

1 **Health behaviors among male and female university**

2 **students in Cambodia: a cross-sectional survey**

3

4 **Say Sok^{1,2}, Khuondyla Pal¹, Sovannary Tuot¹, Rosa Yi³, Pheak Chhoun¹, Siyan Yi^{1,4,5*}**

5

6 ¹KHANA Center for Population Health Research, Phnom Penh, Cambodia

7 ²Department of Media and Communication, Royal University of Phnom Penh, Phnom Penh,

8 Cambodia

9 ³Faculty of Development Studies, Royal University of Phnom Penh, Phnom Penh, Cambodia

10 ⁴Center for Global Health Research, Touro University California, Vallejo, CA, USA

11 ⁵Saw Swee Hock School of Public Health, National University of Singapore and National

12 University Health System, Singapore, Singapore

13

14 *Correspondence: siyan@doctor.com

15

16 Co-authors' emails:

17 SS: saysok@gmail.com

18 KP: pkhuondyla@khana.org.kh

19 ST: tsovannary@khana.org.kh

20 RY: rosa.ifl@gmail.com

21 PC: cpheak@khana.org.kh

22

23

24

25

26

27

28

29

30

31 Abstract

32

33 Background

34 Students go through a transition when they enter university, which involves major individual
35 and contextual changes in every domain of life that may lead to several behavioral and health
36 problems. This paper describes a wide range of health behaviors among male and female
37 university students in Cambodia.

38

39 Methods

40 A cross-sectional survey was conducted in 2015 among students randomly selected from the
41 Royal University of Phnom Penh and University of Battambang. Health-related behaviors in
42 different domains were collected using a structured questionnaire. Chi-square test, Fisher's
43 exact test, or independent Student's *t*-test was used as appropriate to describe and compare
44 the variables among male and female students.

45

46 Results

47 This study included 1359 students, of whom 50.8% were male, and the mean age was 21.3
48 years (SD= 2.3). Of the total, 79.5% reported not having any vigorous-intensity activities,
49 25.9% not having moderate-intensity activities, and 33.5% not having walked continuously
50 for 10 minutes during the past seven days. The prevalence of substance use was low with
51 38.3% currently drinking alcohol, 1.1% smoking tobacco, and 0.4% using an illicit drug during
52 the past 12 months. About one in ten (10.6%) reported having sexual intercourse, with a mean
53 number of partners of 2.1 (SD= 2.4) during the past 12 months, and 42.4% not using a condom
54 in the last intercourse. Only 7.1% reported having been diagnosed with a sexually transmitted
55 infection in the past 12 months; of whom, 60% sought for treatment. About one-third (33.6%)
56 reported eating fast food once or twice, and 5.3% having it three times or more over the last
57 week. More than half (55.6%) had one to two servings of fruits and vegetables daily, and 9.9%
58 did not eat any fruits and vegetables over the last week.

59

60 Conclusions

61 We found that the prevalence of sexual risk behaviors and substance use was plausibly low
62 among university students in this study. However, the rates of inactive lifestyle and unhealthy
63 food consumption were concerning. Public policy and universities should promote healthy
64 behaviors among the students. The interventions may take advantage of and expend upon
65 the good health behaviors and consider gender differences.

66

67 **Keywords**

68 Chronic disease, health behavior, health promotion, knowledge, lifestyle, risk behavior

69

70 **Introduction**

71 Globally, chronic diseases such as cancer, stroke, heart disease, and diabetes are the major
72 causes of death [1]. Behavioral risk factors including tobacco smoking, alcohol consumption,
73 physical inactivity, sedentary behaviors, and obesity are major determinants of adult chronic
74 diseases, morbidity, and mortality [1-4]. In addition to the disease burden attributed to single
75 chronic behavioral risk factors, a growing body of evidence suggests that many behavioral risk
76 factors co-occur among youths, including university students [5-7] and that their
77 combinations yield greater risks for chronic diseases than the sum of their individual
78 independent effects [7-9].

79 People living in developing countries are mostly affected by health risks and behaviors
80 associated with poverty such as under-nutrition and unsafe sex [10]. With economic growth
81 and increase in life expectancies, major risks to health shift from these risks to other more
82 contemporary risks, e.g. obesity and physical inactivity, other diet-related factors such as fast
83 food and sugary product consumption, and tobacco and alcohol-related risks [11]. Besides
84 coping with the heavy burden of diseases associated with underdevelopment, these countries
85 thus need to fight with the growing burden of non-communicable diseases as well [10].

86 Different health risk behaviors have been shown to be associated with several
87 important factors, including economic growth, mobility, and low self-esteem. Studies have
88 shown that economic growth can lead to a rise in obesity or over nutrition, which suggests
89 that university students aiming for higher economic mobility may be at risk for obesity [12].
90 This population needs to be aware of the myriads of health risks for diseases in order to
91 prevent further incidence [6,13]. There are also many predictors for suicidal behaviors,

92 alcohol and other drug problems which include psychiatric disorders, substance abuse, lack
93 of social support, negative family environment, major life stressors, peer pressure and
94 conformity, and demographic factors [14,15].

95 Health behaviors formed during childhood and adolescence, including during
96 university, can have a significant impact on the occurrence of future illnesses and may
97 continue into adulthood and beyond [16,17]. While the full etiology of any of these diseases
98 has yet to be understood, behavioral factors such as tobacco use, exercise, diet, alcohol
99 consumption, and preventive health checks are strongly implicated as risk factors [3,18,19].

100 Like the trend in general youths, health risk behaviors among students are more
101 inclined towards the negative too. Research into the health behaviors of young European
102 university students indicates a growing trend towards a less healthy lifestyle [6,7,16]. Heavy
103 drinking and other risky behaviors, for example, tend to increase during this academic
104 transition [20,21]. Many studies from around the world have identified different health
105 behaviors among university students such as transport safety, violence, smoking, the use of
106 alcohol and illegal drugs, sexual behaviors, unhealthy eating, weight control, and the lack of
107 practice of physical exercise [6,7,16,22-24]. Like anywhere else, students in Cambodia go
108 through the same transition when they enter university, which involves major individual and
109 contextual change in every domain of life. However, there is no known study that examines
110 health risk behaviors among Cambodian university students. A few studies on risky sexual
111 behaviors, alcohol consumption, and tobacco use among other Cambodian youth groups,
112 however, indicates that some health risk behaviors are rather a concern [25,26].

