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Social and behavioral factors associated with depressive symptoms among university students in Cambodia: A cross-sectional study

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3	1	Social and behavioral factors associated with depressive symptoms among university
4 5 6	2	students in Cambodia: A cross-sectional study
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Objective To explore social and behavioral factors associated with depressive symptoms among university students in Cambodia. Design Cross-sectional study. Settings Two public universities, one in the capital city of Phnom Penh and another in Battambang provincial town. Participants This study included 1,359 students randomly selected from all departments in the two universities using a multi-stage cluster sampling method for a self-administered questionnaire survey in 2015. **Primary outcome measure** Depressive symptoms measured by using the Center for Epidemiologic Studies Depression scale (CES-D). **Results** The proportion of students with depressive symptoms and severe depressive symptoms were 50.6% and 19.6%, respectively. Students with depressive symptoms were significantly more likely to report poor academic performance (AOR=7.31, 95% CI=2.24-23.86), having thought of ending life (AOR=1.60, 95% CI=1.01-2.56), higher consumption of unhealthy food (AOR=1.72, 95% CI=1.08-2.76), severe problem with sleeping (AOR=2.81, 95% CI=1.31-6.06), a negative perception about their body shape (AOR=0.54, 95% CI=0.29-0.99) and their general health status (AOR=2.99, 95% CI= 1.28-7.00), and limited physical activeness (AOR=0.30, 95% CI=0.16-0.58). Students with depressive symptoms were also significantly more likely to encounter physical violence (AOR=1.39, 95% CI=1.04-1.86) and psychological abuse (AOR=1.82, 95% CI=1.37-2.42), and lack of general and medical care (AOR=0.51, 95% CI=0.30-0.86) by their family when they were growing up. **Conclusions** The key factors associated with depressive symptoms were family-related and

individual behaviors and attitudes. Thus, efforts should be invested in comprehensive screening and intervention programs to diagnose those vulnerable students early, offer immediate treatment, and cater appropriate support.

ABSTRACT

Strengths and limitations of this study

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determine mental health status of university students in resource-poor settings.

multi-stage cluster sampling method.

mental health of university students.

bias of self-reported measures.

This research is among a very few studies in which standardized tools are used, and

rigorous analyses were performed to explore social and behavioral factors that may

It included a large sample students randomly selected from all departments in two

public universities – one in the capital city and another one in a provincial town – using a

Several factors in different domains were identified highlighting particular efforts that

should be invested in comprehensive screening and intervention programs to improve

Limitations of the study included the representativeness of the study sample, the

cross-sectional nature of the data that limits causation inferences, and potential

71 INTRODUCTION

University students have poorer health and higher rates of mental disorders, notably depression and anxiety, compared with their peers globally.¹⁻⁵ Depression is one of the most prevalent mental health problems among university students, and the prevalence is rising.⁶⁷ There are varied prevalence estimates of depressive symptoms among university students, ranging from in the area of 10%⁸⁻¹¹ to in the region of 20%¹² and up to 40% and 80%.¹³⁻¹⁵ However, the mean prevalence of depression in university students stands at 30.6%.⁶ University students are in a critical period of life since they transition from adolescence to adulthood, which requires them to make many major decisions. During this period, they encounter tremendous pressures, chiefly from economic stress, academic demands, interpersonal relationships, and struggles with making crucial decisions.¹⁶

Depression manifests in a wide range of symptoms, encompassing sleep and eating disturbances, lack of self-care, poor concentration, anxiety, and disinterest in everyday activities.¹⁷ For university students, depression is correlated with poor academic achievements;¹⁸ drop-out;^{19 20} relationship instability;²¹ suicidal ideation, attempts, and conducts;^{18 23 23} poor work performance;²⁴ substance abuse;^{25 26} acute infectious illnesses;²⁷ and

poor physical and mental health in general.^{28 29} Moreover, depression in this early period can build up negative consequences in adult life through its impacts on career prospects and social relationships.^{30 31}

Thus, tackling depression among university students is vital since most lifetime mental disorders commence during the university age,³² and their mental health has essential ramifications for campus health services in particular and mental health policy-making in general. ^{33 34} Put another way, from a public health standpoint, early detection and prevention of mental health problems among young adults in higher education is paramount. Comprehension of their salient psychological distress, namely depression, and its correlates, would enable tailor-made screening and intervention programs to prevent mental health defects in this population. This is integral for their educational performance and triumph in their prospective profession as well as for the national advancement since they are future leaders.

The prevalence of depression is induced by many factors, including study populations, socio-demographics,^{16 35} study sites,^{16 36} diagnostic tools and sampling methods,^{36 37} and socio-cultural environments.¹⁶ Contextualization of facets linked with depression thus is significant for mitigation measures.

In Cambodia, little is known about social and behavioral determinants of depressive symptoms among student populations. In 2012, a study on 1,943 students at 11 junior high and high schools found that exposure to violence among community members, peers, or family was a predictor for depressive symptoms in the students.^{38 39} A 2013 study on a sample of 28 students at a Cambodian university found that life events, problems of everyday life, and availability of social support were the main stress factors affecting students' life satisfaction.⁴⁰ Moreover, exposure to daily hassles was a stress factor having a strong impact on students' psychological and somatic responses. Nonetheless, no research has been conducted to examine social and behavioral determinants of depression among Cambodian university students. This study therefore intends to identify factors associated with depressive symptoms among university students in Cambodia.

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1 2		
3 4	116	METHODS
5	117	Study sites and population
7	118	This cross-sectional study was conducted with students at the University of Battambang (UB) in
8 9	119	Battambang province and the Royal University of Phnom Penh (RUPP) in the capital city of
10 11	120	Cambodia in June and July 2015. Epi Info was used to calculate the sample size from the
12 13	121	university student population of approximately 168,000.41 The anticipated percentage
14 15	122	frequency was not known, so 50% was put for the calculation to prevent any underestimated
16 17	123	prevalence. Based on a 95% confidence level (CI) and a +5% margin of error, the minimum
17	124	sample size required for this study was 767 students. Adjusted for 10% of incomplete
19 20	125	responses, missing data, and rejection rate, the final minimum required sample size was 850
21 22	126	students.
23 24	127	
25 26	128	Sampling and data collection procedure
27	129	A multi-stage cluster sampling method was used to select the participants. First, the two
20 29	130	universities were purposively selected, considering administration and logistic limitations. All
30 31	131	departments of the selected universities were included in the study. In each department, non-
32 33	132	proportion to sample size sampling method was used to select the sample from a name list
34 35	133	provided by the department administrator to meet the required sample size. On the designated
36 37	134	date of data collection, all selected students were approached by trained data collectors, and
38	135	questionnaires and instructions were delivered to them. Students were informed that the
40	136	survey concerned questions related to health, and they were asked for a written informed
41 42	137	consent. The participants then completed the questionnaires by themselves.
43 44	138	
45 46	139	Questionnaire development and training
47 48	140	We first developed a structured questionnaire in English and translated it into Khmer, the
49	141	national language of Cambodia. Then, the Khmer questionnaire was back-translated into
50 51	142	English by local experts to check its accuracy. The Khmer questionnaire was pretested with a
52 53	143	sample of 20 students at RUPP to ensure that the wording and contents were culturally suitable
54 55 56	144	and clearly understandable. We also received comments on the questionnaire from experts
57 58		5

working on health and education in Cambodia. The questionnaire was finalized based on their feedback and findings from the piloting.

All researchers spent two days to provide training on the study protocol and data collection method to the data enumerators and supervisors. The training focused on building familiarity with the study protocol and questionnaire, interview techniques, privacy assurance, and confidentiality. It also addressed quality control strategies, such as rechecking and reviewing the questionnaires after administration, and resolving issues that might arise during the fieldwork. The data collection supervisors were instructed to perform regular reviews with the data enumerators to monitor progress and settle any issues occurring during the process.

Variables and measurements

Depressive symptoms

Depressive symptoms were assessed by using the Center for Epidemiologic Studies Depression scale (CES-D).⁴² This scale consists of 20 questions addressing six symptoms of depression, including depressed mood, guilt or worthlessness, helplessness or hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance experienced during the preceding week. Each question is scored on a scale of 0 to 3 according to the frequency of the symptoms, and the total CES-D score ranges from 0 to 60. To calculate the total score, four items (I felt I was just as good as other people, I felt hopeful about the future, I was happy, and I enjoyed life) were reverse coded. The criterion validity of the CES-D scale has been well established in Western⁴² and Asian⁴³ populations. We defined depressive symptoms as present when a subject had a CES-D score of \geq 16. A cutoff value of \geq 23 was also used to define severe depressive state.44

Socio-demographic characteristics, substance use, and sexual behaviors

We adapted standardized tools from the most recent Cambodia Demographic and Health Survey⁴⁵ as well as from our previous student and young people health surveys in Cambodia^{38 39} ⁴⁶⁻⁴⁸ to measure socioeconomic characteristics, sexual behaviors with different partners, and substance use (alcohol, tobacco, and illicit drugs). Socio-demographic characteristics of the

respondents included study site, gender, age, marital status, year of the study, living situations, perceived family economic status, and perceived academic performance. Health related behaviors We used the Health Behavior Survey,⁴⁹ which was designed as a broad survey of health-related behaviors and beliefs, components of the "national college health risk behavior survey" (1997),⁵⁰ and the Global School-based Student Health Survey.⁵¹ Each health behavior area was addressed by only a limited number of items. For example, frequency of consumption of fast food in an average week was assessed by a question, "On average, how many times do you eat fast food per week?" with response options of 0 time, 1-2 times a week, and 3 or more times a week. Similar questions and response options were used to assess consumption of several other kinds of healthy and unhealthy food, such as high-fat snack or fruits/vegetables. Self-ratings were also used for some questions, such as perceived body size (rated from very overweight to very underweight), general health status (rated from very good to very poor), and problems with sleeping in the past 30 days (rated from none to severe). Adverse childhood experiences (ACEs) Five questions were adapted from the brief screening version of the Childhood Trauma Questionnaire to measure ACEs.⁵² The five guestions asked about the experiences of physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect during the time when they were growing up. The response options for each question ranged from (1) 'never' to (5) 'very often.' Participants who responded 'never' and 'rarely' were grouped together as those without ACEs. Participants who answered 'sometimes,' 'often', and 'very often' were grouped together as those with ACEs.

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199 Self-rated health

SF-12 Health Survey (SF-12) was used to measure self-rated health.^{53 54} The SF-12 is a multipurpose short-form generic measure of health status. It is a subset of the larger SF-36 and monitors health in general and in specific populations. The SF-12 measures eight health

aspects, namely physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role limitations due to emotional problems, and mental health (psychological distress and psychological well-being).

Data analyses

Double data entry was performed using EpiData version 3 (Odense, Denmark). χ^2 test, or Fisher's exact test when the sample sizes were smaller than five in one cell, was used for categorical variables and Student's t-test was used for continuous variables to compare socio-demographic characteristics, health risk behaviors (sexual behaviors, substance use, eating behaviors, body size, and problems with sleeping), self-rated health (SF-12), and ACEs among students with depressive symptoms, defined by a CES-D score of ≥16, to those without depressive symptoms. The same comparisons were also made among students with and without severe depressive symptoms, defined by a CES-D score of ≥ 23 .

To control for potential confounding factors, two multivariate logistic regression models were constructed, one for depressive symptoms and the other for severe depressive symptoms. In the multivariate models, we first included all variables significantly associated with the outcome variables in the bivariate analyses at a level of p-value <0.05 simultaneously in the models. Variables with a p-value >0.05 were then removed, and the models were refitted. The steps were repeated until all *p*-values of the remaining variables were <0.05 in the final models. Adjusted odds ratio (AOR) were obtained and presented with CI and p-values. SPSS version 22 (IBM Corporation, New York, USA) was used for all statistical analyses.

Ethical considerations

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

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23	32							
23	33	RESULTS						
23	34	Socio-demographic	characterist	tics				
23	35	The study sample in	ncluded 493	students (36.	3%) from l	JB and 866 s	students (63	.7%) from RUPP.
0 1 23	36	Of the total, 50.8%	5 of the resp	ondents we	re male, w	ith a mean	age of 21.3	years [standard
2 3 23	37	deviation (SD)=2.3]	. The majorit	ty of the resp	ondents (9	97.9%) were	unmarried;	and 43.4% were
4 23	38	living with their pa	arents. Regai	rding their fa	amily econ	omic status	, 59.2% rep	orted that their
6 23	39	family was neither	rich nor poo	or. The prop	ortion of s	tudents wit	h depressive	e symptoms and
/ 8 24	40	severe depressive s	ymptoms we	ere 50.6% and	d 19.6%, re	spectively.		
9 0 24	41	Table 1 sho	ws the com	parisons of s	ocio-demo	graphic cha	racteristics (of students with
1 2 24	42	and without depre	essive sympt	toms. Compa	ared to th	eir compar	ison groups	, students with
3 1 24	43	depressive sympto	ms were sig	nificantly mo	ore likely t	o be from I	UB (<i>p</i> =0.004	l), to be from a
4 5 24	44	poorer family (p=0).002), and ⁺	to report po	orer acad	emic perfor	mance (p<0	0.001). Similarly,
6 724	45	students with sev	ere depress	ive sympton	ns were s	ignificantly	more likely	, to be female
8 9 24	46	(p=0.002). to be fr	om a poorer	r family (p=0	.04). and t	o report po	orer acaden	nic performance
0	47	(p<0.001).						
$\frac{1}{2}$	48	(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
3 - 4 24	40	Table 1 Comparisons	of socio-dem	ogranhic chara	acteristics of	f university st	udents with a	and without
5 ⁻ 6 2!	50	depressive symptom	s			university st		
7		Characteristics	Depressiv	e symptoms		Severe dep	ressive symp	toms [†]
9				No.	D -1 - [‡]			
0			NO	Yes	P-value	NO	Yes	P-value
1 ว		Study site			0.004			0.08
3		Battambang	218 (44.2)) 275 (55.8)		384 (77.9)	109 (22.1)	

