0.146	0.298	0.608
Gender (0=male, 1=female)					-1.105 (0.394)	0.153	0.331	0.717
Alcohol consumption (Never)					-	-	-	-
Alcohol consumption (1)					2.338 (1.054)	1.314	10.362	81.707
Alcohol consumption (2)					3.049 (1.044)	2.727	21.085	163.025
Alcohol consumption (3)					2.169 (1.135)	0.946	8.746	80.899
Alcohol consumption (4)					4.198 (1.545)	3.220	66.581	1376.682
Tobacco consumption (0=No, 1=Yes)					1.051 (0.419)	1.258	2.861	6.506
Psychoactive substances (Never)					-	-	-	-
Psychoactive substances (1)					0.636 (0.517)	0.685	1.890	5.210
Psychoactive substances (2)					2.038 (0.649)	2.149	7.672	27.397
Psychoactive substances (3)					2.721 (0.641)	4.331	15.198	53.340
-2LL	339.295				244.850			
Model χ^2	4.27, df=1	p=0.039			92.937, df=10	p<0.001		
Nagelkerke R^2	0.017				0.351			
Hosmer & Lemeshow test	p<0.001				p=0.969			
Classification Accuracy	88.1%				89.9%			
TOBACCO CONSUMPTION (Model 1 n=473, Model 2 n=464)	**B(SE)**	**Lower**	**Exp(B)**	**Upper**	**B(SE)**	**Lower**	**Exp(B)**	**Upper**
Constant	*-2.453 (0.261)*	-	*0.086*	-	*-3.736 (0.661)*	-	*0.024*	-
University (0=HAW, 1=MMU)	0.917 (0.305)	1.376	2.502	4.552	1.326 (0.364)	1.846	3.765	7.682
Gender (0=male, 1=female)					-0.430 (0.375)	0.312	0.650	1.356
Alcohol consumption (Never)					-	-	-	-
Alcohol consumption (1)					0.572 (0.518)	0.641	1.771	4.891
Alcohol consumption (2)					0.465 (0.528)	0.566	1.592	4.478
Alcohol consumption (3)					1.317 (0.590)	1.175	3.731	11.851
Alcohol consumption (4)					1.437 (1.076)	0.511	4.208	34.677
Cannabis consumption (Never)					-	-	-	-
Cannabis consumption (1)					0.832 (0.475)	0.905	2.298	5.833
Cannabis consumption (2)					1.749 (0.485)	2.220	5.747	14.876
Cannabis consumption (3)					1.787 (0.476)	2.349	5.971	15.181
Psychoactive substances (Never)					-	-	-	-
Psychoactive substances (1)					0.182 (0.496)	0.453	1.199	3.172
Psychoactive substances (2)					-0.118 (0.778)	0.194	0.889	4.080
Psychoactive substances (3)					0.858 (0.631)	0.684	2.358	8.126
-2LL	364.954				293.553			
Model χ^2	9.994, df=1	p=0.002			71.348, df=12	p<0.001		
Nagelkerke R^2	0.038				0.262			
Hosmer & Lemeshow test	p<0.001				p=0.786			
Classification Accuracy	86.5%				89.0%			