113 Studies of health behaviors, especially of university students, in low- and middle-
114 income countries are important since the mortality and morbidity from common causes such
115 as coronary heart disease and cancers and adoption of healthy lifestyles differ widely across
116 countries [6,7,10,27], and not much is known about the situation in Cambodia. The National
117 Institute for Health and Care Excellence, the United Kingdom, stressed that social and
118 economic conditions can prevent people from changing their behaviors to improve their
119 health and can also reinforce behaviors that damage it [28]. Besides the great disparity of
120 social and economic conditions within the country, being one of the fastest growing
121 economies would intensify the impact of social and economic conditions on lifestyle and
122 behaviors of young populations in Cambodia.

123 The rationale for studying university students is that this population is faced with a lot
124 of transitions in their academic and living environments [7], which might lead to either
125 positive or negative behaviors. They need to adapt to new changes, brought about by the
126 academic transition, and have more freedom over their health and lifestyles. This important
127 transition provides a good opportunity to adopt healthy behaviors or otherwise [29].
128 Research has shown that many university students throughout the world engage in health
129 risk behaviors, and such can have long-term implications for their health and lifestyle
130 [6,16,17,30]. Studies regarding health behaviors related to non-communicable diseases in
131 developing countries are still scarce [7]. Further, this population subgroup will occupy
132 important positions in the government and society, including ones that promote public
133 health. It is therefore important to understand their health behaviors and to promote
134 remedial actions [7].

135 The aim of this study is to assess a wide range of health behaviors among university
136 students in Cambodia. Broadly speaking, the article focuses on six areas of basic health
137 behaviors: physical activities, substance use, sexual behaviors, eating behaviors, sleeping
138 behaviors, and driving behaviors. Variables covered in this study are presented in the sub-
139 section on variables and measurements in more details below.

140

141 **Materials and Methods**

142 **Ethics statement**

143 The National Ethics Committee for Health Research of the Ministry of Health, Cambodia,
144 approved the study protocol and materials (No. 191NECHR). Participation in this study was
145 voluntary. In the process of obtaining their written informed consent, participants were made
146 clear that they could refuse or discontinue their participation at any time and for any reason.
147 The confidentiality and privacy of the respondents were protected by administering the
148 questionnaires in a private premise and by excluding personal identifiers in the survey.

149

150 **Study design and settings**

151 This cross-sectional study was conducted in June and July 2015 among a sample of
152 undergraduate students randomly selected from the Royal University of Phnom Penh and
153 University of Battambang. These universities were purposively selected to partake in this

154 research. The Royal University of Phnom Penh is the oldest and largest university in the
155 country, and the University of Battambang is one of the most established universities in
156 northwestern Cambodia.

157

158 **Participants and sample size**

159 Epi Info (Atlanta, GA, United States) was used to calculate the sample size. There were
160 approximately 168000 students registered in the higher education institutions [31]. Because
161 the prevalence of health risk behaviors among university students in Cambodia was not
162 known, a 50% rate was used for the calculation to prevent any underestimated prevalence.
163 Based on a 95% confidence level (CI) and a 5% margin of error, the minimum required sample
164 size was 767 university students. Adjusted for 10% of incomplete response, missing data and
165 rejection rate, the final minimum required sample size was 850.

166

167 **Sampling and data collection procedures**

168 Undergraduate students from first to fourth years from all departments in the two
169 universities were eligible and selected to participate in the study. A multi-stage cluster
170 sampling method was used to select the participants. First, two universities were
171 conveniently selected for administration and logistics purposes. All departments in the
172 selected universities were included in the study. In each department, a proportional to size
173 sampling method was used to select the students to meet the required sample size.
174 Participants were randomly selected from a name list of students in each department, and a
175 personal identification number was assigned to each selected student. On the designated
176 date of data collection, all selected students were approached by our trained data collectors,
177 and questionnaires with an information sheet were delivered to them. Students were asked
178 for a written informed consent. The self-administered questionnaire was developed in
179 English, then translated into Khmer, and back translated into English by local experts. The
180 questionnaire was pre-tested as part of data collection training with 10 male and 10 female
181 students at the Royal University of Phnom Penh, who were later excluded from the main
182 study.

183

184 **Variables and measurements**

185 The design of the core part of the self-reported questionnaire was informed by the Health
186 Behavior Survey [32], the National College Health Risk Behavior Survey (the United States)
187 [33], and the Global School-based Student Health Survey [34]. There were five sections in the
188 survey. The first section focused on socio-demographic characteristics of the participants
189 including age (continuous), gender (male, female), marital status (single, married, cohabiting),
190 year of study in the university, living situation (with parent, relative, friend, partner, or alone),
191 perceived family economic status (wealthy, quite well-off, not very well-off, quite poor),
192 academic performance (excellent, good, fair, poor), weight (in kilograms, continuous), and
193 height (in centimeters, continuous). The second section collected information on vigorous-
194 intensity and moderate physical activities during the last seven days using the International
195 Physical Activity Questionnaire short version (IPAQ-S7S) [35].

196 Substance use, including tobacco use, alcohol drinking, and drug use, was covered in
197 the third section. Variables included current use of tobacco (yes, no), experience of daily
198 tobacco use (yes, no), frequency of smoking (not smoking, once or twice per week, weekly),
199 current status of alcohol drinking (non-drinker, very occasional drinker, occasional drinker,
200 regular drinker), average number of alcohol drinks during the past two weeks (cans or bottles
201 for beer and glasses for wine, continuous), and the use of illicit drugs (yes, no) during past 12
202 months.

203 Sexual behaviors were the focus of the fourth section. The participants were asked
204 questions on whether they had sexual intercourse during the past 12 months (yes, no), age
205 at first sexual intercourse (continuous), number of sexual partners during the past 12 months
206 (continuous), alcohol and drug use during the last sex (yes, no), condom use during the last
207 sex (yes, no), sex in exchange for money or gifts during the past 12 months (yes, no), condom
208 use during last sex in exchange for money or gifts, diagnosis of sexually transmitted infections
209 (STIs) during the past 12 months (yes, no), treatment seeking behaviors for the most recent
210 STI, and history of unwanted pregnancy in lifetime.

211 Eating, sleeping, and driving behaviors were covered in the last section. Overall, the
212 variables in this section collected information on the frequency and amount of fast food, soft
213 drinks, soda or sweet tea, high-fat snacks, margarine, butter, meat fat, fruits or vegetables,
214 and lean protein consumed during the past week. We also asked about the average sleeping
215 hours in 24 hours during the past week (continuous).