2									
5 4			Married	17 (58.6)	12 (41.4)		27 (93.1)	2 (6.9)	
5		Year	of study			0.59			0.66
6 7			1	240 (48.4)	256 (51.6)		394 (79.4)	102 (20.6)	
8			2	145 (51.6)	136 (48.4)		224 (79.7)	57 (20.3)	
9 10			3	123 (49.0)	128 (51.0)		201 (80.1)	50 (19.9)	
11			4	164 (49.5)	167 (50.5)		274 (82.8)	57 (17.2)	
12 13		Curr	optly living with	201 (1910)	107 (0010)	0.25	271 (0210)	<i>37 (1712)</i>	0.70
14 15		Curr		207 (40.0)	200 (50 4)	0.35	400 (04 7)	100 (10 2)	0.70
15 16			Parents	297 (49.9)	298 (50.1)		486 (81.7)	109 (18.3)	
17			Relatives	81 (45.0)	99 (55.0)		139 (77.2)	41 (22.8)	
18 19			Sibling	87 (56.1)	68 (43.9)		124 (80.0)	31 (20.0)	
20			Friend	162 (50.2)	161 (49.8)		258 (79.9)	65 (20.1)	
21			Spouse/partners	10 (47.6)	11 (52.4)		19 (90.5)	2 (9.5)	
23			Alone	26 (41.9)	36 (58.1)		50 (80.6)	12 (19.4)	
24 25			Other	9 (39.1)	14 (60.9)		17 (73.9)	6 (26.1)	
26 27		Perc	eived family econor	nic status		0.002			0.04
28			Well-off/quite	248 (55.7)	197 (44.3)	5	374 (84.0)	71 (16.0)	
29 30			well-off	210 (0017)	107 (1110)		071 (0110)	, 1 (1010)	
31			Noither poor por	209 (17 0)	110 (52 0)		660 (71-1)	177 (20.0)	
32 33				558 (47.0)	448 (55.0)		009 (71.1)	177 (20.9)	
34			Well-off				4		
35 36			Poor	26 (38.2)	42 (61.8)		50 (73.5)	18 (26.5)	
37		Perc	eived academic per	formance		<0.001			<0.001
38 39			Very good	44 (77.2)	13 (22.8)		52 (91.2)	5 (5.8)	
40			Good	180 (59.0)	123 (40.6)		263 (86.8)	40 (13.2)	
41 42			Fairly good	301 (50.5)	295 (49.5		484 (81.2)	112 (18.8)	
43 44			Fair	138 (37.7)	228 (62.3)		275 (75.1)	91 (24.9)	
45			Poor	9 (24.3)	28 (75.7)		19 (51.4)	18 (48.6)	
40 47 48 49 50 51 52 53 54 55 56 57	251 252 253 254 255 256 257 258	Abbr Valu cont. Defi. [†] Defi [‡] Chi- varic	reviation: SD, stand es are numbers of s inuous variables. ned by a Center for ined by a CES-D sco square test was use ables.	ard deviation ubjects (%) fo Epidemiolog re of ≥23. ed for catego). or categorical y Studies Dep rical variables	l variables c ression Sca s; independ	and means ± st le (CES-D) scor ent Student's t	andard deviat e of ≥16. -test was used	ion (SD) for I for continuous
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60			For pee	er review only	- http://bmjop	en.bmj.com	/site/about/gui	delines.xhtml	

259 Health risk behaviors

As shown in Table 2, compared to students without symptoms, students with symptoms were significantly more probable to report having thought of ending life (p < 0.001 for both depressive symptoms and severe depressive symptoms) and higher consumption of unhealthy food, such as high-fat snack (p=0.001 for depressive symptoms; p<0.001 for severe depressive symptoms), margarine, butter, or meat fat (p=0.02 for depressive symptoms; p<0.001 for severe depressive symptoms). The students with depressive symptoms were significantly less likely to report higher consumption of healthy food, such as fruits and vegetables (p=0.009 for depressive symptoms; p=0.007 for severe depressive symptoms), or lean protein (p<0.001 for depressive symptoms; p=0.03 for severe depressive symptoms). The students with depressive symptoms were significantly more likely to report not having desert over the past week (p=0.003 for depressive symptoms; p=0.008 for severe depressive symptoms). Moreover, the students with depressive symptoms were significantly more likely to perceive that their body size was very overweight or very underweight (p<0.001 for both depressive symptoms and severe depressive symptoms) and report having moderate or severe problems with sleeping in the past 30 days (p < 0.001 for both depressive symptoms and severe depressive symptoms).

276 Table 2 Comparisons of health risk behaviors among university students with and without depressive

277 symptoms

Health and health risk	Depressive	symptoms		Severe depre	essive sympto	oms [†]
behaviors	No	Yes	P-value [‡]	No	Yes	P-value [‡]
Current tobacco smokers	5 (33.3)	10 (66.7)		12 (80.0)	3 (20.0)	0.97
Self-perception regarding a	alcohol use		0.25			0.004
Non drinker	425 (50.7)	413 (49.3)		681 (81.3)	157 (18.7)	
Occasional drinker	247 (47.4)	271 (52.6)		412 (78.7)	106 (21.3)	
Regular drinker	0 (0.0)	3 (100)		0 (0.0)	3 (100)	
Current illicit drug users	0 (0.0)	4 (100)	0.05	1 (25.0)	3 (75.0)	0.03
Condom use at last sex	39 (47.0)	44 (53.0)	0.95	73 (88.0)	10 (12.0)	0.08
Diagnosed with an STI	4 (40.0)	6 (60.0)	0.75	110 (84.0)	21 (16.0)	0.67
Thought of ending life	40 (24.8)	121 (75.2)	<0.001	84 (52.2)	77 (47.8)	<0.001

Attempted to end life	5 (20.0)	20 (80.0)	0.63	11 (44.0)	14 (56.0)	0.47
Frequency of eating fast	food per week		0.49			0.24
0 time	410 (49.3)	421 (50.7)		679 (81.7)	152 (18.3)	
1-2 times	231 (50.7)	225 (49.3)		360 (78.9)	96 (21.1)	
3 times or more	31 (43.1)	41 (56.9)		54 (75.0)	18 (25.0)	
Frequency of daily soft di	rink consumpti	on	0.31			0.01
0 time	105 (46.5)	121 (53.5)		178 (78.8)	48 (21.2)	
1-2 times	399 (51.2)	380 (48.8)		647 (83.1)	132 (16.9)	
3 times or more	168 (47.5)	186 (52.5)		268 (75.7)	86 (24.3)	
Frequency of weekly high	-fat snack cons	sumption	0.001			<0.001
0 time	162 (52.8)	145 (47.2)		260 (84.7)	47 (15.3)	
1-2 times	443 (51.0)	426 (49.0)		711 (81.8)	158 (18.2)	
3 times or more	67 (36.6)	116 (63.4)		122 (66.7)	61 (33.3)	
Frequency of weekly des	ert consumptio	'n	0.003			0.008
0 time	106 (40.6)	155 (59.4)		192 (73.6)	69 (26.4)	
1-2 times	434 (52.7)	389 (47.3)		676 (82.1)	147 (17.9)	
3 times or more	132 (48.0)	143 (52.0)		225 (81.8)	50 (18.2)	
Frequency of weekly fruit	/vegetable cor	nsumption	0.009			0.007
0 time	50 (37.3)	84 (62.7)		94 (70.1)	40 (29.9)	
1-2 times	390 (51.7)	365 (48.3)		617 (81.7)	138 (18.3)	
3 times or more	232 (49.4)	238 (50.6)		382 (81.3)	88 (12.7)	
Frequency of weekly lear	n protein consu	mption	<0.001			0.03
0 time	57 (34.8)	107 (65.2)		119 (72.6)	45 (27.4)	
1-2 times	453 (51.8)	421 (48.2)		714 (81.7)	160 (18.3)	
3 times or more	162 (50.5)	159 (49.5)		260 (81.0)	61 (19.0)	
Amount of margarine/bu	tter/meat fat c	onsumption	0.02			<0.001
None/very little	296 (52.4)	269 (47.6)		471 (83.4)	94 (16.6)	
Some	339 (48.7)	357 (51.3)		558 (80.2)	138 (19.8)	
A lot	37 (37.8)	61 (62.2)		64 (65.3)	34 (34.7)	
Self-perception about bo	dy size		<0.001			<0.001
About right	275 (55.4)	221 (44.6)		428 (86.3)	68 (13.7)	
Very overweight	27 (34.2)	52 (65.8)		55 (69.6)	24 (30.4)	

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3	Slightly overweight	161 (48.9)	168 (51.1)		247 (75.1)	82 (24.9)	
4		- ()	()		(- <i>)</i>	- (-)	
5	Slightly underweight	191 (49.6)	194 (50.4)		319 (82.9)	66 (17.1)	
6			\mathbf{r}_{2}		44/62 0)	\mathbf{a}	
7	very underweight	18 (25.7)	52 (74.3)		44 (62.9)	26 (37.1)	
8	Problem with sleening in t	he nast 30 day	/5	<0.001			<0.001
9	ribblem with sleeping in t		y 5	10.001			VO.001
10	None	133 (61.9)	82 (38.1)		194 (90.2)	21 (9.8)	
11						()	
12	Mild	283 (62.3)	171 (37.7)		409 (90.1)	45 (9.9)	
13	Moderate	2/12 (/11 /1)	211 (58 6)		117 (76 1)	1/0 (22 0)	
14	Modelate	243 (41.4)	544 (58.0)		447 (70.1)	140 (23.5)	
15	Severe	13 (12.6)	90 (87.4)		43 (41.7)	60 (58.3)	
16		· /	. /		· · /	, /	

Abbreviations: STI, sexually transmitted infections.

Values are numbers of subjects (%).

Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of \geq 16.

[†]Defined by a CES-D score of ≥ 23 .

^{*}Chi-square test was used or Fisher's exact test was used as appropriate.

Self-rated health (SF-12)

The comparisons of self-rated health (SF-12) among students with and without depressive symptoms and severe depressive symptoms are shown in Table 3. The students with depressive symptoms were significantly more likely to perceive that their general health status was poor (p<0.001 for both depressive symptoms and severe depressive symptoms). The students with depressive symptoms were significantly more probable to report higher levels of limitation in several daily activities, such as limitation in moderate activities (p < 0.001 for depressive symptoms; p=0.02 for severe depressive symptoms), climbing several flights of stairs (p<0.001for depressive symptoms), or other kinds of activities in the past four weeks as a result of their physical or emotional health problems (p<0.001 for both depressive symptoms and severe depressive symptoms). Further, they reported higher levels of problems in several other physical and emotional health aspects in the past four weeks, such as the feeling that they had accomplished less than they would like (p<0.001 for both depressive symptoms and severe depressive symptoms), pain interferes with their normal work (p<0.001 for both depressive symptoms and severe depressive symptoms), having less energy (p < 0.001 for both depressive symptoms and severe depressive symptoms), down-hearted and blue (p<0.001 for both depressive symptoms and severe depressive symptoms), and their physical health interferes with their social acts (p<0.001 for both depressive symptoms and severe depressive symptoms).

university students with and without depressive

1		
2		
3	302	
4	302	
5	303	Table 3 Comparisons of self-rated health (SF-12) among
о 7	304	symptoms

Self-rated health (SF-12)	Depressive	symptoms		Severe depressive symptoms [*]		
	No	Yes	P-value [‡]	No	Yes	P-value [*]
Self-perception on general he	ealth status		<0.001			<0.001
Very good	106 (64.2)	59 (35.8)		147 (89.1)	18 (10.9)	
Good	380 (58.5)	270 (41.5)		566 (87.1)	84 (12.9)	
Neither good nor poor	176 (38.0)	287 (62.0)		351 (75.8)	112 (24.2)	
Poor	10 (12.3)	71 (87.7)		29 (35.8)	52 (64.2)	
Limitation in moderate activi	ties on a typic	cal day	<0.001			0.02
Greatly limited	20 (28.2)	51 (71.8)		50 (70.4)	21 (29.6)	
Mildly limited	291 (45.6)	347 (54.4)		505 (79.2)	133 (20.8)	
Not limited	361 (55.5)	289 (44.5)		538 (82.8)	112 (17.2)	
Limitation in climbing severa	l flights of sta	irs	<0.001			0.24
Greatly limited	64 (35.8)	115 (64.2)		140 (78.2)	39 (21.8)	
Mildly limited	323 (47.8)	353 (52.2)		536 (79.3)	140 (20.7)	
Not limited	285 (56.5)	219 (43.5)		417 (82.7)	87 (17.2)	
Limitation in other kinds of	271 (37.8)	446 (62.2)	<0.001	516 (72.0)	201 (28.0)	<0.001
activities in past 4 weeks						
Accomplished less than you	377 (61.9)	232 (38.1)	<0.001	553 (50.6)	197 (26.3)	<0.001
would like in past 4 weeks						
as a result of emotional						
health						
Accomplished less than you	304 (67.3)	148 (32.7)	<0.001	675 (74.4)	232 (25.6)	<0.001
would like in past 4 weeks						
as a result of physical						
health						
Did activities less carefully	378 (41.8)	526 (58.2)	<0.001	677 (74.9)	227 (25.1)	<0.001
than usual in past 4 weeks						
Pain interferes with your nor	mal work in p	ast 4 weeks	<0.001			<0.001
Not at all	141 (75.8)	45 (24.2)		176 (94.6)	10 (5.4)	

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A little bit	401 (57.6)	295 (42.4)		635 (91.2)	61 (8.8)	
Moderately	106 (32.9)	216 (31.4)		216 (67.1)	106 (32.9)	
Quite a bit	23 (16.5)	116 (83.5)		62 (44.6)	77 (55.4)	
Extremely	1 (6.3)	15 (93.8)		4 (25.0)	12 (75.0)	
Feeling calm and peaceful in	past 4 weeks		0.33			0.06
A lot of the time	22 (42.3)	30 (57.7)		38 (73.1)	14 (26.9)	
Most of the time	68 (53 5)	50 (46 5)		(7, 2, 2, 2)	25 (27.6)	
	145 (50.0)	J (40.J)		92 (72.9)	33 (27.0) 20 (16.2)	
A good bit of time	115 (50.9)	111 (49.1)		188 (83.2)	38 (16.2)	
Some of the time	278 (46.8)	316 (53.2)		477 (80.3)	117 (17.7)	
A little of the time	170 (51.8)	158 (48.2)		274 (83.5)	54 (16.5)	
None of the time	19 (59.4)	13 (40.6)		24 (75.0)	8 (25.0)	
Having a lot of energy in past	t 4 weeks		<0.001			<0.00
A lot of the time	46 (61.3)	29 (38.7)		66 (88.0)	9 (12.0)	
Most of the time	111 (68.9)	50 (31.1)		149 (92.5)	12 (7.5)	
A good hit of time	245 (56 8)	186 (43.2)		383 (88 9)	48 (11 1)	
Some of the time	243 (30.0)	202 (EQ E)		264 (72.0)	125 (27 1)	
	207 (41.3)	292 (38.3)		504 (72.9)	155 (27.1) 52 (24.4)	
A little of the time	57 (33.7)	112 (66.3)		116 (68.6)	53 (31.4)	
None of the time	6 (25.0)	18 (75.0)		15 (62.5)	9 (37.5)	
Feeling down-hearted and bl	lue in past 4 w	veeks	<0.001			<0.00
A lot of the time	7 (21.9)	25 (78.1)		14 (43.8)	18 (56.3)	
Most of the time	8 (8.3)	88 (91.7)		36 (37.5)	60 (62.5)	
A good bit of the time	42 (17.9)	171 (80.3)		117 (54.9)	96 (45.1)	
Some of the time	222 (46.7)	253 (53.3)		412 (86.7)	63 (13.3)	
A little of the time	354 (71.5)	141 (28.5)		469 (94.7)	26 (5.3)	
None of the time	39 (81.3)	9 (18.8)		45 (93.8)	3 (6.3)	
Physical health interferes so	rial act in nast	4 weeks	<0.001	10 (3010)	5 (0.5)	<0.00
A lot of the time	د دد: ۱۵ مال مال ۸ (۲۲ ۲)	9 (66 7)	0.001	6 (50 0)	6 (50.0)	\$0.00
	4 (55.5)	o (00.7)			0 (50.0)	
Most of the time	10 (23.3)	33 (76.7)		18 (41.9)	58 (58.1)	
Some of the time	146 (38.1)	237 (61.9)		275 (71.8)	108 (28.2)	
A little of the time	355 (53.7)	306 (46.3)		568 (85.9)	93 (14.1)	
None of the time	157 (60.4)	103 (39.6)		226 (26.9)	34 (13.2)	

Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of ≥ 16 . ^{$^{+}}Defined by a CES-D score of \geq 23.$ </sup> [‡]Chi-square test was used for categorical variables or Fisher's exact test was used as appropriate. Adverse childhood experiences (ACEs) Table 4 shows the comparisons of ACEs among students with and without depressive symptoms and severe depressive symptoms. The students with depressive symptoms were significantly more likely to report having been hit, slapped, or kicked by a parent or guardian (p < 0.001 for both depressive symptoms and severe depressive symptoms); that people in their family had said hurtful or insulting things to them (p<0.001 for both depressive symptoms and severe depressive symptoms); and that someone had tried to touch them or make them touch him/her in a sexual way (p=0.001 for depressive symptoms; p<0.001 for severe depressive symptoms). The students with depressive symptoms were significantly less likely to report that there had been someone to take care of them and take them to medical care when they got sick (p=0.04 for depressive symptoms; p=0.03 for severe depressive symptoms), and there had been someone who helped them feel that they were loved and important (p=0.03 for depressive symptoms; p < 0.001 for severe depressive symptoms).

Table 4 Comparisons of adverse childhood experiences among university students with and without

325 depressive symptoms

Adverse childhood	Depressive symptoms Severe depressive symptoms [†]					
experiences	No	Yes	P-value [‡]	No	Yes	P-value [‡]
Had been hit, slapped,	200 (38.2)	323 (61.8)	<0.001	384 (73.4)	139 (26.6)	<0.001
kicked, by a						
parent/guardian						
People in my family had	297 (39.0)	464 (61.0)	<0.001	558 (73.3)	203 (26.7)	<0.001
said hurtful or insulting						
things to me						
Someone had tried to	87 (39.2)	135 (60.8)	0.001	159 (71.6)	63 (28.4)	<0.001
touch me or make me						
touch them in a sexual way						

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1 2 3 4 5 6 7		There had been someone 636 (50.2) 632 (49.8) 0.04 1028 (81.1) 240 (18.9) 0.03 to take care me and take me to medical care when I								
 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 		got sick There had been someone 647 (50.1) 644 (49.9) 0.03 1050 (81.3) 266 (19.6) <0.001 who helped me feel that I was loved and important								
	326 327 328 329 330	Values are numbers of subjects (%). * Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of \geq 16. * Defined by a CES-D score of \geq 23. * Chi-square test was used.								
	331	Risk factors of depressive symptoms								
	332	The results of multivariate logistic analyses are shown in Table 5. After controlling for potential								
	333	confounding factors, the students with symptoms remained significantly more likely to report								
	334	poor academic performance (depressive symptoms: AOR=7.31, 95% Cl=2.24-23.86; severe								
	335	depressive symptoms: AOR=7.38, 95% CI=1.75-10.94); having thought of ending life (depressive								
	336	symptoms: AOR=1.60, 95% CI=1.01-2.56; severe depressive symptoms: AOR=2.52, 95% CI=1.58-								
	337	4.01); higher consumption of unhealthy food, including high-fat snack, margarine, butter, or								
34 35	338	meat fat (depressive symptoms: AOR=1.72, 95% CI=1.08-2.76; severe depressive symptoms:								
36	339	AOR=2.13, 95% CI=1.15-3.95); and severe problem with sleeping in the past 30 days (depressive								
37 38	340	symptoms: AOR=2.81, 95% CI=1.31-6.06; severe depressive symptoms: AOR=2.84, 95% CI=1.32-								
39 40	341	6.13). They remained significantly less likely to perceive that their body size was slightly								
41 42	342	underweight (depressive symptoms: AOR=0.54, 95% CI=0.29-0.99; severe depressive								
43 44	343	symptoms: AOR=0.37, 95% CI=0.18-0.77).								
45	344	Regarding self-rated health, the students with symptoms remained significantly more								
40	345	likely to perceive that their general health status was poor (depressive symptoms: AOR=2.99,								
48 49	346	95% CI=1.28-7.00; severe depressive symptoms: AOR=5.43, 95% CI=2.19-13.46), to report								
50 51	347	higher level of limitation in moderate activities (depressive symptoms: AOR=0.30 (95% CI=0.16-								
52 53	348	0.58), to report higher level of pain interference with their normal work (depressive symptoms:								
54 55 56	349	AOR=10.43, 95% CI=1.05-10.94; severe depressive symptoms: AOR=10.02, 95% CI=1.99-9.28),								

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and to report higher level of	of feeling down-hearted and	blue (depr	essive symptoms: A	\OR=6.69,	
95% CI=1.87-23.90; severe	depressive symptoms: AOR=	8.72, 95% (CI=1.69-14.86).		
For ACEs, they remain	ained significantly more likel	y to report	having been hit, sl	apped, or	
kicked by a parent or guardian (depressive symptoms: AOR=1.39, 95% CI=1.04-1.86); to report					
that people in their family had said hurtful or insulting things to them (depressive symptoms:					
AOR=1.82, 95% CI=1.37-2.42; severe depressive symptoms: AOR=2.18, 95% CI=1.46-3.24); and					
less likely to report that t	here had been someone to	take care	e of them and take	them to	
medical care when they go	ot sick (depressive symptom	s: AOR=0.	51, 95% CI=0.30-0.8	36; severe	
depressive symptoms: AOR	=0.26, 95% CI=0.13-0.52).				
	~				
Table 5 Factors associated wit	h depressive symptoms and se	vere depres	sive symptoms		
Variables in the final model	Depressive symptoms [†]	-	Severe depressive	symptoms [‡]	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value	
Perceived academic performa	nce				
Very good	Reference		Reference		
Good	2.28 (1.01-5.15)	0.04	1.22 (0.35-4.19)	0.76	
Fairly good	3.51 (1.58-7.78)	0.002	2.15 (0.65-7.11)	0.21	
Fair	5.30 (2.35-11.93)	<0.001	2.52 (0.75-8-43)	0.13	
Poor	7.31 (2.24-23.86)	0.001	7.38 (1.75-10.94)	0.006	
Thought of ending life					
No	Reference		Reference		
Yes	1.60 (1.01-2.56)	0.04	2.52 (1.58-4.01)	<0.001	
Frequency of weekly high-fat	snack consumption				
0 time	Reference		Reference		
1-2 times	0.99 (0.72-1.37)	0.95	1.25 (0.78-1.99)	0.36	
3 times or more	1.72 (1.08-2.76)	0.02	2.13 (1.15-3.95)	0.02	
Frequency of weekly lean prot	tein consumption				
0 time	Reference		Reference		
1-2 times	0.52 (0.34-0.79)	0.002	0.69 (0.41-1.18)	0.17	
3 times or more	0.62 (0.38-0.96)	0.04	0.80 (0.44-1.47)	0.48	
Amount of margarine/butter/	meat fat consumption				
	18				
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2					
3	None/very little			Reference	
5	Some			0.98 (0.66-1.46)	0.91
6 7	A lot			1.92 (1.02-3.64)	0.04
8	Self-perception about body shap	P		· · ·	
9 10	Vory overweight	Poforonco			
10					
12	Slightly overweight	0.56 (0.31-1.07)	0.08	0.65 (0.32-1.14)	0.25
13 14	About right	0.58 (0.32-1.05	0.07	0.45 (0.22-0.93)	0.03
15	Slightly underweight	0.54 (0.29-0.99)	0.04	0.37 (0.18-0.77)	0.008
16 17	Very underweight	0.92 (0.38-2.25)	0.86	0.38 (0.14-0.99)	0.04
18	Problem with sleeping in the pas	t 30 davs			
19 20	Nono	Poference			
21	None				
22	Mild	0.79 (0.53-1.19)	0.26	1.08 (0.55-2.16)	0.82
23 24	Moderate	1.06 (0.72-1.58)	0.76	1.45 (0.89-2.66)	0.26
25	Severe	2.81 (1.31-6.06)	0.008	2.84 (1.32-6.13)	0.008
26 27	Self-perception on general health	n status			
28	Very good				
29				4 4 9 (9 6 9 9 9 9)	0.00
30 31	Good	1.05 (0.68-1.64)	0.82	1.19 (0.60-2.38)	0.62
32	Fair	1.58 (0.99-2-51)	0.05	1.47 (0.73-2.96)	0.28
33 34	Poor	2.99 (1.28-7.00)	0.01	5.43 (2.19-13.46)	<0.001
35	Limitation in moderate activities	on a typical day			
36 37	Greatly limited	Reference		Reference	
38	Mildly limited	0.20 (0.20-0.74)	0.004		0.22
39 40		0.39 (0.20-0.74)	0.004	0.04 (0.29-1.34)	0.25
40 41	Not limited	0.30 (0.16-0.58)	<0.001	0.63 (0.30-1.36)	0.24
42	Pain interferes with your normal	work in past 4 weeks			
43 44	Not at all	Reference		Reference	
45	A little bit	1.68 (1.08-2.61)	0.02	1.01 (0.46-2.22)	0.99
46 47	Moderately	3.10 (1.89-5.10)	<0.001	3.69 (1.68-7.11)	0.001
48	Quito a hit	4 14 (2 12 8 0E)	<0.001	4 68 (2.01 10.02)	<0.001
49 50		4.14 (2.15-6.05)	<0.001	4.08 (2.01-10.92)	<0.001
50	Extremely	10.43 (1.05-10.94)	0.04	10.02 (1.99-9.28)	0.005
52	Feeling down-hearted and blue in	n past 4 weeks			
53 54	None of the time	Reference		Reference	
55	A little of the time	0.52 (0.63-3.66)	0.35	1.02 (0.24-4.29)	0.98
56 57		. ,		· - /	
58		19			

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2 3		Some of the time	3.42 (1.42-8.23)	0.006	1.83 (0.45-7.45)	0.40
4 5		A good bit of the time	7.70 (3.02-19.66)	<0.001	6.01 (1.45-4.85)	0.01
6		Most of the time	20.71 (6.47-66.37)	<0.001	9.04 (2.31-13.71)	0.002
7 8		A lot of the time	6.69 (1.87-23.90)	0.003	8 72 (1 69-14.86)	0.01
9 10		Had been hit, slapped, kicked, by	a parent/guardian	0.000	0.12 (1105 1 1100)	0.01
11		No	Reference		Reference	
12 13		No	1 20 (1 04 1 96)	0.02	1 11 (0 75 1 65)	0.50
14 15		Deeple in my femily had eaid hum	1.39 (1.04-1.80)	0.03	1.11 (0.75-1.05)	0.39
15 16		People in my family had said nurt	iui or insulting things to me			
17 18		NO	Reference		Reference	
19		Yes	1.82 (1.37-2.42)	<0.001	2.18 (1.46-3.24)	<0.001
20 21		There had been someone to take	care of me and take me to	medical care	e when I got sick	
22		No	Reference		Reference	
23 24		Yes	0.51 (0.30-0.86)	0.01	0.26 (0.13-0.52)	<0.001
27 28 29 30 31 32	363 364 365 366	logistic regression model after set [†] Defined by a Center for Epidemic [‡] Defined by a CES-D score of ≥23.	veral steps of model fitting. plogy Studies Depression Sco	ale (CES-D) s	core of ≥16.	univariate
33	367	DISCUSSION				
34 35	368	This study unearthed a nun	nber of factors correlat	ed with d	epressive symptom	s among
36 37	369	university students in Cambo	dia. The salient factors	comprised	cultural and socio-	economic
38 39	370	dimensions (gender, socio-ec	onomic background, and	d lack of g	eneral and medica	l care by
40	371	family), individual behaviors a	and attitudes (poor acade	emic accon	nplishment, suicidal	ideation,
42	372	consumption of unhealthy foo	d, severe problem with s	leeping, ne	gative perception at	out their
43 44	373	body and their general healt	h status, and limited ph	nysical acti	veness), and nurtu	e-related
45 46	374	facets (physical violence and p	sychological abuse by fan	nily).		
47 48	375	The bivariate outcome	s display that students fr	rom the pro	ovincial university (l	JB) and a
49	376	poorer family were more susce	eptible to depressive sym	ptoms. Like	ewise, students from	a poorer
51	377	family and female students	were more prone to se	evere depre	essive symptoms. A	lbeit not
52 53	378	manifesting in the multivari	iate model, these facto	ors are co	prroborated by the	existing
54 55 56 57	379	scholarship. Various studies re	evealed that university st	tudents fro	m rural areas and l	ow socio-
58			20			

economic backgrounds were predisposed to higher depression.^{1 16 28 55 56} This could be explained by an economic situation where students with a rural background tended to stipulate a poorer family status. Plus, financial vulnerability could further exacerbate depression in students from low-income families. A meta-analysis of 60 studies unveiled that people in the lowest socio-economic quintile had 1.81 the probability of depression compared with those in the highest socio-economic quintile.⁵⁷ A global study on 17,348 university students from 23 high-, middle-, and low-income countries also uncovered that higher depressive symptoms were recorded among students in low-income countries and economies with greater income inequality.¹⁶ The Cambodian economy has been growing rapidly in terms of income per capita; yet, income gaps between the rich and the poor and between rural and urban areas remain large.⁵⁸ The gaps in income and material growth, which typify economic conditions, may induce people's mental health problems. In another word, poor economic status may bring about low self-esteem and self-confidence, which would lead to depression.

Some research also discovered that female students were more at risk to depression.¹⁶ ⁵⁹⁻⁶² This might be due to social difficulties, physiological tenets, higher self-expectations, and perceived lack of competence among female students.⁵⁹ In the Cambodian culture, young women would perceive a great deal of challenges when living away from their family or parents since they need to maintain the cultural behavior and meanwhile cope with independent habitation. Over half (56.6%) of the student respondents in our study were not living with their parents. Moreover, women tended to over-report medical and psychological symptoms as indicated in a study on 440 undergraduate students in America.⁶³ Articulating their emotions may be one strategy for dealing with stressful events.

Our multivariate results depict that students with depressive symptoms, regardless of severity, tended to report poor academic performance, having thought of ending life, and higher consumption of unhealthy food. These findings conform to a systematic review of 24 studies⁶ and studies in Asia, such as China,⁷ which pinpoint low scholastic merit and suicidal ideation as consistent correlates of depression in university students probably as a culmination of poor concentration and solitude. On the consumption of unhealthy food, the transition from adolescence to adulthood, and thus the changes in lifestyle such as living arrangements and

independence, might have rendered university students to indulge in unhealthy food, as pinpointed by a meta-analysis of 39 studies in China.⁷ As afore-mentioned, more than half of our sample were not living with their parents; therefore, it might have been hard for them to maintain healthy daily food. Conversely, depression might have made students care-free about themselves and consequently eat unhealthily.¹⁷ This implies that nutrition education for both physical and mental health, stressing healthy food for the body and mind, is imperative for university students.

Students with depressive symptoms, regardless of magnitude, also tended to have severe problem with sleeping and a negative perception about their body and their general health status. This finding confirms the general perception among depressed people who are not gratified with their body and health.¹⁷ Further, depressed students were more likely to have limited physical activeness, more pain interference with their normal work, and more dismay or sorrow. This reflects scientific facts that lack of physical activities may cause blue feelings and subsequently depression.^{64 65} Therefore, physical exercises, such as sports, should be regularly promoted among university students.

Finally, students with depressive symptoms were more likely to encounter physical violence by their parent or guardian, psychological abuse by their family members (for both students with depressive and severely depressive symptoms), and lack of general and medical care by their family (for both students with depressive and severely depressive symptoms). As for the physical violence and psychological abuse, this finding tends to acquiesce with a study in Cambodia that postulates that exposure to violence within family is associated with depression in high school students.^{38 39} On the lack of general and medical care by family, a Chinese study on 5,245 students at six universities found that students who had a poor parental relationship were more vulnerable to depression.⁶⁶ Also, a global study on 17,348 university students from 23 high, middle-, and low-income countries iterated that university students with less individualistic cultures, particularly in Asia, reported higher extents of depressive symptoms.¹⁶ Students of these cultures longed for more familial and societal ties and assistance, and thus felt depressed once this social capital was unavailable.¹⁶ This highlights a significant role of family bonds and scaffolding in association with depression among university students. In an

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Asian culture like Cambodian, family is an integral part for young adults and is pivotal for their
study and career advancement. Family environment and support, especially from parents,
affect students' emotional state. Poor parental relationships could cause negligence over
children, which could deteriorate their mental health. Thus, family atmosphere and support are
vital for mitigating mental health defects, such as depression, in university students.