216

217 Data analyses

218 Data were cleaned and entered into a Microsoft Excel (version 2010) database and analyzed
219 using SPSS version 22.0 (IBM Corporation, New York, USA). Descriptive statistics were used to
220 compute means and standard deviations for continuous variables as well as frequencies and
221 percentages for categorical variables. Exploratory univariate and bivariate analyses were
222 conducted to measure the distribution of frequencies of variables. Bivariate analyses were
223 conducted using χ^2 test (or Fisher's exact test when a sample size was smaller than five in one
224 cell) for categorical variables and independent Student's *t*-test for continuous variables to
225 compare socio-demographic characteristics, health status, and health risk behaviors by
226 student sex.

227

228 Results

229 Of 1462 students approached, 1359 completed the questionnaire (a response rate of 92.9%).
230 The majority (98.6%) of those who declined the participation reported time constraint as the
231 main reason. About half (50.8%) of the respondents were male, and the mean age was 21.3
232 years (SD= 2.3). The majority (97.9%) of the respondents were single. Of the total, 36.5% was
233 in year one, and 70.8% reported fair academic performance. Almost half (43.8%) were living
234 with parents, and 67.3% reported coming from a not very well-off or quite poor family. There
235 were significant differences between male and female respondents in terms of age, living
236 situation, family economic conditions, height, and weight (Table 1).

237

238 **Table 1. Socio-demographic characteristics of male and female university students**

Variables	Frequency			<i>p</i> -value*
	Total <i>n</i> (%)	Male <i>n</i> (%)	Female <i>n</i> (%)	
Age (in years, mean \pm SD)	21.3 \pm 2.3	21.7 \pm 2.5	21 \pm 2.2	<0.001
Marital status				0.88
Single	1330 (97.9)	674 (97.7)	656 (98.1)	
Married	27 (2.0)	15 (2.2)	12 (1.8)	
Cohabiting	2 (0.1)	1 (0.1)	1 (0.1)	
Year of study in the university				0.15

Year 1	496 (36.5)	245 (35.5)	251 (37.5)	
Year 2	281 (20.7)	130 (18.8)	151 (22.6)	
Year 3	251 (18.5)	137 (19.86)	114 (17.0)	
Year 4	331 (24.3)	178 (25.8)	153 (22.9)	
Living arrangement				<0.001
Parent	595 (43.8)	271 (39.3)	324 (48.4)	
Relative	335 (24.6)	173 (25.1)	162 (24.2)	
Friends	346 (25.5)	188 (27.2)	158 (23.6)	
Couple	21 (1.5)	14 (2.0)	7 (1.0)	
Alone	18 (2.7)	44 (6.4)	18 (2.7)	
Perceived family economic status				<0.001
Wealthy	1 (0.1)	1 (0.2)	0 (0.0)	
Quite well-off	443 (32.6)	194 (28.2)	249 (37.2)	
Not very well off	846 (62.3)	449 (65.2)	397 (59.3)	
Quite poor	68 (5.0)	45 (6.5)	23 (3.4)	
Perceived academic performance				0.92
Excellent	57 (4.2)	29 (4.2)	28 (4.2)	
Good	303 (22.3)	157 (22.8)	146 (21.8)	
Faire	962 (70.8)	487 (70.6)	475 (71.0)	
Poor	37 (2.7)	17 (2.5)	20 (3.0)	
Weight (in kg, mean \pm SD)	53.0 \pm 9.1	57.7 \pm 8.5	48.1 \pm 6.9	<0.001
Height (in cm, mean \pm SD)	163.1 \pm 14.8	168.5 \pm 18.5	157.5 \pm 5.3	<0.001

239 *Abbreviations: n, number; SD, standard deviation.*

240 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*

241 *for categorical variables and independent Student's t-test for continuous variables.*

242

243 As shown in Table 2, 79.5% of the respondents had no vigorous intensity activity;

244 25.9% had no moderate-intensity activities; and 33.5% did not walk continuously for 10

245 minutes during the past seven days. More than half of those who had vigorous-intensity

246 activities (51.1%) and those who had moderate-intensity activities (59.6%) did it in a period

247 of less than 30 minutes. Of those who had walked continuously for at least 10 minutes, 73.1%

248 did it in a period of less than 30 minutes. There is a statistical difference between male and

249 female in the frequency and time spent on vigorous-intensity activities.

250 **Table 2. Physical activities among male and university students in the study**

Variables	Frequency			p-value
	Total	Male	Female	
	n (%)	n (%)	n (%)	
Work involved vigorous-intensity activities for ≥ 10 min continuously				0.001
Never	973 (71.7)	444 (64.4)	529 (79.5)	
Had 1-3 days/week	261 (19.3)	159 (23.1)	102 (15.3)	
Had 4-7 days/week	120 (8.9)	86 (12.5)	34 (5.1)	
Time usually spent doing vigorous-intensity activities on one of those days				0.001
≤ 30 minutes	161 (51.1)	89 (42.8)	72 (67.3)	
31-60 minutes	65 (20.6)	53 (25.5)	12 (11.2)	
> 60 minutes	89 (28.3)	66 (31.7)	23 (21.5)	
Work involved moderate-intensity activities for ≥ 10 min continuously				0.61
Never	352 (25.9)	185 (26.9)	167 (25.0)	
Had 1-3 days/week	564 (41.6)	278 (40.4)	286 (42.8)	
Had 4-7 days/week	441 (32.5)	226 (32.8)	215 (32.2)	
Time spent doing moderate-intensity activities on one of those days				0.94
≤ 30 minutes	514 (59.6)	264 (60.0)	250 (59.1)	
31-60 minutes	204 (23.6)	104 (23.6)	100 (23.6)	
> 60 minutes	145 (16.8)	72 (16.4)	73 (17.3)	
Days walking for ≥ 10 min continuously to get to and from places				0.08
Never	470 (34.7)	247 (35.9)	223 (33.5)	
Had 1-3 days/week	338 (24.9)	154 (22.4)	184 (27.6)	
Had 4-7 days/week	547 (40.4)	288 (41.8)	259 (38.9)	
Time usually spent walking on one of those days				0.19
≤ 30 minutes	545 (73.1)	261 (70.2)	284 (75.9)	
31-60 minutes	111 (14.9)	60 (16.1)	51 (13.6)	
> 60 minutes	90 (12.1)	51 (13.7)	39 (10.4)	

251 *Abbreviations: n, number.*

252 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used.*

253

254 Table 3 shows that 38.3% of the respondents reported currently drinking alcohol, 1.1%
 255 smoking tobacco, and 0.4% using illicit drugs during the past 12 months. Of those who
 256 reported using illicit drugs during the past 12 months, 50% used methamphetamines, 25%
 257 used heroine, and 25% used other types of drugs. Among those who reported alcohol
 258 drinking, average number of days they drank during the past two weeks was 1.3 (SD= 2.0),
 259 and average number of alcoholic drinks used during the past two weeks was 1.8 (SD= 2.9).
 260 There were statistically significant gender differences in frequency of smoking, frequency in
 261 alcohol drinking, and average number of alcoholic drinks used during the past two weeks.