A study on a sample of 2,671 respondents in nine provinces and a capital city in 2012 revealed that Cambodia greatly needs more and better counseling and mental health services.⁶⁷ The study also pointed out the shortage of skilled professionals in the field of mental health, particularly those with high clinical and counseling skills to treat mental disorders. In 2012, Cambodia had only 49 trained psychiatrists and 45 psychiatric nurses working in mental health facilities and private practices.^{67 68} Many health staff lack training, supervision, and experience in these areas. Only about 300 doctors completed basic mental healthcare training.⁶⁹ At university level, the 2012 study called for more awareness raising for self-care and burnout prevention and mental health counseling services for staff and students.⁶⁷ Given the paucity of mental health services in general, let alone at universities, our findings fuel the needs for more and better mental healthcare in Cambodia.

This study contains certain limitations. First, it examined students at only two public universities, one in a city and the other in a province. Hence, its findings cannot be generalized at a national level. Second, the cross-sectional design did not enable an establishment of the causal linkages between depressive symptoms and the related factors. Given the temporal order and the cross-sectional nature of the data, causal relationships between the variables could not be derived. Potential bi-directionality of the associations could occur either way. For instance, physical inactivity could cause depression. Nonetheless, the reverse could also be true—that depression could lead to inactivity, and of course both could be true simultaneously, where depressive symptoms worsen with physical inactivity, making physical activity less likely. Third, this study employed self-reported data, which might have been subject to recall bias of over-reporting and under-reporting. Nonetheless, the quality of the data was ensured by thorough training of the enumerators and field supervisors on the study protocols and data collection method. Finally, some of the measures, such as ACEs, were modified from other

research, and have not been validated in the Cambodian setting. Notwithstanding these
malfeasances, the findings of this study offer first and foremost implications for policy
development and future research in the Cambodian context.

11 471 **CONCLUSIONS**

This study identified social and behavioral factors associated with depressive symptoms among Cambodian students at two universities. While causation could not be drawn between these factors and depression, we surmise that these factors were inter-twined, and thus need to be addressed in an integrated and holistic fashion.

These findings render three major implications. First, given the current educational reform and labor market that demand better quality and ergo more competition among university students, the correlates of depressive symptoms could not be more critical for tackling for the time being. Failure to ameliorate these factors would jeopardize the gualification and career development of this populace and finally the human capital for nation-building. Second, these findings warrant an acceleration of on-campus counseling services for university students throughout the course of studentship. Efforts should be invested in comprehensive screening and intervention programs to diagnose those susceptible students early, offer immediate treatment, and cater appropriate support. Ultimately, the jurisdiction of refining students' mental state should go beyond universities to families and pertinent governmental bodies at large, provided we are to assist the young to overcome their academic challenges and enjoy a prosperous post-graduation life. Further research could delve into changing lifestyles and their associations with depressive symptoms among a larger sample of university students.

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	497	drafted the manuscript. KP, PC and RY supported the protocol and tools development and were
	498	responsible for training and data collection. All authors contributed to the writing and approved
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30 31	510	Ethics approval The National Ethics Committee for Health Research of the Ministry of Health,
32 33 34 35	511	Cambodia approved this study (Reference no. 082NECHR), and a written informed consent was
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36 37	513	
37 38 30	514	Data sharing statement Data used for this analysis are available upon request from the
40	515	Principal Investigator (Dr. Siyan Yi) at <u>siyan@doctor.com</u> . The data cannot be made publicly
41 42	516	available due to ethical restriction.
43 44	517	
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	Item No	Recommendation
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or the abstract
		Confirmed (Lines 1-55)
		(b) Provide in the abstract an informative and balanced summary of what was done
		and what was found. Confirmed (Lines 30-55)
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported.
C		Confirmed (Lines 71-110)
Objectives	3	State specific objectives, including any prespecified hypotheses. Confirmed (Lines
		110-112)
Methods		
Study design	4	Present key elements of study design early in the paper. Confirmed (Line 116)
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment,
		exposure, follow-up, and data collection. Confirmed (Line 1160-118)
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of
		participants. Confirmed (Lines 118-134)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect
		modifiers. Give diagnostic criteria, if applicable. Confirmed (Lines 152-201)
Data sources/	8*	For each variable of interest, give sources of data and details of methods of
measurement		assessment (measurement). Describe comparability of assessment methods if there is
		more than one group. Confirmed (Lines 152-201)
Bias	9	Describe any efforts to address potential sources of bias. Confirmed (Lines 136-150)
Study size	10	Explain how the study size was arrived at. Confirmed (118-123)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable,
		describe which groupings were chosen and why. Confirmed (Lines 203-219)
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding.
		Confirmed (Lines 204-218)
		(b) Describe any methods used to examine subgroups and interactions. (Not
		applicable)
		(c) Explain how missing data were addressed (Not applicable)
		(d) If applicable, describe analytical methods taking account of sampling strategy. $(2 + 1)$
		(<u>e</u>) Describe any sensitivity analyses. (Not applicable)
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially
		eligible, examined for eligibility, confirmed eligible, included in the study,
		(b) Circo area on a finance participation at each steer (Distanglights)
		(b) Give reasons for non-participation at each stage (Not applicable)
Degenintizza dat	114	(c) Consider use of a flow diagram (Not applicable)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential conformators. Confirmed (Lines 221, 242)
		(b) Indicate number of participants with missing data for each variable of interest
		(b) mutcate number of participants with missing data for each variable of interest.
Outcome data	15*	Report numbers of outcome events or summary measures. Confirmed (235-236)
	15	report numbers of outcome events of summary measures. Committee (25-250)

		their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included. Confirmed (237-242, 254-269, 279-296, 305-317, 326-353)
		(<i>b</i>) Report category boundaries when continuous variables were categorized. (Not applicable)
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period. (Not applicable)
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses. Confirmed (320-325)
Discussion		
Key results	18	Summarise key results with reference to study objectives. Confirmed (Lines 363-369)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or
		imprecision. Discuss both direction and magnitude of any potential bias. Confirmed
		(Lines 449-464)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations,
		multiplicity of analyses, results from similar studies, and other relevant evidence.
		Confirmed (Lines 370-448)
Generalisability	21	Discuss the generalisability (external validity) of the study results. Confirmed (Lines
		449-451)
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if
		applicable, for the original study on which the present article is based. Confirmed
		(Lines 496-498)

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.
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Social and behavioral factors associated with depressive symptoms among university students in Cambodia: A cross-sectional study

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Keywords:	Cross-sectional survey, Depressive symptoms, MENTAL HEALTH, Social and behavioral factors, University students, Cambodia

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2	1	Social and behavioral factors associated with depressive symptoms among university
4 5	2	students in Cambodia: A cross-sectional study
6 7	3	
8 9	4	Chanrith Ngin, ^{1,2} Khuondyla Pal, ¹ Sovannary Tuot, ¹ Pheak Chhoun, ¹ Rosa Yi, ² Siyan Yi ^{1,3,*}
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ABSTRACT **Objective** To explore social and behavioral factors associated with depressive symptoms among university students in Cambodia. Design Cross-sectional study. Settings Two public universities, one in the capital city of Phnom Penh and another in Battambang provincial town. Participants This study included 1,359 students randomly selected from all departments in the two universities using a multi-stage cluster sampling method for a self-administered questionnaire survey in 2015. **Primary outcome measure** Depressive symptoms measured by using the Center for Epidemiologic Studies Depression scale (CES-D). **Results** The proportion of students with depressive symptoms and severe depressive symptoms were 50.6% and 19.6%, respectively. After adjustment in multivariate logistic regression analysis, depressive symptoms remained significantly associated with poor academic performance (AOR=7.31, 95% CI=2.24-23.86), higher consumption of unhealthy food (AOR=1.72, 95% CI=1.08-2.76), a negative self-perception about body shape (AOR=0.54, 95% CI=0.29-0.99) and general health status (AOR=2.99, 95% CI= 1.28-7.00), and limited physical activeness (AOR=0.30, 95% CI=0.16-0.58). Depressive symptoms also remained significantly associated with adverse childhood experiences including physical violence (AOR=1.39, 95% CI=1.04-1.86), psychological abuse (AOR=1.82, 95% CI=1.37-2.42), and lack of general and medical care (AOR=0.51, 95% CI=0.30-0.86) by family during childhood. **Conclusions** The key factors associated with depressive symptoms were family-related and

individual behaviors and attitudes. Thus, efforts should be invested in comprehensive screening and intervention programs to diagnose those vulnerable students early, offer immediate treatment, and cater appropriate support.

Strengths and limitations of this study

This research is among a very few studies in which standardized tools are used and rigorous analyses are performed.

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 It included a large sample of students randomly selected from all departments in two public universities – one in the capital city and the other in a provincial town – using a multi-stage cluster sampling method.

 Limitations of the study, however, included the representativeness of the study sample, the cross-sectional nature of the data that limits causation inferences, unknown validity of the scales used to measures important constructs in Cambodian contexts, and potential bias of self-reported measures.

67 INTRODUCTION

Several studies have suggested that the aspects of mental health among university students are considerably poorer than that of their peers in the general population.¹⁻⁵ Depression is one of the most prevalent mental health problems among university students, and the prevalence is rising.^{6 7} There are varied prevalence estimates of depressive symptoms among university students, ranging from in the area of 10%⁸⁻¹¹ to in the region of 20%¹² and up to 40% and 80%.¹³⁻¹⁵ However, the mean prevalence of depression in university students stands at 30.6%.⁶ University students are in a critical period of life since they transition from adolescence to adulthood, which requires them to make many major decisions. During this period, they encounter tremendous pressures, chiefly from economic stress, academic demands, interpersonal relationships, and struggles with making crucial decisions.¹⁶

Depression manifests in a wide range of symptoms, encompassing sleep and eating disturbances, lack of self-care, poor concentration, anxiety, and disinterest in everyday activities.¹⁷ For university students, depression is correlated with poor academic achievements;¹⁸ drop-out;^{19 20} relationship instability;²¹ suicidal ideation, attempts, and commitments;¹⁸ ²² ²³ poor work performance;²⁴ substance abuse;²⁵ ²⁶ acute infectious illnesses;²⁷ and poor physical and mental health in general.^{28 29} Moreover, depression in this early period can build up negative consequences in adult life through its impacts on career prospects and social relationships.^{30 31}

Thus, tackling depression among university students is vital since most lifetime mental disorders commence during the university age,³² and their mental health has essential

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ramifications for campus health services in particular and mental health policy-making in general. ^{33 34} Put another way, from a public health standpoint, early detection and prevention of mental health problems among young adults in higher education is paramount. Comprehension of their salient psychological distress, namely depression, and its correlates, would enable tailor-made and early screening and intervention programs to reduce mental health problems in this population. This is integral for their educational performance and triumph in their prospective profession as well as for the national advancement since they are future leaders.

96 The prevalence of depression is induced by many factors, including study populations, 97 socio-demographics,^{16 35} study sites,^{16 36} diagnostic tools and sampling methods,^{36 37} and socio-98 cultural environments.¹⁶ Contextualization of facets linked with depression thus is significant 99 for mitigation measures.

In Cambodia, little is known about social and behavioral determinants of depressive symptoms among student populations. In 2012, a study on 1,943 students at 11 junior high and high schools found that exposure to violence among community members, peers, or family was a predictor for depressive symptoms in the students.^{38 39} A 2013 gualitative study on a sample of 28 students at a Cambodian university found that life events, problems of everyday life, and availability of social support were the main stress factors affecting students' life satisfaction.⁴⁰ Moreover, exposure to daily hassles was a stress factor having a strong impact on students' psychological and somatic responses. Nonetheless, no research has been conducted to examine social and behavioral determinants of depression among Cambodian university students. This study therefore intends to identify factors associated with depressive symptoms among university students in Cambodia.

46 111

[/] 112 **METHODS**

9 113 Study sites and population

This cross-sectional study was conducted with students at the University of Battambang (UB) in
 Battambang province and the Royal University of Phnom Penh (RUPP) in the capital city of
 Cambodia in June and July 2015. Epi Info (Centers for Disease Control and Prevention, Atlanta,

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GA) was used to calculate the sample size from the university student population of approximately 168,000.⁴¹ The anticipated percentage frequency was not known, so 50% was put for the calculation to prevent any underestimated prevalence. Based on a 95% confidence interval (CI) and a +5% margin of error, the minimum sample size required for this study was 767 students. Adjusted for 10% of incomplete responses, missing data, and rejection rate, the final minimum required sample size was 850 students.

Patient and public involvement

The development of the research questions and outcome measures was informed by university students' priorities, experience, and preferences gathered though consultative meetings with representatives of students, faculty members, and school administrators. The workshops aimed to collect inputs from the representatives for designing the study and developing the study protocol and materials. The representatives were also invited to participate in the study finding dissemination workshops in each participating university.

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Sampling and data collection procedure

A multi-stage cluster sampling method was used to select the participants. First, the two universities were purposively selected, considering administration and logistic limitations. All departments of the selected universities were included in the study. In each department, non-proportion to sample size sampling method was used to select the sample from a name list provided by the department administrator to meet the required sample size. On the designated date of data collection, all selected students were approached by trained data collectors with support from a school administrator. Questionnaires and instructions were then distributed to them in a classroom for self-administration, which took approximately 30min to complete. The participants then completed the questionnaires by themselves.

Questionnaire development and training

We first developed a structured questionnaire in English and translated it into Khmer, the national language of Cambodia. Then, the Khmer questionnaire was back-translated into

English by a local expert to check its accuracy. The Khmer questionnaire was pretested with a
sample of 20 students at RUPP to ensure that the wording and contents were culturally suitable
and clearly understandable. We also received comments on the questionnaire from experts
working on health and education in Cambodia. The questionnaire was finalized based on their
feedback and findings from the pretest.

A two-day training on the study protocol and data collection methods was provided to the data enumerators and supervisors. The training focused on building familiarity with the study protocol and questionnaire, interview techniques, privacy assurance, and confidentiality. It also addressed quality control strategies, such as rechecking and reviewing the questionnaires after administration, and resolving issues that might arise during the fieldwork. The data collection supervisors were instructed to perform regular reviews with the data enumerators to monitor progress and settle any issues occurring during the process.

²⁵ 158

159 Variables and measurements

160 Depressive symptoms

Depressive symptoms were assessed by using the Center for Epidemiologic Studies Depression scale (CES-D).⁴² This scale consists of 20 questions addressing six symptoms of depression, including depressed mood, guilt or worthlessness, helplessness or hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance experienced during the preceding week. Each question is scored on a scale of 0 to 3 according to the frequency of the symptoms, and the total CES-D score ranges from 0 to 60. To calculate the total score, four items (I felt I was just as good as other people, I felt hopeful about the future, I was happy, and I enjoyed life) were reverse coded. The criterion validity of the CES-D scale has been well established in Western⁴² and Asian⁴³ populations. We defined depressive symptoms as present when a subject had a CES-D score of ≥16. A cutoff value of ≥23 was also used to define severe depressive state.44

51 172

173 Socio-demographic characteristics, substance use, and sexual behaviors

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We adapted standardized tools from the most recent Cambodia Demographic and Health Survey⁴⁵ as well as from our previous student and young people health surveys in Cambodia^{38 39} ⁴⁶⁻⁴⁸ to measure socioeconomic characteristics, sexual behaviors with different partners, and substance use (alcohol, tobacco, and illicit drugs). Socio-demographic characteristics of the respondents included study site, gender, age, marital status, academic year, living situations, perceived family economic status, and perceived academic performance.

¹⁴ 180

181 Health related behaviors

We used the Health Behavior Survey,⁴⁹ which was designed as a broad survey of health-related behaviors and beliefs, components of the "National College Health Risk Behavior Survey" (1997),⁵⁰ and the Global School-based Student Health Survey.⁵¹ Each health behavior area was addressed by only a limited number of items. For example, frequency of consumption of fast food in an average week was assessed by a question, "On average, how many times do you eat fast food per week?" with response options of 0 time, 1-2 times a week, and 3 or more times a week. Similar questions and response options were used to assess consumption of several other kinds of healthy and unhealthy food, such as high-fat snack or fruits/vegetables. Self-ratings were also used for some questions, such as perceived body size (rated from very overweight to very underweight) and general health status (rated from very good to very poor).

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³⁶ 192

³ 193 Adverse childhood experiences (ACEs)

Five questions were adapted from the brief screening version of the Childhood Trauma Questionnaire to measure ACEs.⁵² The five yes/no questions asked about the experiences of physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect during childhood.

^{4/} 198

199 Self-rated health

51 200 SF-12 Health Survey (SF-12) was used to measure self-rated health.^{53 54} The SF-12 is a 52 53 201 multipurpose short-form generic measure of health status. It is a subset of the larger SF-36 and 54 55 202 monitors health in general and in specific populations. The SF-12 measures eight health

aspects, namely physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role limitations due to emotional problems, and mental health (psychological distress and psychological well-being).

Data analyses

Double data entry was performed using EpiData version 3 (Odense, Denmark). χ^2 test, or Fisher's exact test when a sample size was smaller than five in one cell, was used for categorical variables, and Student's t-test was used for continuous variables to compare socio-demographic characteristics, health risk behaviors (sexual behaviors, substance use, and eating behaviors), self-rated health (SF-12), and ACEs among students with depressive symptoms, defined by a CES-D score of \geq 16, to those without depressive symptoms. The same comparisons were also made among students with and without severe depressive symptoms, defined by a CES-D score of \geq 23.

In multivariate models, we first included all variables significantly associated with depressive symptoms in the bivariate analyses at a level of p-value <0.05 simultaneously in the models. Variables with a p-value >0.05 were then removed, and the models were refitted. The steps were repeated until all *p*-values of the remaining variables were <0.05 in the final models. Adjusted odds ratio (AOR) were obtained and presented with CI and p-values. SPSS version 22 (IBM Corporation, New York) was used for all statistical analyses.

Ethical considerations

The National Ethics Committee for Health Research of the Ministry of Health, Cambodia, approved the study protocol and materials (No. 191NECHR). Participation in this study was voluntary. In the process of obtaining a written informed consent, students were made clear that they could refuse or discontinue their participation at any time and for any reason. The confidentiality and privacy of the respondents were protected by administering the questionnaires in a private premise and by excluding personal identifiers from the data and field notes. After completing the survey, each participant received a small gift (costing approximately \$US 2.0) for their time compensation.

1 2										
3 4	232									
5 6 7 8 9 10 11 12 13	233	RESULTS								
	234	Socio-demographic	characteristic	cs						
	235	The study sample in	cluded 493 st	udents (36.3	3%) from L	JB and 866 st	tudents (63.7	%) from RUPP.		
	236	About half (50.8%)	of the respo	ndents were	e male, wi	th a mean a	nge of 21.3 y	ears [standard		
	237	deviation (SD)=2.3].	Less than 2	.0% (<i>n</i> = 26)) of the s	tudents initi	ally selected	for the study		
14 15	238	declined the particip	oation, mostly	due to thei	r time con	strains. They	were then r	eplaced by the		
16 17	239	next gender-matche	d student in t	he student i	name list. ⁻	The majority	of the respo	ndents (97.9%)		
17	240	were unmarried, an	nd 43.4% wer	e living wit	h their pa	rents. Regar	ding their fa	mily economic		
19 20	241	status, 59.2% reported that their family was neither rich nor poor. The proportion of students								
21 22	242	with depressive sy	mptoms and	d severe d	lepressive	symptoms	were 50.6%	6 and 19.6%,		
23 24	243	respectively.								
25 26	244	Table 1 that	a significant	ly higher pr	roportion	of students	with depress	sive symptoms		
27	245	were from UB ($p=0.004$) and from a poorer family ($p=0.002$) and reported poorer academic								
28 29	246	performance (p<0.001). Similarly, a significantly higher proportion of students with severe								
30 31	247	depressive symptoms were female ($p=0.002$) and from a poorer family ($p=0.04$) and reported								
32 33	248	poorer academic performance (p<0.001).								
34 35	249									
36 37	250	Table 1 Comparisons of	of socio-demog	graphic charad	cteristics of	university stu	idents with an	d without		
38	251	depressive symptoms								
39 40		Characteristics Depressive symptoms Severe depres				essive sympto	ms [†]			
41 42			No	Yes	P-value [‡]	No	Yes	P-value [‡]		
43		Study site			0.004			0.08		
44 45		Battambang	218 (44.2)	275 (55.8)		384 (77.9)	109 (22.1)			
46 47		Phnom Penh	454 (52.4)	412 (47.6)		709 (81.9)	157 (18.1)			
48 ⊿q		Gender			0.20			0.002		
50		Female	319 (47.7)	350 (52.3)		515 (77.0)	154 (23.0)			
51 52		Male	353 (51.2)	337 (48.8)		578 (83.8)	112 (16.2)			
53 54		Age (mean ± SD)	21.3 ± 2.4	21.4 ± 2.3	0.82	21.4 ± 2.3	21.1 ± 2.4	0.12		
55 56		Marital status			0.34			0.08		
50 57					0					
50 59					Э					

Page	10	of	3
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1 2										
3		Unmarried	655 (49.2)	675 (50.8)		1066 (80.2)	264 (19.8)			
4 5		Married	17 (58.6)	12 (41.4)		27 (93.1)	2 (6.9)			
5 6 7		Academic year	_/ (00.0)	(,	0.59	_/ (001_)	_ (0.0)	0.66		
8		, 1	240 (48 4)	256 (51 6)		394 (79 4)	102 (20 6)			
9		1		100 (01.0)))))) ())	FZ (20.0)			
10 11		2	145 (51.0)	136 (48.4)		224 (79.7)	57 (20.3)			
12		3	123 (49.0)	128 (51.0)		201 (80.1)	50 (19.9)			
13 14		4	164 (49.5)	167 (50.5)		274 (82.8)	57 (17.2)			
15		Currently living with			0.35			0.70		
16 17		Parents	297 (49.9)	298 (50.1)		486 (81.7)	109 (18.3)			
18 10		Relatives	81 (45.0)	99 (55.0)		139 (77.2)	41 (22.8)			
20		Sibling	87 (56.1)	68 (43.9)		124 (80.0)	31 (20.0)			
21 22		Friend	162 (50.2)	161 (49.8)		258 (79.9)	65 (20.1)			
23		Spouse/partners	10 (47.6)	11 (52.4)		19 (90.5)	2 (9.5)			
24 25		Alone	26 (41 9)	36 (58 1)		50 (80 6)	12 (19 4)			
26		Other	Q (3Q 1)	14 (60.9)		17 (73.9)	6 (26 1)			
27 28				14 (00.5)	0.002	17 (75.5)	0 (20.1)	0.04		
29		Perceived family econo	mic status		0.002			0.04		
30 31		Well-off/quite	248 (55.7)	197 (44.3)		374 (84.0)	71 (16.0)			
32		well-off								
33 34		Neither poor nor	398 (47.0)	448 (53.0)		669 (71.1)	177 (20.9)			
35		well-off								
36 37		Poor	26 (38.2)	42 (61.8)		50 (73.5)	18 (26.5)			
38 30		Perceived academic per	formance		<0.001			<0.001		
40		Very good	44 (77.2)	13 (22.8)		52 (91.2)	5 (5.8)			
41 42		Good	180 (59.0)	123 (40.6)		263 (86.8)	40 (13.2)			
43 44		Fairly good	301 (50.5)	295 (49.5		484 (81.2)	112 (18.8)			
45		Fair	138 (37.7)	228 (62.3)		275 (75.1)	91 (24.9)			
46 47		Poor	9 (24.3)	28 (75.7)		19 (51.4)	18 (48.6)			
48 49 50 51 52 53 54 55 56 57 57	252 253 254 255 256 257 258	Abbreviation: SD, standard deviation. Values are numbers of subjects (%) for categorical variables and means \pm standard deviation (SD) for continuous variables. [*] Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of \geq 16. [†] Defined by a CES-D score of \geq 23. [‡] Chi-square test was used for categorical variables; independent Student's t-test was used for continuous variables.								
59		For por	er review only	- http://bmion	10	a/site/about/oui	delines vhtml			
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1 2									
3 4	259								
5	260	Health risk behaviors							
7	261	As shown in Table 2, a	significantly	higher prop	oortion of	students wit	h depressiv	e symptoms	
8 9	262	reported consuming unh	ealthy food	frequently,	such as hi	gh-fat snack	(<i>p</i> =0.001 fo	r depressive	
10 11	263	symptoms; p<0.001 for	severe depr	essive symp	otoms), ma	irgarine, but	ter, or meat	fat (<i>p</i> =0.02	
12 13	264	for depressive sympton	ns; <i>p</i> <0.001	for severe	depressiv	e symptoms). A signific	antly lower	
14 15	265	proportion of students	with depr	essive sym	otoms rep	orted consu	uming of h	ealthy food	
16 17	266	frequently, such as fruits	and vegeta	bles (<i>p</i> =0.00	9 for depr	essive sympt	oms; <i>p</i> =0.00	7 for severe	
17	267	depressive symptoms),	or lean prot	ein (<i>p</i> <0.00	1 for depr	essive sympt	:oms; <i>p</i> =0.03	3 for severe	
19 20	268	depressive symptoms). A	significantl	y higher pro	portion of	students wit	th depressiv	e symptoms	
21 22	269	reported not having des	ert over the	past week (<i>p</i> =0.003 fc	or depressive	symptoms;	<i>p</i> =0.008 for	
23 24	270	severe depressive symp	toms). Mor	eover, a sig	nificantly	higher prop	ortion of st	udents with	
25 26	271	depressive symptoms pe	erceived that	t their body	size was v	very overwei	ght or very ເ	underweight	
27	272	(<i>p</i> <0.001 for both depres	sive sympto	oms and seve	re depressive symptoms).				
20	273								
30 31	274	Table 2 Comparisons of he	alth risk beha	viors among	university s	tudents with a	and without d	epressive	
32 33	275	symptoms							
34 35		Health and health risk	Depressive	symptoms		Severe depre	essive sympto	oms [†]	
36		behaviors	No	Yes	P-value [‡]	No	Yes	P-value [‡]	
37 38		Current tobacco smokers	5 (33.3)	10 (66.7)		12 (80.0)	3 (20.0)	0.97	
39 40		Self-perception regarding a	lcohol use		0.25			0.004	
40		Non drinker	425 (50.7)	413 (49.3)		681 (81.3)	157 (18.7)		
42 43		Occasional drinker	247 (47.4)	271 (52.6)		412 (78.7)	106 (21.3)		
44		Regular drinker	0 (0.0)	3 (100)		0 (0.0)	3 (100)		
45 46		Current illicit drug users	0 (0.0)	4 (100)	0.05	1 (25.0)	3 (75.0)	0.03	
47 48		Condom use at last sex	39 (47.0)	44 (53.0)	0.95	73 (88.0)	10 (12.0)	0.08	
49 50		Diagnosed with an STI	4 (40.0)	6 (60.0)	0.75	110 (84.0)	21 (16.0)	0.67	
51		Thought of ending life	40 (24.8)	121 (75.2)	<0.001	84 (52.2)	77 (47.8)	<0.001	

Attempted to end life 5 (20.0) Frequency of eating fast food per week

52

53 54

59

60

11

0.63

0.49

11 (44.0)

14 (56.0)

0.47

0.24

20 (80.0)

0 time	410 (49.3)	421 (50.7)		679 (81.7)	152 (18.3)	
1-2 times	231 (50.7)	225 (49.3)		360 (78.9)	96 (21.1)	
3 times or more	31 (43.1)	41 (56.9)		54 (75.0)	18 (25.0)	
Frequency of daily soft dri	nk consumptio	on	0.31			0.01
0 time	105 (46.5)	121 (53.5)		178 (78.8)	48 (21.2)	
1-2 times	399 (51.2)	380 (48.8)		647 (83.1)	132 (16.9)	
3 times or more	168 (47.5)	186 (52.5)		268 (75.7)	86 (24.3)	
Frequency of weekly high-	fat snack cons	sumption	0.001			<0.001
0 time	162 (52.8)	145 (47.2)		260 (84.7)	47 (15.3)	
1-2 times	443 (51.0)	426 (49.0)		711 (81.8)	158 (18.2)	
3 times or more	67 (36.6)	116 (63.4)		122 (66.7)	61 (33.3)	
Frequency of weekly dese	rt consumptio	n	0.003			0.008
0 time	106 (40.6)	155 (59.4)		192 (73.6)	69 (26.4)	
1-2 times	434 (52.7)	389 (47.3)		676 (82.1)	147 (17.9)	
3 times or more	132 (48.0)	143 (52.0)		225 (81.8)	50 (18.2)	
Frequency of weekly fruit/	vegetable cor	sumption	0.009			0.007
0 time	50 (37.3)	84 (62.7)		94 (70.1)	40 (29.9)	
1-2 times	390 (51.7)	365 (48.3)		617 (81.7)	138 (18.3)	
3 times or more	232 (49.4)	238 (50.6)		382 (81.3)	88 (12.7)	
Frequency of weekly lean	protein consu	mption	<0.001			0.03
0 time	57 (34.8)	107 (65.2)		119 (72.6)	45 (27.4)	
1-2 times	453 (51.8)	421 (48.2)		714 (81.7)	160 (18.3)	
3 times or more	162 (50.5)	159 (49.5)		260 (81.0)	61 (19.0)	
Amount of margarine/but	ter/meat fat c	onsumption	0.02			<0.001
None/very little	296 (52.4)	269 (47.6)		471 (83.4)	94 (16.6)	
Some	339 (48.7)	357 (51.3)		558 (80.2)	138 (19.8)	
A lot	37 (37.8)	61 (62.2)		64 (65.3)	34 (34.7)	
Self-perception about bod	y size		<0.001			<0.001
About right	275 (55.4)	221 (44.6)		428 (86.3)	68 (13.7)	
Very overweight	27 (34.2)	52 (65.8)		55 (69.6)	24 (30.4)	
Slightly overweight	101 (40.0)	168 (51 1)		247 (75.1)	82 (24.9)	
Slightly overweight	161 (48.9)	100 (51.1)		(/ 0)	- (-)	