262

263 **Table 3. Substance use among male and female university students in the study**

Variables	Frequency			p-Value
	Total n (%)	Male n (%)	Female n (%)	
Current tobacco smokers				0.47
Yes	15 (1.1)	9 (1.3)	6 (0.9)	
No	1344 (98.9)	681 (98.7)	663 (99.1)	
Experience of daily smoking for at least 30 days				0.16
Yes	8 (0.6)	6 (0.9)	2 (0.3)	
No	1351 (99.4)	684 (99.1)	667 (99.7)	
Frequency of smoking during the past 3 months				0.002
I don't smoke	1343 (98.8)	676 (98.0)	667 (99.8)	
Once or twice	13 (1.0)	12 (1.7)	1 (0.1)	
Weekly	3 (0.2)	2 (0.3)	1 (0.1)	
Would you describe yourself as:				<0.001
Non-drinker	838 (61.7)	274 (39.7)	564 (84.3)	
Very occasional drinker	367 (27.0)	292 (42.3)	75 (11.2)	
Occasional drinker	151 (11.1)	121 (17.5)	30 (4.5)	
Regular drinker	3 (0.2)	3 (0.4)	0 (0.0)	
Average number of days drinking alcohol during the past 2 weeks (mean ± SD)	1.2 ± 2.0	1.4 ± 2.2	0.7 ± 2.0	0.001

Average number of alcohol drinks [†] during the past 2 weeks (mean ±SD)	1.8 ± 3.0	2.1 ± 3.1	1.1 ± 2.2	0.002
Used illicit drugs during the past 12 months				0.33
Yes	4 (0.3)	3 (0.4)	1 (0.1)	
No	1355 (99.7)	687 (99.6)	668 (99.9)	

264 *Abbreviations: n, number; SD, standard deviation.*

265 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*
 266 *for categorical variables and independent Student's t-test for continuous variables.*

267 *†Can was a unit used for beer and glass for wine.*

268

269 Regarding sexual behaviors (Table 4), 10.6% of the respondents reported having
 270 sexual intercourse during the past 12 months with an average number of sexual partners of
 271 2.1 (SD= 2.4). Among those who responded, 42.4% reported not using condom, and 6.3%
 272 reported using alcohol during their last sexual intercourse. Only 9.2% reported having sex in
 273 exchange for money or gifts. Less than one in 10 (7.1%) reported having been diagnosed with
 274 an STI in the past 12 months; of whom, 60% sought for treatment for the most recent STI.
 275 Among students who reported having sexual intercourse in the past 12 months, 12.7%
 276 reported having been or made someone pregnant in lifetime. There were significant gender
 277 differences in sexual encounter, mean number of sexual partners, condom use, and
 278 experience in having sex with commercial partners.

279

280 **Table 4. Sexual behaviors among male and female university students in the study**

Variables	Frequency			p-Value
	Total n (%)	Male n (%)	Female n (%)	
Had sexual intercourse in the past 12 months				<0.001
Yes	144 (10.6)	119 (17.3)	25 (3.7)	
No	1215 (89.4)	571 (82.7)	644 (96.3)	
Alcohol use during last sex				0.60
Yes	9 (6.3)	8 (6.8)	1 (4.0)	
No	134 (93.7)	110 (93.2)	24 (96.0)	

Condom use during last sex				0.004
Yes	83 (57.6)	75 (63.0)	8 (32.0)	
No	61 (42.4)	44 (37.0)	17 (68.0)	
Sex in exchange for money or gifts				0.08
Yes	13 (9.2)	13 (11.2)	0 (0)	
No	128 (90.8)	103 (88.8)	25 (100)	
Condom use during last sex in exchange for money or gifts				N/A
Yes	8 (61.5)	8 (61.5)	N/A	
No	5 (38.5)	5 (38.5)	N/A	
Diagnosed with a sexually transmitted infection in the past 12 months				0.51
Yes	10 (7.1)	9 (7.8)	1 (4.0)	
No	131 (92.9)	107 (92.2)	24 (96.0)	
Sought for treatment for the most recent sexually transmitted infection				0.39
Yes	6 (60.0)	5 (55.6)	1 (100)	
No	4 (40.0)	4 (44.4)	0 (0)	
Ever made someone pregnant/been pregnant				0.58
Yes	18 (12.7)	14 (12.0)	4 (16.0)	
No	124 (87.3)	103 (88.0)	21 (84.0)	
Age at first sexual intercourse (in years, mean± SD)	20.6 ± 3.2	20.7 ± 2.9	20.2 ± 4.4	0.47
Number of partner during the past 12 months (mean± SD)	2.1 ± 2.4	2.3 ± 2.6	1.0 ± 0.2	0.02
Age first made someone pregnant/became pregnant (in years, mean± SD)	23.1 ± 3.2	23.3 ± 3.4	22.3 ± 2.3	0.65

281 *Abbreviations: n, number; SD, standard deviation.*

282 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*

283 *for categorical variables and independent Student's t-test for continuous variables.*

284

285 Table 5 presents eating behaviors among the participants. Of the total, 33.6% reported

286 having fast food once or twice per week, and 5.3% having it three times or more per week.

287 More than half (57.3%) reported drinking soft or sweet drinks once or twice per week, and

288 26.0% drinking three times or more per week. About two-thirds (63.9%) reported consuming

289 high-fat snacks once or twice per week, and 13.5% consuming three times or more per week.
 290 Similarly, 51.2% reported consuming fat and its associated products daily, and 7.2%
 291 consuming a lot of them. About one in ten (9.9%) reported not consuming any fruits and
 292 vegetables, and 12.1% not consuming any lean meat in the past week.

293

294 **Table 5. Eating, sleeping, and driving behaviors among male and female university**
 295 **students**

Variables	Frequency			<i>p</i> -Value
	Total <i>n</i> (%)	Male <i>n</i> (%)	Female <i>n</i> (%)	
Times do eating fast food per week				<0.001
0 times	881 (61.1)	457 (66.2)	374 (55.9)	
1-2 times	456 (33.6)	201 (29.1)	255 (38.1)	
3 or more times	72 (5.3)	32 (4.6)	40 (6.0)	
Number of soft drinks, glasses of soda or sweet tea consumed per day				0.01
None	226 (16.6)	100 (14.5)	126 (18.8)	
1-2	779 (57.3)	389 (56.4)	390 (58.3)	
3 or more	354 (26.0)	201 (29.1)	153 (22.9)	
Times consuming high-fat snacks per week				0.001
0 times	307 (22.6)	174 (25.2)	133 (19.9)	
1-2 times	869 (63.9)	445 (64.5)	424 (63.4)	
3 or more times	183 (13.5)	71 (10.3)	112 (16.7)	
Amount of margarine, butter, meat fat consumed				0.67
None or very little	565 (41.6)	285 (41.3)	280 (41.9)	
Some	696 (51.2)	351 (50.9)	345 (51.6)	
A lot	98 (7.2)	54 (7.8)	44 (6.6)	
Number of servings of fruits or vegetables consumed per day				0.006
0 servings	134 (9.9)	84 (12.2)	50 (7.5)	
1-2 servings	755 (55.6)	385 (55.8)	370 (55.3)	
3 or more servings	470 (34.6)	221 (32.0)	249 (37.2)	
Times consuming lean protein per week				0.81

0 times	164 (12.1)	83 (12.0)	81 (12.1)	
1-2 times	874 (64.3)	439 (63.6)	435 (65.0)	
3 or more times	321 (21.6)	168 (24.3)	153 (22.9)	
Self-perception on body weight				<0.001
Overweight	408 (30.0)	157 (22.8)	251 (37.5)	
About right	496 (36.5)	251 (36.4)	245 (36.6)	
Underweight	455 (33.5)	282 (40.8)	173 (25.8)	
Problem with sleeping in the last 30 days				0.98
None	215 (15.8)	110 (15.9)	105 (15.7)	
Mild	454 (33.4)	231 (33.5)	223 (33.3)	
Moderate	587 (43.2)	295 (42.8)	292 (43.6)	
Severe	103 (7.6)	54 (7.8)	49 (7.3)	
Used seatbelt when driving a car or other motor vehicle in the past 30 days				0.04
I did not drive	756 (55.6)	397 (57.5)	359 (53.7)	
Never	211 (15.5)	88 (12.8)	123 (18.4)	
Rarely	93 (6.8)	44 (6.4)	49 (7.3)	
Sometimes	108 (7.9)	60 (8.7)	48 (7.2)	
Most of the time	68 (5.0)	41 (5.9)	27 (4.0)	
Always	123 (9.1)	60 (8.7)	63 (9.4)	
Used a helmet when riding a bicycle in the past 30 days				0.04
I did not ride	156 (11.5)	64 (9.3)	92 (13.8)	
Never	49 (3.6)	22 (3.2)	27 (4.0)	
Rarely	33 (2.4)	19 (2.8)	14 (2.1)	
Sometimes	51 (3.8)	29 (4.2)	22 (3.3)	
Most of the time	319 (23.5)	179 (25.9)	140 (25.9)	
Always	751 (55.3)	377 (54.6)	374 (55.9)	
Drove a car or other motor vehicle after drinking alcohol in the past 30 days				<0.001
I did not drive	371 (27.3)	151 (21.9)	220 (32.9)	
0 times	797 (58.6)	370 (53.6)	427 (63.8)	
1 time	120 (8.8)	105 (15.2)	15 (2.2)	
2-3 times	52 (3.8)	48 (7.0)	4 (0.6)	

≥4 times	19 (1.4)	16 (2.3)	3 (0.4)	
Average sleeping hours/24h during the past week (± SD)	7.2 ± 1.5	7.2 ± 1.5	7.3 ± 1.5	0.15

296 *Abbreviations: n, number; SD, standard deviation.*

297 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*

298 *for categorical variables and independent Student's t-test for continuous variables.*

299

300 As also shown in Table 5, on average, participants reported sleeping 7.2 hours per day

301 (SD= 1.5), while 33.4% reported having mild sleeping problems, and 50.8% having moderate

302 or severe sleeping problems. Of those who used a car in the past 12 months, 22.3% never or

303 rarely used a seatbelt. Of those who used a motorbike, 6.0% never or rarely used a helmet.

304 Regarding drunk driving, 14.0% reported driving or riding a vehicle after drinking at least once

305 during the past 30 days. There were significant sex differences in the frequency of

306 consumption of fast food and high-fat snacks, amount of soft or sweet drinks, fat and fat-

307 associated products, and fruits or vegetables. Perception on body weight, seatbelt and helmet

308 use, and drunk driving practice also differed significantly among the two sexes.

309

310 **Discussion**

311 This study is among the few investigations into health behaviors of Cambodian university

312 students. There were a comparable number of male and female respondents, and they came

313 from all years of the undergraduate programs. While many major findings above are perhaps

314 more or less in line with findings elsewhere or in other studies of Cambodian youths, there

315 are some exceptions too.

316 A positive point about the students' health behaviors is that the majority of the

317 respondents were not involved in any of the major health-risk behaviors, including tobacco

318 use, drug use, alcohol consumption, and sexual activities, and hence they could veer from

319 negative outcomes from such behaviors. Some of these findings seem to contradict with or

320 different from those of previous studies conducted on university students or youths, more

321 broadly, in Cambodia [36] or elsewhere [37]. Reproductive health issues and casual sex, for

322 instance, were reportedly higher among other Cambodian youth groups [25,38]. The self-

323 reported consumption of alcohol seemed to be relatively lower than that of adolescents in

324 Cambodia and in some other countries in the region as reported in other studies [6,39,40].

325 This may also be applied to the use of tobacco [41].

326 Such positive results are good for individual development and public health, given the
327 grave consequences from their consumption or involvement on the individuals' health and
328 finance and on the government and society at large [11,37]. Alcohol and drug abuse, for
329 instance, are known to be negatively associated with individuals' and family wellbeing and
330 can incur high societal and economic cost to the government [42], while drug use and
331 trafficking is a barrier to achieving international development, including the Sustainable
332 Development Goals [42]. A systematic review of alcohol consumption and disease burden
333 found that alcohol impacts many disease outcomes (both chronic and acute) and injuries,
334 including death [43]. Another systematic review indicated that heavy alcohol consumption in
335 the late adolescence continues into adulthood and is associated with alcohol problems [44].