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2		
3 ⊿		Very underweight 18 (25.7) 52 (74.3) 44 (62.9) 26 (37.1)
4 5	276	Abbreviations: STI, sexually transmitted infections.
6	277	Values are numbers of subjects (%).
7	278	* Defined by a Center for Enidemiology Studies Depression Scale (CES-D) score of >16
8	279	^t Defined by a CES-D score of >23
9	275	[†] Chi square test was used or Eisher's evact test was used as appropriate
10	200	chi-square test was used of fisher's exact test was used as appropriate.
11	201	
12 13	282	Self-rated health (SF-12)
14 15	283	Table 3 shows that significantly higher proportion of students with depressive symptoms
16 17	284	perceived that their general health status was poor (p <0.001 for both depressive symptoms and
18 19	285	severe depressive symptoms). A significantly higher proportion of students with depressive
20 21	286	symptoms reported higher levels of limitation in several daily activities, such as limitation in
22	287	moderate activities (p <0.001 for depressive symptoms; p =0.02 for severe depressive
24	288	symptoms), climbing several flights of stairs (p<0.001 for depressive symptoms), or other kinds
25 26	289	of activities in the past four weeks as a result of their physical or emotional health problems
27 28	290	(p<0.001 for both depressive symptoms and severe depressive symptoms). Further, they
29 30	291	reported higher levels of problems in several other physical and emotional health aspects in the
31 32	292	past four weeks, such as the feeling that they had accomplished less than they would like
33 34	293	(p<0.001 for both depressive symptoms and severe depressive symptoms), pain interferes with
35	294	their normal work (p<0.001 for both depressive symptoms and severe depressive symptoms),
36 37	295	having less energy (p<0.001 for both depressive symptoms and severe depressive symptoms),
38 39	296	down-hearted and blue (p<0.001 for both depressive symptoms and severe depressive
40 41	297	symptoms), and that their physical health interferes with their social acts (p <0.001 for both
42 43	298	depressive symptoms and severe depressive symptoms).
43 44	299	

Table 3 Comparisons of self-rated health (SF-12) among university students with and without depressive symptoms

Self-rated health (SF-12)	Depressive	symptoms		Severe dep	ressive sympt	toms [†]
	No	Yes	P-value [‡]	No	Yes	P-value [‡]
Self-perception on general h	nealth status		<0.001			<0.001
Very good	106 (64.2)	59 (35.8)		147 (89.1)	18 (10.9)	
Good	380 (58.5)	270 (41.5)		566 (87.1)	84 (12.9)	

Page	14	of	3
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Neither good nor poor	176 (38.0)	287 (62.0)		351 (75.8)	112 (24.2)	
Poor	10 (12.3)	71 (87.7)		29 (35.8)	52 (64.2)	
Limitation in moderate activi	ties on a typi	cal day	<0.001			0.02
Greatly limited	20 (28.2)	51 (71.8)		50 (70.4)	21 (29.6)	
Mildly limited	291 (45.6)	347 (54.4)		505 (79.2)	133 (20.8)	
Not limited	361 (55.5)	289 (44.5)		538 (82.8)	112 (17.2)	
Limitation in climbing severa	l flights of sta	irs	<0.001			0.24
Greatly limited	64 (35.8)	115 (64.2)		140 (78.2)	39 (21.8)	
Mildly limited	323 (47.8)	353 (52.2)		536 (79.3)	140 (20.7)	
Not limited	285 (56.5)	219 (43.5)		417 (82.7)	87 (17.2)	
Limitation in other kinds of	271 (37.8)	446 (62.2)	<0.001	516 (72.0)	201 (28.0)	<0.001
activities in past 4 weeks						
Accomplished less than you	377 (61.9)	232 (38.1)	<0.001	553 (50.6)	197 (26.3)	<0.001
would like in past 4 weeks						
as a result of emotional						
health						
Accomplished less than you	304 (67.3)	148 (32.7)	<0.001	675 (74.4)	232 (25.6)	<0.001
would like in past 4 weeks						
as a result of physical						
health						
Did activities less carefully	378 (41.8)	526 (58.2)	<0.001	677 (74.9)	227 (25.1)	<0.001
than usual in past 4 weeks						
Pain interferes with your nor	mal work in p	ast 4 weeks	<0.001			<0.001
Not at all	141 (75.8)	45 (24.2)		176 (94.6)	10 (5.4)	
A little bit	401 (57.6)	295 (42.4)		635 (91.2)	61 (8.8)	
Moderately	106 (32.9)	216 (31.4)		216 (67.1)	106 (32.9)	
Quite a bit	23 (16.5)	116 (83.5)		62 (44.6)	77 (55.4)	
Extremely	1 (6.3)	15 (93.8)		4 (25.0)	12 (75.0)	
Feeling calm and peaceful in	past 4 weeks		0.33			0.06
A lot of the time	22 (42.3)	30 (57.7)		38 (73.1)	14 (26.9)	
Most of the time	68 (53.5)	59 (46.5)		92 (72.9)	35 (27.6)	
A good bit of time	115 (50.9)	111 (49.1)		188 (83.2)	38 (16.2)	

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	Some of the time	278 (46.8)	316 (53.2)		477 (80.3)	117 (17.7)	
	A little of the time	170 (51.8)	158 (48.2)		274 (83.5)	54 (16.5)	
	None of the time	19 (59.4)	13 (40.6)		24 (75.0)	8 (25.0)	
н	laving a lot of energy in pas	t 4 weeks		<0.001			<0.001
	A lot of the time	46 (61.3)	29 (38.7)		66 (88.0)	9 (12.0)	
	Most of the time	111 (68.9)	50 (31.1)		149 (92.5)	12 (7.5)	
	A good bit of time	245 (56.8)	186 (43.2)		383 (88.9)	48 (11.1)	
	Some of the time	207 (41.5)	292 (58.5)		364 (72.9)	135 (27.1)	
	A little of the time	57 (33.7)	112 (66.3)		116 (68.6)	53 (31.4)	
	None of the time	6 (25.0)	18 (75.0)		15 (62.5)	9 (37.5)	
F۴	eeling down-hearted and bl	lue in past 4 w	veeks	<0.001			<0.001
	A lot of the time	7 (21.9)	25 (78.1)		14 (43.8)	18 (56.3)	
	Most of the time	8 (8.3)	88 (91.7)		36 (37.5)	60 (62.5)	
	A good bit of the time	42 (17.9)	171 (80.3)		117 (54.9)	96 (45.1)	
	Some of the time	222 (46.7)	253 (53.3)		412 (86.7)	63 (13.3)	
	A little of the time	354 (71.5)	141 (28.5)		469 (94.7)	26 (5.3)	
	None of the time	39 (81.3)	9 (18.8)		45 (93.8)	3 (6.3)	
P	hysical health interferes so	cial act in past	4 weeks	<0.001	- ()	- ()	<0.001
	A lot of the time	4 (33 3)	8 (66 7)		6 (50 0)	6 (50 0)	
	Most of the time	10 (23 3)	33 (76 7)		18 (41 9)	58 (58 1)	
	Some of the time	1/6 (29.1)	227 (61 0)		1 0 (4 1.5) 27 5 (71.8)	102 (22 2)	
	A little of the time	140 (30.1) 255 (53 7)	206 (46 2)			02 (14 1)	
	A little of the time	300 (53.7)	300 (40.3)			95 (14.1)	
	None of the time	157 (60.4)	TO3 (39.6)		226 (26.9)	34 (13.2)	

Values are numbers of subjects (%) for categorical variables.

Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of ≥ 16 .

[†]Defined by a CES-D score of \geq 23.

^{*}Chi-square test was used for categorical variables or Fisher's exact test was used as appropriate.

Adverse childhood experiences (ACEs)

Table 4 shows that a significantly higher proportion of students with depressive symptoms reported having been hit, slapped, or kicked by a parent or guardian (p<0.001 for both depressive symptoms and severe depressive symptoms); that people in their family had said hurtful or insulting things to them (p<0.001 for both depressive symptoms and severe

depressive symptoms); and that someone had tried to touch them or make them touch him/her in a sexual way (p=0.001 for depressive symptoms; p<0.001 for severe depressive symptoms). In contrast, significantly lower proportion of students with depressive symptoms reported that there had been someone to take care of them and take them to medical care when they got sick (p=0.04 for depressive symptoms; p=0.03 for severe depressive symptoms), and someone who helped them feel that they were loved and important (p=0.03 for depressive symptoms; *p*<0.001 for severe depressive symptoms).

Table 4 Comparisons of adverse childhood experiences among university students with and without

19		
20	321	depressive symptoms

xperiences ad been hit, slapped, cked, by a arent/guardian eople in my family had	No 200 (38.2)	Yes 323 (61.8)	P-value[‡] <0.001	No 384 (73.4)	Yes 139 (26.6)	P-value[‡] <0.001
ad been hit, slapped, cked, by a arent/guardian eople in my family had	200 (38.2)	323 (61.8)	<0.001	384 (73.4)	139 (26.6)	<0.001
icked, by a arent/guardian eople in my family had	207 (22.2)					
arent/guardian eople in my family had	207 (22.2)					
eople in my family had	207 (22.2)					
vid burtful or inculting	297 (39.0)	464 (61.0)	<0.001	558 (73.3)	203 (26.7)	<0.001
and nurthul or insulting						
nings to me						
omeone had tried to	87 (39.2)	135 (60.8)	0.001	159 (71.6)	63 (28.4)	<0.001
ouch me or make me						
ouch them in a sexual way						
nere had been someone	636 (50.2)	632 (49.8)	0.04	1028 (81.1)	240 (18.9)	0.03
) take care me and take						
e to medical care when I						
ot sick						
nere had been someone	647 (50.1)	644 (49.9)	0.03	1050 (81.3)	266 (19.6)	<0.001
ho helped me feel that I						
as loved and important						
	omeone had tried to buch me or make me buch them in a sexual way here had been someone take care me and take e to medical care when I of sick here had been someone ho helped me feel that I as loved and important calues are numbers of subject efined by a Center for Epido Defined by a CES-D score of	between end tried to $87 (39.2)$ buch me or make mebuch them in a sexual waybetween had been someone $636 (50.2)$ between the takebetween take <tr< td=""><td>between end tried to87 (39.2)135 (60.8)buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)betake care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)ho helped me feel that Ias loved and importantbeta are numbers of subjects (%).efined by a Center for Epidemiology Studies Depressionbefined by a CES-D score of ≥23.</td><td>between end tried to87 (39.2)135 (60.8)0.001buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)0.04betake care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)0.03ho helped me feel that Ias loved and importantbulkes are numbers of subjects (%).efined by a Center for Epidemiology Studies Depression Scale (CES-I)befined by a CES-D score of ≥23.</td><td>be a procession of the second second</td><td>borneone had tried to87 (39.2)135 (60.8)0.001159 (71.6)63 (28.4)buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)0.041028 (81.1)240 (18.9)be take care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)0.031050 (81.3)266 (19.6)ho helped me feel that Ias loved and importantbe gined by a Center for Epidemiology Studies Depression Scale (CES-D) score of ≥16.be fined by a CES-D score of ≥23.</td></tr<>	between end tried to87 (39.2)135 (60.8)buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)betake care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)ho helped me feel that Ias loved and importantbeta are numbers of subjects (%).efined by a Center for Epidemiology Studies Depressionbefined by a CES-D score of ≥23.	between end tried to87 (39.2)135 (60.8)0.001buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)0.04betake care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)0.03ho helped me feel that Ias loved and importantbulkes are numbers of subjects (%).efined by a Center for Epidemiology Studies Depression Scale (CES-I)befined by a CES-D score of ≥23.	be a procession of the second	borneone had tried to87 (39.2)135 (60.8)0.001159 (71.6)63 (28.4)buch me or make mebuch them in a sexual wayhere had been someone636 (50.2)632 (49.8)0.041028 (81.1)240 (18.9)be take care me and takee to medical care when Ibot sickhere had been someone647 (50.1)644 (49.9)0.031050 (81.3)266 (19.6)ho helped me feel that Ias loved and importantbe gined by a Center for Epidemiology Studies Depression Scale (CES-D) score of ≥16.be fined by a CES-D score of ≥23.

1 2		
2 3 4	326	
5	327	Risk factors of depressive symptoms
0 7	328	Results of multivariate logistic analyses are shown in Table 5. After controlling for potential
8 9 10 11	329	confounding factors, the odds of depressive symptoms increased significantly with self-
	330	reported poor academic performance (depressive symptoms: AOR=7.31, 95% CI=2.24-23.86;
12 13	331	severe depressive symptoms: AOR=7.38, 95% CI=1.75-10.94) and high consumption of
14 15	332	unhealthy food, including high-fat snack, margarine, butter, or meat fat (depressive symptoms:
16 17	333	AOR=1.72, 95% CI=1.08-2.76; severe depressive symptoms: AOR=2.13, 95% CI=1.15-3.95). The
18	334	odds decreased significantly with the perception that their body size was slightly underweight
19 20	335	compared to the perception that their body size was very overweight (depressive symptoms:
21 22	336	AOR=0.54, 95% CI=0.29-0.99; severe depressive symptoms: AOR=0.37, 95% CI=0.18-0.77).
23 24	337	Regarding self-rated health, the odds of depressive symptoms increased significantly
25 26	338	with the perception that their general health status was poor (depressive symptoms: AOR=2.99,
27 28 29	339	95% CI=1.28-7.00; severe depressive symptoms: AOR=5.43, 95% CI=2.19-13.46) and the report
	340	of higher level of limitation in moderate activities (depressive symptoms: AOR=0.30 (95%
30 31	341	CI=0.16-0.58), higher level of pain interference with their normal work (depressive symptoms:
32 33	342	AOR=10.43, 95% CI=1.05-10.94; severe depressive symptoms: AOR=10.02, 95% CI=1.99-9.28),
34 35	343	and higher level of feeling down-hearted and blue (depressive symptoms: AOR=6.69, 95%
36 37	344	CI=1.87-23.90; severe depressive symptoms: AOR=8.72, 95% CI=1.69-14.86).
38 39	345	For ACEs, the odds of depressive symptoms increased significantly with the report of
40	346	having been hit, slapped, or kicked by a parent or guardian (depressive symptoms: AOR=1.39,
41	347	95% CI=1.04-1.86) and that people in their family had said hurtful or insulting things to them
43 44	348	(depressive symptoms: AOR=1.82, 95% CI=1.37-2.42; severe depressive symptoms: AOR=2.18,
45 46	349	95% CI=1.46-3.24) during their childhood. In contrast, the odds of depressive symptoms
47 48	350	decreased significantly with the report that there had been someone to take care of them and
49 50	351	take them to medical care when they got sick (depressive symptoms: AOR=0.51, 95% CI=0.30-
51 52	352	0.86; severe depressive symptoms: AOR=0.26, 95% CI=0.13-0.52).
52 53	353	

Table 5 Factors associated with depressive symptoms and severe depressive symptoms