336 Besides, there were some positive eating behaviors among the students too according
337 to their self-report, i.e. low consumption of fast food, soft and sweet drinks, high-fat snacks,
338 and fat and fat-associated products, as well as quite adequate sleep. The findings on healthy
339 dietary behaviors from other studies are inconclusive, with some indicating that students
340 elsewhere have 'satisfactory' eating habits, while others reported concerning behaviors
341 [17,45]. Public health policies in Cambodia should take advantage of and sustain these
342 positive behaviors and try to promote such behaviors beyond their university life.

343 While students' limited involvement in major health-risk behaviors and some positive
344 health behaviors are plausible, many other negative health behaviors were concerning. These
345 issues include relatively high consumption of soft and sweet drinks; low consumption of fruits,
346 vegetables, and lean protein; sleep disorders; low frequency in usage of a seatbelt and
347 helmet; and drunk driving practices. Many of these behaviors can have negative implications
348 for individual health, as many of them are more susceptible to the modern health risks
349 [8,9,11,16,45], which may result in big financial burden and social costs on the individuals and
350 government in the future.

351 Another noticeable negative instance was the inactive lifestyles of many participants.
352 The majority of them never had any vigorous- or moderate-intensity activities, and never
353 walked continuously for 10 minutes or more. For those who had vigorous-intensity activities,
354 moderate-intensity activities, and walked continuously for 10 minutes or so, the majority
355 reported to have done so for less than 30 minutes, the level of daily moderate-intensity
356 activity recommended by the World Health Organization for a healthy lifestyle [46]. Other

357 studies also found that university students had inactive lifestyles [7,45]. Apart from the
358 proactive response from the national policy, therefore, Cambodian universities may need to
359 promote healthy lifestyles and habits; for example, through extracurricular activities and
360 social engagement.

361 Differences between the two sexes can be observed in some areas. First, female
362 students were observed to have better dietary behaviors and nutritional knowledge, perhaps
363 due to the need to watch over one's weight and stronger beliefs in healthy eating [17,45].
364 Second, there was a significant difference between male and female students in smoking
365 frequency, frequency and amount of alcohol consumption [6], sexual activities including
366 number of partners and condom use, frequency of fast food and high-fat snack consumption,
367 and amount of soft and sweet drinks. Third, there is a statistically significant difference
368 between the two sexes in the involvement of vigorous-intensity activities and time spent on
369 the activities. Gender differences can also be seen in the amount of fruits and vegetables
370 consumed, perception of body weight, frequency in usage of seatbelts and helmets, and
371 frequency of drunk driving practices. Other studies also found gender differences in physical
372 activities (male being more active) and body weight [7,45]. Given the sex differences in many
373 outcome variables (including negative health risk behaviors), a gender lens may be considered
374 in any potential interventions and policy considerations.

375 Overall, the negative health behaviors and lifestyles could present multiple health
376 risks, especially the threat from chronic diseases and/or severe health conditions, to the
377 participants in the future [2,3,47], depending on the intensity of their current health
378 behaviors, risks and lifestyles, and the changes in behaviors and lifestyles in the future.
379 Coupled with the health risks associated with economic underdevelopment, they may be
380 facing, that is, according to the family status of a majority of the respondents, e.g., 67.3% of
381 them reported as not very well off or quite poor, which had a negative repercussion on or
382 implications for their diet and quality of the food consumed, among others, that they may
383 face these other health risks in the future is certainly high [6,11]. This prediction could be
384 more accurate and precise through regression analyses of the response, which is not the case
385 in this article. However, given the response and the multiple unhealthy and risky health
386 behaviors and lifestyles reported by many of the respondents, chances are very high that
387 many of the health risk factors could co-occur among many of them. It is commonly
388 understood that negative health behaviors, attitudes, and lifestyles formed during childhood

389 and adolescence have a profound impact on future health behaviors and lifestyles of the
390 individuals. They will have significant negative impact on the individual health as well as
391 familial economy and will be a big burden for the public policy to address in the future
392 [3,16,18,33].

393 This study has some limitations. Firstly, the cross-sectional design could capture only
394 a snapshot view of the study population and could not document changes in the variables
395 over time. Given that conduct of student or youth health surveys are a rare phenomenon in
396 Cambodia, findings from this study can provide some pioneering thoughts on the issue.
397 Nevertheless, it must be underlined that many respondents reportedly adopted positive
398 health behaviors and lifestyles, which may co-occur [17], although whether they co-occur was
399 not examined in this study and warrant further analyses and research. Many of the health
400 issues need to be examined into more details – examples include quality and adequacy of the
401 food consumed, quality of sleep, and rigorousness of the physical activities. Other health and
402 associated issues that may be addressed in the future research include mental health, family
403 environment, and peer pressure. Secondly, the self-reported measures may have led to social
404 desirability bias, particularly for sensitive information such as sexual behaviors and substance
405 abuse. Future studies may want to triangulate the data through, for example, adoption of a
406 mixed-method study. Third, the study may benefit from multiple regression analyses and
407 multi-factorial association tests, which may shed better light on the results that would provide
408 more nuanced and comprehensive findings. However, given that this paper attempts only to
409 present broad basic description of the students' health behaviors, this is beyond the scope of
410 our study. Finally, this study included a sample of students selected from only two major
411 universities located in the capital city and a province; therefore, findings from this study may
412 not be generalized to a wider university student population in the country. However, because
413 this is one of the few studies on Cambodian students' health, it can provide policy implications
414 for national health and education policy makers as well as the university community.