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Variables in the final model	Depressive symptoms	Depressive symptoms ⁺		
	AOR (95% CI)	P-value	AOR (95% CI)	P-value
Perceived academic performanc	e			
Very good	Reference		Reference	
Good	2.28 (1.01-5.15)	0.04	1.22 (0.35-4.19)	0.76
Fairly good	3.51 (1.58-7.78)	0.002	2.15 (0.65-7.11)	0.21
Fair	5.30 (2.35-11.93)	<0.001	2.52 (0.75-8-43)	0.13
Poor	7.31 (2.24-23.86)	0.001	7.38 (1.75-10.94)	0.006
Frequency of weekly high-fat sn	ack consumption			
0 time	Reference		Reference	
1-2 times	0.99 (0.72-1.37)	0.95	1.25 (0.78-1.99)	0.36
3 times or more	1.72 (1.08-2.76)	0.02	2.13 (1.15-3.95)	0.02
Frequency of weekly lean protei	n consumption			
0 time	Reference		Reference	
1-2 times	0.52 (0.34-0.79)	0.002	0.69 (0.41-1.18)	0.17
3 times or more	0.62 (0.38-0.96)	0.04	0.80 (0.44-1.47)	0.48
Amount of margarine/butter/m	eat fat consumption			
None/very little			Reference	
Some			0.98 (0.66-1.46)	0.91
A lot			1.92 (1.02-3.64)	0.04
Self-perception about body shap	De			
Very overweight	Reference			
Slightly overweight	0.56 (0.31-1.07)	0.08	0.65 (0.32-1.14)	0.25
About right	0.58 (0.32-1.05	0.07	0.45 (0.22-0.93)	0.03
Slightly underweight	0.54 (0.29-0.99)	0.04	0.37 (0.18-0.77)	0.008
Very underweight	0.92 (0.38-2.25)	0.86	0.38 (0.14-0.99)	0.04
Self-perception on general healt	h status			
Very good				
Good	1.05 (0.68-1.64)	0.82	1.19 (0.60-2.38)	0.62
Fair	1.58 (0.99-2-51)	0.05	1.47 (0.73-2.96)	0.28
Poor	2.99 (1.28-7.00)	0.01	5.43 (2.19-13.46)	<0.001

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3 4		Greatly limited	Reference		Reference	
5		Mildly limited	0.39 (0.20-0.74)	0.004	0.64 (0.29-1.34)	0.23
6 7		Not limited	0.30 (0.16-0.58)	<0.001	0.63 (0.30-1.36)	0.24
8		Pain interferes with your norma	l work in past 4 weeks			
9 10		Not at all	Reference		Reference	
11		Δ little hit	1 68 (1 08-2 61)	0.02	1 01 (0 46-2 22)	0 99
12 13		A little bit	2.10 (1.00 2.01)	40.001	1.01(0.402.22)	0.001
14		woderately	3.10 (1.89-5.10)	<0.001	3.69 (1.68-7.11)	0.001
15 16		Quite a bit	4.14 (2.13-8.05)	<0.001	4.68 (2.01-10.92)	<0.001
17		Extremely	10.43 (1.05-10.94)	0.04	10.02 (1.99-9.28)	0.005
18 19		Feeling down-hearted and blue	in past 4 weeks			
20		None of the time	Reference		Reference	
21 22		A little of the time	0.52 (0.63-3.66)	0.35	1.02 (0.24-4.29)	0.98
23		Some of the time	3.42 (1.42-8.23)	0.006	1.83 (0.45-7.45)	0.40
24 25		A good bit of the time	7.70 (3.02-19.66)	<0.001	6.01 (1.45-4.85)	0.01
26 27		Most of the time	20.71 (6.47-66.37)	<0.001	9.04 (2.31-13.71)	0.002
27 28		A lot of the time	6 60 (1 87-23 00)	0.001	8 72 (1 60-14 86)	0.002
29 30			0.09 (1.87-23.90)	0.003	8.72 (1.09-14.80)	0.01
31		Had been nit, slapped, kicked, b	y a parent/guardian			
32 33		No	Reference		Reference	
33 34		Yes	1.39 (1.04-1.86)	0.03	1.11 (0.75-1.65)	0.59
35 36		People in my family had said hu	rtful or insulting things to m	ne		
37		No	Reference		Reference	
38 39		Yes	1.82 (1.37-2.42)	<0.001	2.18 (1.46-3.24)	<0.001
40		There had been someone to tak	e care of me and take me to	o medical care	e when I got sick	
41 42		No	Reference		Reference	
43		Yes	0.51 (0.30-0.86)	0.01	0.26 (0.13-0.52)	<0.001
44 45	255	Abbreviations: AOR adjusted or	, Ids ratio: CL confidence inte	prval	, ,	
46 47 48 49 50 51	356 357 358 359 360	*Variables in the table were th logistic regression model after so [†] Defined by a Center for Epidem [‡] Defined by a CES-D score of ≥23	ne ones that remained sta everal steps of model fitting iology Studies Depression S 3.	itistically sign g. cale (CES-D) s	ificant in the final m core of ≥16.	ultivariate
52 53 54	361	DISCUSSION				
56 57 58			19			
59 60		For peer review	only - http://bmiopen.bmi.co	m/site/about/o	guidelines.xhtml	
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This study unearthed a number of factors correlated with depressive symptoms among university students in Cambodia. The salient factors comprised cultural and socio-economic dimensions (gender, socio-economic background, and lack of general and medical care by family during their childhood), individual behaviors and attitudes (poor academic accomplishment, consumption of unhealthy food, negative perception about their body and their general health status, and limited physical activeness), and nurture-related facets (physical violence and psychological abuse by family during their childhood).

The bivariate outcomes display that students from the provincial university (UB) and a poorer family were more susceptible to depressive symptoms. Likewise, students from a poorer family and female students were more prone to severe depressive symptoms. Albeit not manifesting in the multivariate model, these factors are corroborated by the existing scholarship. Various studies revealed that university students from rural areas and low socio-economic backgrounds were predisposed to higher depression.^{1 16 28 55 56} This could be explained by an economic situation where students with a rural background tended to stipulate a poorer family status. Plus, financial vulnerability could further exacerbate depression in students from low-income families. A meta-analysis of 60 studies unveiled that people in the lowest socio-economic guintile had 1.81 the probability of depression compared with those in the highest socio-economic quintile.⁵⁷ A global study on 17,348 university students from 23 high-, middle-, and low-income countries also uncovered that higher depressive symptoms were recorded among students in low-income countries and economies with greater income inequality.¹⁶ The Cambodian economy has been growing rapidly in terms of income per capita; vet, income gaps between the rich and the poor and between rural and urban areas remain large.⁵⁸ The gaps in income and material growth, which typify economic conditions, may induce people's mental health problems. In another word, poor economic status may bring about low self-esteem and self-confidence, which would lead to depression.

Some research also discovered that female students were more at risk to depression.¹⁶ Some research also discovered that female students were more at risk to depression.¹⁶ This might be due to social difficulties, physiological tenets, higher self-expectations, and perceived lack of competence among female students.⁵⁹ In the Cambodian culture, young women would perceive a great deal of challenges when living away from their family or parents Page 21 of 33

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since they need to maintain the cultural behaviors and meanwhile cope with independent habitation. Over half (56.6%) of the student respondents in our study were not living with their parents. Moreover, women tended to over-report medical and psychological symptoms as indicated in a study on 440 undergraduate students in America.⁶³ Articulating their emotions may be one strategy for dealing with stressful events.

Our multivariate results depict that students with depressive symptoms, regardless of severity, tended to report poor academic performance and higher consumption of unhealthy food. These findings conform to a systematic review of 24 studies⁶ and studies in Asia, such as China,⁷ which pinpoint low scholastic merit and suicidal ideation as consistent correlates of depression in university students probably as a culmination of poor concentration and solitude. On the consumption of unhealthy food, the transition from adolescence to adulthood, and thus the changes in lifestyle such as living arrangements and independence, might have rendered university students to indulge in unhealthy food, as pinpointed by a meta-analysis of 39 studies in China.⁷ As afore-mentioned, more than half of our sample were not living with their parents; therefore, it might have been hard for them to maintain healthy daily food. Conversely, depression might have made students care-free about themselves and consequently eat unhealthily.¹⁷ This implies that nutrition education for both physical and mental health, stressing healthy food for the body and mind, is imperative for university students.

Students with depressive symptoms, regardless of magnitude, also tended to have a negative perception about their body and their general health status. These findings confirms the general perception among depressed people who are not gratified with their body and health,¹⁷ although these relationships require a cautious interpretation given that CES-D also measures some aspects of negative self-perception. Further, depressed students were more likely to have limited physical activeness, more pain interference with their normal work, and more dismay or sorrow.^{64 65} Therefore, physical exercises, such as sports, should be regularly promoted among university students.

Finally, students with depressive symptoms, disregard of severity, were more likely to encounter physical violence by their parent or guardian, psychological abuse by their family members, and lack of general and medical care by their family when they were growing up. As

for the physical violence and psychological abuse, this finding tends to acquiesce with a study in Cambodia that postulates that exposure to violence within family is associated with depression in high school students.^{38 39} On the lack of general and medical care by family, a Chinese study on 5,245 students at six universities found that students who had a poor parental relationship were more vulnerable to depression.⁶⁶ Also, a global study on 17,348 university students from 23 high, middle-, and low-income countries iterated that university students with less individualistic cultures, particularly in Asia, reported higher extents of depressive symptoms.¹⁶ Students of these cultures longed for more familial and societal ties and assistance, and thus felt depressed once this social capital was unavailable.¹⁶ This highlights a significant role of family bonds and scaffolding in association with depression among university students. The lack of social support from the family presumably would only be a factor for students living independently. But, for those living with relatives, friends, or spouse, they would still have such support.

A study on a sample of 2,671 respondents in nine provinces and a capital city in 2012 revealed that Cambodia greatly needs more and better counseling and mental health services.⁶⁷ The study also pointed out the shortage of skilled professionals in the field of mental health, particularly those with high clinical and counseling skills to treat mental disorders. In 2012, Cambodia had only 49 trained psychiatrists and 45 psychiatric nurses working in mental health facilities and private practices.^{67 68} Many health staff lack training, supervision, and experience in these areas. Only about 300 doctors completed basic mental healthcare training.⁶⁹ At university level, the 2012 study called for more awareness raising for self-care and burnout prevention and mental health counseling services for staff and students.⁶⁷ Given the paucity of mental health services in general, let alone at universities, our findings fuel the needs for more and better mental healthcare in Cambodia. Further to medical care, universities should provide measures, such as student loans and healthy canteens, to mitigate some key predictors of depression among students, such as financial hardship and poor diets.

446 This study contains certain limitations. First, it examined students at only two public 447 universities, one in a city and the other in a province. Hence, its findings cannot be generalized 448 at a national level. Second, the cross-sectional design did not enable an establishment of the Page 23 of 33

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causal linkages between depressive symptoms and the related factors. Given the temporal order and the cross-sectional nature of the data, causal relationships between the variables could not be derived. Potential bi-directionality of the associations could occur either way. For instance, physical inactivity could cause depression. Nonetheless, the reverse could also be true—that depression could lead to inactivity, and of course both could be true simultaneously, where depressive symptoms worsen with physical inactivity, making physical activity less likely. Third, this study employed self-reported data, which might have been subject to recall bias of over-reporting and under-reporting. Future studies should attempt to use more objective data (e.g., linking participants' responses to university records of academic performance) to increase validity of the information. Nonetheless, the quality of the data was ensured by thorough training of the enumerators and field supervisors on the study protocols and data collection method. Finally, the main outcome measure (CES-D) and some other measures, such as ACEs and SF-12, were modified from other research and have not been validated in the Cambodian settings. Therefore, the interpretation of the findings must be made with caution. Notwithstanding these malfeasances, the findings of this study offer first and foremost implications for policy development and future research in the Cambodian context.

CONCLUSIONS

This study identified social and behavioral factors associated with depressive symptoms among Cambodian students at two universities. While causation could not be drawn between these factors and depression, we surmise that these factors were inter-twined, and thus need to be addressed in an integrated and holistic fashion.

These findings render three major implications. First, given the current educational reform and labor market that demand better quality and ergo more competition among university students, the correlates of depressive symptoms could not be more critical for tackling for the time being. Failure to ameliorate these factors would jeopardize the gualification and career development of this populace and finally the human capital for nation-building. Second, these findings warrant an acceleration of on-campus counseling services for university students throughout the course of studentship. Efforts should be invested in

comprehensive screening and intervention programs to diagnose those susceptible students early, offer immediate treatment, and cater appropriate support. Ultimately, the jurisdiction of refining students' mental state should go beyond universities to families and pertinent governmental bodies at large, provided we are to assist the young to overcome their academic challenges and enjoy a prosperous post-graduation life. Further research could delve into changing lifestyles and their associations with depressive symptoms among a larger sample of university students. Furthermore, validation studies are required to develop and validate reliable instruments for use in Cambodian populations. Acknowledgements The authors thank research assistants; representatives of students, faculty members, and school administrators who supported the development of the study design and tools; and the study participants for their contribution to this study. **Contributions** SY, KP and TS conceived research questions, designed the study and developed the research protocol and tools. SY and CN analyzed the data and interpreted the results and

drafted the manuscript. KP, PC and RY supported the protocol and tools development and were responsible for training and data collection. All authors contributed to the writing and approved the final manuscript.

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Competing interests None declared

1 2		
3 4	506	Ethics approval The National Ethics Committee for Health Research of the Ministry of Health,
5	507	Cambodia approved this study (Reference no. 082NECHR), and a written informed consent was
7	508	obtained from each participant.
8 9	509	
10 11	510	Data sharing statement Data used for this analysis are available upon request from the
12 13	511	Principal Investigator (Dr. Siyan Yi) at siyan@doctor.com . The data cannot be made publicly
14 15	512	available due to ethical restriction.
16 17	513	
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STROBE Statement-Checklist of items that should be included in reports of cross-sectional studies

	Item No	Recommendation
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract
	-	Confirmed (Lines 1-54)
		(b) Provide in the abstract an informative and balanced summary of what was done
		and what was found Confirmed (Lines 30-54)
I 4		
Introduction	2	Fundain the activities have been advective to fing the investigation being more that
Background/rationale	Z	Confirmed (Lines 67-110)
Objectives	3	State specific objectives, including any prespecified hypotheses. Confirmed (Lines
		108-110)
Methods	~	
Study design	4	Present key elements of study design early in the paper. Confirmed (Line 114)
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment,
6		exposure, follow-up, and data collection. Confirmed (Line 114-116)
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of
1		participants. Confirmed (Lines 124-133)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect
		modifiers. Give diagnostic criteria, if applicable, Confirmed (Lines 152-201)
Data sources/	8*	For each variable of interest, give sources of data and details of methods of
measurement	Ũ	assessment (measurement). Describe comparability of assessment methods if there is
meusurement		more than one group Confirmed (Lines 159-205)
Bias	9	Describe any efforts to address potential sources of bias Confirmed (Lines 143-157)
Study size	10	Explain how the study size was arrived at Confirmed (116-122)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable
Quantitudive variables	11	describe which groupings were chosen and why Confirmed (Lines 207-215)
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding
Statistical methods	12	Confirmed (Lines 216-221)
		(b) Describe any methods used to examine subgroups and interactions (Not
		applicable)
		(c) Explain how missing data were addressed (Not applicable)
		(d) If applicable, describe analytical methods taking account of sampling strategy.
		(Not applicable)
		(e) Describe any sensitivity analyses. (Not applicable)
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially
-		eligible, examined for eligibility, confirmed eligible, included in the study,
		completing follow-up, and analysed. Confirmed (Lines 235)
		(b) Give reasons for non-participation at each stage (Not applicable)
		(c) Consider use of a flow diagram (Not applicable)
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and
-		information on exposures and potential confounders. Confirmed (Lines 236-243)
		(b) Indicate number of participants with missing data for each variable of interest.
		(Not applicable)
Outcome data	15*	Report numbers of outcome events or summary measures. Confirmed (241-243)
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and
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		their precision (eg, 95% confidence interval). Make clear which confounders were
		adjusted for and why they were included. Confirmed (244-359)
		(b) Report category boundaries when continuous variables were categorized. (Not
		applicable)
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a
		meaningful time period. (Not applicable)
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions, and
		sensitivity analyses. Not applicable.
Discussion		
Key results	18	Summarise key results with reference to study objectives. Confirmed (Lines 362-
		368)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or
		imprecision. Discuss both direction and magnitude of any potential bias. Confirmed
		(Lines 446-464)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations,
		multiplicity of analyses, results from similar studies, and other relevant evidence.
		Confirmed (Lines 369-445)
Generalisability	21	Discuss the generalisability (external validity) of the study results. Confirmed (Lines
		446-448)
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if
		applicable, for the original study on which the present article is based. Confirmed
		(Lines 497-499)

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Social and behavioral factors associated with depressive symptoms among university students in Cambodia: A cross-sectional study

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Secondary Subject Heading:	Public health, Epidemiology, Sociology, Health services research
Keywords:	Cross-sectional survey, Depressive symptoms, MENTAL HEALTH, Social and behavioral factors, University students, Cambodia

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3	1	Social and behavioral factors associated with depressive symptoms among university
4 5 6	2	students in Cambodia: A cross-sectional study
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8 9	4	Chanrith Ngin, ^{1,2} Khuondyla Pal, ¹ Sovannary Tuot, ¹ Pheak Chhoun, ¹ Rosa Yi, ² Siyan Yi ^{1,3,4,*}
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ABSTRACT

Objective To explore social and behavioral factors associated with depressive symptoms among university students in Cambodia.