415

416 **Conclusions**

417 Despite the above-mentioned limitations, our study provides preliminary insights into health-
418 related behaviors among university students in Cambodia. We found that the prevalence of
419 some health risks (such as risky sexual behaviors, tobacco use, alcohol consumption, and illicit

420 drug use) among university students in this study was plausibly low. However, the rates of
421 many other negative health behaviors (inactive lifestyle, high consumption of unhealthy food,
422 and low consumption of healthy) were concerning. These health risks may predict later poor
423 health including increased risks of non-communicable chronic diseases such as diabetes,
424 hypertension, and other cardiovascular disease among this potential population. Further
425 studies are needed to explore factors associated with specific health risk behaviors and
426 effective intervention programs for promoting university student health in Cambodia. Effort
427 may be needed to conduct such surveys on a more regular basis and on a larger scale to better
428 inform public health programs and policies.

429

430 **Acknowledgements**

431 The authors thank research assistants and the study participants for their contribution to this
432 study. We also thank staff members at the Royal University of Phnom Penh and University of
433 Battambang for their support during the data collection.

434

435 **Author Contributions**

436 **Conceptualization:** Siyan Yi, Khuondyla Pal, Sovannary Tuot.

437 **Data curation:** Siyan Yi, Khuondyla Pal, Say Sok.

438 **Formal analysis:** Khuondyla Pal, Say Sok, Siyan Yi.

439 **Funding acquisition:** Sovannary Tuot, Siyan Yi.

440 **Investigation:** Siyan Yi, Khuondyla Pal, Pheak Chhoun, Rosa Yi, Sovannary Tuot, Say Sok.

441 **Methodology:** Siyan Yi, Khuondyla Pal, Pheak Chhoun, Rosa Yi, Say Sok, Sovannary Tuot.

442 **Project administration:** Khuondyla Pal, Sovannary Tuot, Pheak Chhoun, Rosa Yi.

443 **Resources:** Siyan Yi, Sovannary Tuot.

444 **Software:** Siyan Yi, Say Sok.

445 **Supervision:** Khuondyla Pal, Pheak Chhoun, Rosa Yi, Sovannary Tuot, Siyan Yi.

446 **Validation:** Siyan Yi, Say Sok, Sovannary Tuot.

447 **Visualization:** Sovannary Tuot, Say Sok, Siyan Yi.

448 **Writing – original draft:** Say Sok, Khuondyla Pal, Siyan Yi.

449 **Writing – review & editing:** Siyan Yi, Say Sok, Khuondyla Pal, Sovannary Tuot, Pheak

450 Chhoun, Rosa Yi.

451

452 **References**

- 453 1. Department of Chronic Diseases and Health Promotion, World Health Organization.
454 Preventing chronic diseases: a vital statement. Geneva: World Health Organization;
455 2005.
- 456 2. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United
457 States, 2000. *JAMA*. 2004;291(10):1238-45.
- 458 3. Yusuf S, Hawken S, Ounpuu S, Dans T, Avezum A, Lanas F, et al. Effect of potentially
459 modifiable risk factors associated with myocardial infarction in 52 countries (the
460 INTERHEART study): case-control study. *Lancet*. 2004;364(9438):937-52.
- 461 4. Danaei G, Vander Hoorn S, Lopez AD, Murray CJ, Ezzati M. Causes of cancer in the
462 world: comparative risk assessment of nine behavioural and environmental risk
463 factors. *Lancet*. 2005;366(9499):1784-93.
- 464 5. Lawlor DA, O'Callaghan MJ, Mamun AA, Williams GM, Bor W, Najman JM.
465 Socioeconomic position, cognitive function, and clustering of cardiovascular risk
466 factors in adolescence: findings from the Mater University Study of Pregnancy and its
467 outcomes. *Psychosomatic Medicine*. 2005;67(6):862-8.
- 468 6. Peltzer K, Pengpid S. Heavy drinking and social and health factors in university
469 students from 24 low, middle income and emerging economy countries. *Community
470 Ment Health J*. 2016;52(2):239-44.
- 471 7. Pengpid S, Peltzer K, Kassean HK, Tsala JP, Sychareun V, Müller-Riemenschneider F.
472 Physical inactivity and associated factors among university students in 23 low-,
473 middle-and high-income countries. *Int J Public Health*. 2015;60(5):539-49.
- 474 8. Meng L, Maskarinec G, Lee J, Kolonel LN. Lifestyle factors and chronic diseases:
475 application of a composite risk index. *Prev Med*. 1999;29(4):296-304.
- 476 9. Alamian A, Paradis G. Individual and social determinants of multiple chronic disease
477 behavioral risk factors among youth. *BMC Public Health*. 2012;12:224.
- 478 10. World Health Organization. Global health risks: mortality and burden of disease
479 attributable to selected major risks. Geneva: World Health Organization; 2009.
- 480 11. Peltzer K, Pengid S. Health behaviour interventions in developing countries. New
481 York: Nova Publishers; 2011.

- 482 12. Rieger M. Risk aversion, time preference and health production: Theory and
483 empirical evidence from Cambodia. *Econ Hum Biol.* 2015;17:1-15.
- 484 13. Fukuoka Y, Choi J, S Bender M, Gonzalez P, Arai S. Family history and body mass
485 index predict perceived risks of diabetes and heart attack among community-
486 dwelling Caucasian, Filipino, Korean, and Latino Americans—DiLH Survey. *Diabetes*
487 *Res Clin Pract.* 2015;109(1):157-63.
- 488 14. Hawkins JD, Catalano RF, Miller JY. Risk and protective factors for alcohol and other
489 drug problems in adolescence and early adulthood: implications for substance abuse
490 prevention. *Psychol Bull.* 1992;112(1):64-105.
- 491 15. Perera S, Eisen R, Bawor M, Dennis B, de Souza R, Thabane L. Association between
492 body mass index and suicidal behaviors: a systematic review protocol. *Syst Rev.*
493 2015;4:52.
- 494 16. Steptoe A, Wardle J, Cui W, Bellisle F, Zotti AM, Baranyai R, et al. Trends in smoking,
495 diet, physical exercise, and attitudes toward health in European university students
496 from 13 countries, 1990-2000. *Prev Med.* 2002;35(2):97-104.
- 497 17. Pengpid S, Peltzer K. Dietary health behaviour and beliefs among university students
498 from 26 low, middle and high income countries. *Asia Pac J Clin Nutr.* 2015;24(4):744-
499 52.
- 500 18. Steptoe A, Wardle J. Cognitive predictors of health behaviour in contrasting regions
501 of Europe. *Br J Clin Psychol.* 1992;31:485-502.
- 502 19. Tapert SF, Brown GG, Kindermann SS, Cheung EH, Frank LR, Brown SA. fMRI
503 measurement of brain dysfunction in alcohol-dependent young women. *Alcohol Clin*
504 *Exp Res.* 2001;25(2):236-45.
- 505 20. Banta JE, Addison A, Job JS, Yel D, Kheam T, Singh PN. Patterns of alcohol and
506 tobacco use in Cambodia. *Asia Pac J Public Health.* 2013;25(5 Suppl):33S-44S.
- 507 21. Schulenberg JE, Maggs JL. A developmental perspective on alcohol use and heavy
508 drinking during adolescence and the transition to young adulthood. *J Stud Alcohol*
509 *Suppl.* 2002;(14):54-70.
- 510 22. Douglas KA, Collins JL, Warren C, Kann L, Gold R, Clayton S, et al. Results from the
511 1995 National College Health Risk Behavior Survey. *J Am Coll Health.* 1997;46(2):55-
512 66.

- 513 23. Nanakorn S, Osaka R, Chusilp K, Tsuda A, Maskasame S, Ratanasiri A. Gender
514 differences in health-related practices among university students in northeast
515 Thailand. *Asia Pac J Public Health*. 1999;11(1):10-5.
- 516 24. Peltzer K. Health behaviour in Black South African university students. *S Afr J Psychol*.
517 2000;30(4),46-49.
- 518 25. Yi S, Tuot S, Yung K, Kim S, Chhea C, Saphonn V. Factors associated with high-risk
519 sexual behavior among unmarried male and female most-at-risk young people in
520 Cambodia. *Am J Public Health Res*. 2014;2:211-20.
- 521 26. Yi S, Poudel KC, Yasuoka J, Palmer PH, Yi S, Jimba M. Role of risk and protective
522 factors in risky sexual behavior among high school students in Cambodia. *BMC Public*
523 *Health*. 2010;10:477.
- 524 27. Currie C, Hurrelmann K, Settertobulte W, Smith R, Todd J. *Health and Health*
525 *Behaviour among Young People*. Copenhagen: World Health Organization; 2000.
- 526 28. National Institute for Health and Care Excellence, United Kingdom. *Behaviour*
527 *change: genervious change: general approaches*. Manchester: National Institute for
528 *Health and Care Excellence*; 2007.
- 529 29. Dinger MK, Waigandt A. Dietary intake and physical activity behaviors of male and
530 female college students. *Am J Health Promot*. 1997;11(5):360-2.
- 531 30. Steptoe A. *An international study of personal heath behaviour, attitudes and well-*
532 *being in university students*. London: University of London; 2003.
- 533 31. Cambodia Development Resource Institute. *Anatomy of Higher Education*
534 *Governance in Cambodia*. Phnom Penh: Cambodia Development Resource Institute;
535 2013.
- 536 32. Steptoe A, Wardle J. The European health and behaviour survey: the development of
537 an international study in health psychology. *Psychol Health*. 1996;11:49-73.
- 538 33. Centers for Disease Control and Prevention. *Youth Risk Behavior Surveillance:*
539 *National College Health Risk Behavior Survey – United States, 1995*. *MMWR Morb*
540 *Mortal Wkly Rep*. 1997;46(SS-6):1-54.
- 541 34. Centers for Disease Control and Prevention. *Global School-based Student Health*
542 *Survey (GSHS)*. Atlanta: Centers for Disease Control and Prevention; 2014.

- 543 35. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al.
544 International physical activity questionnaire: 12-Country reliability and validity. *Med*
545 *Sci Sports Exerc.* 2003;35(8):1381-95.
- 546 36. Yi S, Poudel KC, Yasuoka J, Palmer PH, Yi S, Jimba M. Risk vs. protective factors for
547 substance use among adolescents in Cambodia. *J Subst Use.* 2011;16(1):14-26.
- 548 37. Efroymson D, Ahmed S, Townsend J, Alam SM, Dey AR, Saha R, et al. Hungry for
549 tobacco: an analysis of the economic impact of tobacco consumption on the poor in
550 Bangladesh. *Tob Control.* 2001;10(3):212-7.
- 551 38. Sopheab H, Fylkesnes K, Vun MC, O'Farrell N. HIV-related risk behaviors in Cambodia
552 and effects of mobility. *J Acquir Immune Defic Syndr.* 2006;41(1):81-6.
- 553 39. Gover PJ, Daan Aalders GJ. Does prevention have anything to do with it? Phnom
554 Penh: *Cambodian Communication Review*; 2014.
- 555 40. Gover PJ, Daan Aalders GJ. Beyond Curiosity: A Re-examination of Positive
556 Preventative Messages within the Cambodian Press. Phnom Penh: *Cambodian*
557 *Communication Review*; 2016.
- 558 41. Agaku IT, King BA, Husten CG, Bunnell R, Ambrose BK, Hu SS, et al. Tobacco product
559 use among adults--United States, 2012-2013. *MMWR. Morbidity and mortality*
560 *weekly report.* 2014;63(25):542-7.
- 561 42. Singer M. Drugs and development: the global impact of drug use and trafficking on
562 social and economic development. *Int J Drug Policy.* 2008;19(6):467-78.
- 563 43. Rehm J, Baliunas D, Borges GL, Graham K, Irving H, Kehoe T, et al. The relation
564 between different dimensions of alcohol consumption and burden of disease: an
565 overview. *Addiction.* 2010;105(5):817-43.
- 566 44. McCambridge J, McAlaney J, Rowe R. Adult consequences of late adolescent alcohol
567 consumption: a systematic review of cohort studies. *PLoS Med.* 2011;8(2):e1000413.
- 568 45. Yahia N, Wang D, Rapley M, Dey R. Assessment of weight status, dietary habits and
569 beliefs, physical activity, and nutritional knowledge among university students.
570 *Perspect Public Health.* 2016;136(4):231-44.
- 571 46. World Health Organization. Global recommendations on physical activity for health.
572 Geneva: World Health Organization; 2010.

573 47. Peltzer K, Pengpid S, Yung TK, Aounallah-Skhiri H, Rehman R. Comparison of health
574 risk behavior, awareness, and health benefit beliefs of health science and non-health
575 science students: An international study. *Nurs Health Sci.* 2016;18(2):180-7.

576

577 **Supporting information**

578 **S1 File. STROBE checklist for cross-sectional studies**

579

580

581

582

583

584

585

586

587

588