Design Cross-sectional study.

Settings Two public universities, one in the capital city of Phnom Penh and another in Battambang provincial town.

Participants This study included 1,359 students randomly selected from all departments in the two universities using a multi-stage cluster sampling method for a self-administered questionnaire survey in 2015.

Primary outcome measure Depressive symptoms measured by using the Center for Epidemiologic Studies Depression scale (CES-D). All measures in the study were self-reported.

Results The proportion of students with depressive symptoms and severe depressive symptoms were 50.6% and 19.6%, respectively. After adjustment in multivariate logistic regression analysis, depressive symptoms remained significantly associated with poor academic performance (AOR= 7.31, 95% CI= 2.24-23.86), higher consumption of unhealthy food (AOR= 1.72, 95% CI= 1.08-2.76), a negative self-perception about body shape (AOR= 0.54, 95% CI= 0.29-0.99) and general health status (AOR= 2.99, 95% CI= 1.28-7.00), and limited physical activeness (AOR= 0.30, 95% CI= 0.16-0.58). Depressive symptoms also remained significantly associated with adverse childhood experiences including physical violence (AOR= 1.39, 95% CI= 1.04-1.86), psychological abuse (AOR= 1.82, 95% CI= 1.37-2.42), and lack of general and medical care (AOR= 0.51, 95% CI= 0.30-0.86) by family during childhood.

Conclusions The key factors associated with depressive symptoms were family-related and individual behaviors and attitudes. Thus, efforts should be invested in comprehensive screening and intervention programs to diagnose those vulnerable students early, offer immediate treatment, and cater appropriate support.

Strengths and limitations of this study

This research is among a very few studies in developing countries in which standardized tools are used and rigorous analyses are performed.

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 It included a large sample of students randomly selected from all departments in two public universities – one in the capital city and the other in a provincial town – using a multi-stage cluster sampling method.

 Limitations of the study, however, included the representativeness of the study sample, the cross-sectional nature of the data that limits causation inferences, unknown validity of the scales used to measures important constructs in Cambodian contexts, and potential bias of self-reported measures.

67 INTRODUCTION

Several studies have suggested that the aspects of mental health among university students are considerably poorer than that of their peers in the general population.¹⁻⁵ Depression is one of the most prevalent mental health problems among university students, and the prevalence is rising.^{6 7} There are varied prevalence estimates of depressive symptoms among university students, ranging from in the area of 10%⁸⁻¹¹ to in the region of 20%¹² and up to 40% and 80%.¹³⁻¹⁵ However, the mean prevalence of depression in university students stands at 30.6%.⁶ University students are in a critical period of life since they transition from adolescence to adulthood, which requires them to make many major decisions. During this period, they encounter tremendous pressures, chiefly from economic stress, academic demands, interpersonal relationships, and struggles with making crucial decisions.¹⁶

Depression manifests in a wide range of symptoms, encompassing sleep and eating disturbances, lack of self-care, poor concentration, anxiety, and disinterest in everyday activities.¹⁷ For university students, depression is correlated with poor academic achievements,¹⁸ drop-out,^{19 20} relationship instability,²¹ suicidal ideation and attempts,^{18 22 23} poor work performance,²⁴ substance abuse,^{25 26} acute infectious illnesses,²⁷ and poor physical and mental health in general.²⁸ ²⁹ Moreover, depression in this early period can build up negative consequences in adult life through its impacts on career prospects and social relationships.^{30 31}

86 Thus, tackling depression among university students is vital since most lifetime mental 87 disorders commence during the university age,³² and their mental health has essential

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ramifications for campus health services in particular and mental health policy-making in general.^{33 34} Put another way, from a public health standpoint, early detection and prevention of mental health problems among young adults in higher education is paramount. Comprehension of their salient psychological distress, namely depression, and its correlates would enable tailor-made and early screening and intervention programs to reduce mental health problems in this population. This is integral for their educational performance and triumph in their prospective profession as well as for the national advancement since they are future leaders.

The prevalence of depression is induced by many factors, including study populations, socio-demographics,^{16 35} study sites,^{16 36} diagnostic tools and sampling methods,^{36 37} and sociocultural environments.¹⁶ Contextualization of facets linked with depression thus is significant for mitigation measures.

In Cambodia, little is known about social and behavioral determinants of depressive symptoms among student populations. In 2012, a study on 1,943 students at 11 junior high and high schools found that exposure to violence among community members, peers, or family was a predictor for depressive symptoms in the students.^{38 39} A 2013 gualitative study on a sample of 28 students at a Cambodian university found that life events, problems of everyday life, and availability of social support were the main stress factors affecting university students' life satisfaction.⁴⁰ Moreover, exposure to daily hassles was a stress factor having a strong impact on students' psychological and somatic responses. Nonetheless, no research has been conducted to examine social and behavioral determinants of depression among Cambodian university students. This study therefore intends to identify factors associated with depressive symptoms among university students in Cambodia.

46 111

⁷ 112 **METHODS**

9 113 Study sites and population

This cross-sectional study was conducted with students at the University of Battambang (UB) in
 Battambang province and the Royal University of Phnom Penh (RUPP) in the capital city of
 Cambodia in June and July 2015. Epi Info (Centers for Disease Control and Prevention, Atlanta,

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GA) was used to calculate the sample size from the university student population of approximately 168,000.⁴¹ The anticipated percentage frequency was not known, so 50% was put for the calculation to prevent any underestimated prevalence. Based on a 95% confidence interval (CI) and a +5% margin of error, the minimum sample size required for this study was 767 students. Adjusted for 10% of incomplete responses, missing data, and rejection rate, the final minimum required sample size was 850 students.

⁵ 124 Patient and public involvement

The development of the research questions and outcome measures was informed by university students' priorities, experience, and preferences gathered through consultative meetings with representatives of students, faculty members, and school administrators. The workshops aimed to collect inputs from the representatives for designing the study and developing the study protocol and materials. The representatives were also invited to participate in the study finding dissemination workshops in each participating university. BMJ Open: first published as 10.1136/bmjopen-2017-019918 on 28 September 2018. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

- 29 131
- 1 132 Sampling and data collection procedure

A multi-stage cluster sampling method was used to select the participants. First, the two universities were purposively selected, considering administration and logistic limitations. All departments of the selected universities were included in the study. In each department, a non-proportionate quota sampling method was used to select the sample from a name list provided by the department administrator to meet the required sample size. On the designated date of data collection, all selected students were approached by trained data collectors with support from a school administrator. Questionnaires and instructions were then distributed to them in a classroom for self-administration, which took approximately 30min to complete.

7 141

142 Questionnaire development and training

51 143 We first developed a structured questionnaire in English and translated it into Khmer, the 52 144 national language of Cambodia. Then, the Khmer questionnaire was back-translated into 54 145 English by a local expert to check its accuracy. The Khmer questionnaire was pretested with a

sample of 20 students at RUPP to ensure that the wording and contents were culturally suitable and clearly understandable. We also received comments on the questionnaire from experts working on health and education in Cambodia. The questionnaire was finalized based on their feedback and findings from the pretest. The questionnaire is available on request from the corresponding author.

A two-day training on the study protocol and data collection methods was provided to the data enumerators and supervisors. The training focused on building familiarity with the study protocol and questionnaire, interview techniques, privacy assurance, and confidentiality. It also addressed quality control strategies, such as rechecking and reviewing the questionnaires after administration, and resolving issues that might arise during the fieldwork. The data collection supervisors were instructed to perform regular reviews with the data enumerators to monitor progress and settle any issues occurring during the process.

Variables and measurements

Depressive symptoms

Depressive symptoms were assessed by using the Center for Epidemiologic Studies Depression scale (CES-D).⁴² This scale consists of 20 questions addressing six symptoms of depression, including depressed mood, guilt or worthlessness, helplessness or hopelessness, psychomotor retardation, loss of appetite, and sleep disturbance experienced during the preceding week. Each question is scored on a scale of 0 to 3 according to the frequency of the symptoms, and the total CES-D score ranges from 0 to 60. To calculate the total score, four items (I felt I was just as good as other people, I felt hopeful about the future, I was happy, and I enjoyed life) were reverse coded. The criterion validity of the CES-D scale has been well established in Western⁴² and Asian⁴³ populations. We defined depressive symptoms as present when a subject had a CES-D score of ≥16. A cutoff value of ≥23 was also used to define severe depressive state.44

Socio-demographic characteristics, substance use, and sexual behaviors Page 7 of 33

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We adapted standardized tools from the most recent Cambodia Demographic and Health Survey⁴⁵ as well as from our previous student and young people health surveys in Cambodia^{38 39} ⁴⁶⁻⁴⁸ to measure socioeconomic characteristics, sexual behaviors with different partners, and substance use (alcohol, tobacco, and illicit drugs). Socio-demographic characteristics of the respondents included study site, gender, age, marital status, academic year, living situations, perceived family economic status, and perceived academic performance.

¹⁴ 180

181 Health related behaviors

We used the Health Behavior Survey,⁴⁹ which was designed as a broad survey of health-related behaviors and beliefs, components of the "National College Health Risk Behavior Survey" (1997),⁵⁰ and the Global School-based Student Health Survey.⁵¹ Each health behavior area was addressed by only a limited number of items. For example, frequency of consumption of fast food in an average week was assessed by a question, "On average, how many times do you eat fast food per week?" with response options of 0 time, 1-2 times a week, and 3 or more times a week. Similar questions and response options were used to assess consumption of several other kinds of healthy and unhealthy food, such as high-fat snack or fruits/vegetables. Self-ratings were also used for some questions, such as perceived body size (rated from very overweight to very underweight) and general health status (rated from very good to very poor).

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³⁶ 192

³ 193 Adverse childhood experiences (ACEs)

Five questions were adapted from the brief screening version of the Childhood Trauma Questionnaire to measure ACEs.⁵² The five yes/no questions asked about the experiences of physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect during childhood.

^{4/} 198

199 Self-rated health

51 200 SF-12 Health Survey (SF-12) was used to measure self-rated health.^{53 54} The SF-12 is a 52 53 201 multipurpose short-form generic measure of health status. It is a subset of the larger SF-36 and 54 55 202 monitors health in general and in specific populations. The SF-12 measures eight health

aspects, namely physical functioning, role limitations due to physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role limitations due to emotional problems, and mental health (psychological distress and psychological well-being).

Data analyses

Double data entry was performed using EpiData version 3 (Odense, Denmark). χ^2 test, or Fisher's exact test when a sample size was smaller than five in one cell, was used for categorical variables, and Student's t-test was used for continuous variables to compare socio-demographic characteristics, health risk behaviors (sexual behaviors, substance use, and eating behaviors), self-rated health (SF-12), and ACEs among students with depressive symptoms, defined by a CES-D score of \geq 16, to those among students without depressive symptoms. The same comparisons were also made among students with and without severe depressive symptoms, defined by a CES-D score of \geq 23.

In multivariate models, we first included all variables significantly associated with depressive symptoms in the bivariate analyses at a level of p-value <0.05 simultaneously in the models. Variables with a p-value >0.05 were then removed, and the models were refitted. The steps were repeated until all *p*-values of the remaining variables were <0.05 in the final models. Adjusted odds ratios (AOR) were obtained and presented with CI and p-values. SPSS version 22 (IBM Corporation, New York) was used for all statistical analyses.

Ethical considerations

The National Ethics Committee for Health Research of the Ministry of Health, Cambodia, approved the study protocol and materials (No. 191NECHR). Participation in this study was voluntary. In the process of obtaining a written informed consent, students were made clear that they could refuse or discontinue their participation at any time and for any reason. The confidentiality and privacy of the respondents were protected by administering the questionnaires in a private premise and by excluding personal identifiers from the data and field notes. After completing the survey, each participant received a small gift (costing approximately \$US 2.0) for their time compensation.

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5	233	RESULTS								
7	234	Socio-demographic characteristics								
8 9	235	The study sample in	cluded 493 st	udents (36.3	3%) from L	JB and 866 st	tudents (63.7	%) from RUPP.		
10 11	236	About half (50.8%) of the respondents were male, with a mean age of 21.3 years [standard								
12 13	237	deviation (SD)= 2.3]. Less than 2.0% (n = 26) of the students initially selected for the study								
14 15	238	declined the particip	ation, mostly	v due to thei	r time con	strains. They	v were then r	eplaced by the		
16 17 18 19 20	239	next gender-matche	d student in t	he student i	name list.	The majority	of the respo	ndents (97.9%)		
	240	were unmarried, and 43.4% were living with their parents. Regarding their family economic								
	241	status, 59.2% reported that their family was neither rich nor poor. The proportion of students								
21 22	242	with depressive sy	mptoms and	d severe d	lepressive	symptoms	were 50.6%	6 and 19.6%,		
23 24	243	respectively.	respectively.							
25 26	244	Table 1 sho	ws that a s	ignificantly	higher pr	oportion of	students w	ith depressive		
27	245	symptoms were from UB (p = 0.004) and from a poorer family (p = 0.002) and reported poorer								
28 29	246	academic performance (p < 0.001). Similarly, a significantly higher proportion of students with								
30 31	247	severe depressive symptoms were female (p = 0.002) and from a poorer family (p = 0.04) and								
32 33	248	reported poorer academic performance (p< 0.001).								
34 35	249									
36 37	250	Table 1 Comparisons of	of socio-demog	graphic chara	cteristics of	university stu	idents with an	d without		
38	251	depressive symptoms								
39 40		Characteristics	Depressive	symptoms		Severe depr	essive sympto	ms^{\dagger}		
41 42			No	Yes	P-value [‡]	No	Yes	P-value [‡]		
43		Study site			0.004			0.08		
44 45		Battambang	218 (44.2)	275 (55.8)		384 (77.9)	109 (22.1)			
46 47		Phnom Penh	454 (52.4)	412 (47.6)		709 (81.9)	157 (18.1)			
48 49		Gender			0.20			0.002		
49 50 51 52		Female	319 (47.7)	350 (52.3)		515 (77.0)	154 (23.0)			
		Male	353 (51.2)	337 (48.8)		578 (83.8)	112 (16.2)			
53 54		Age (mean ± SD)	21.3 ± 2.4	21.4 ± 2.3	0.82	21.4 ± 2.3	21.1 ± 2.4	0.12		
55 56		Marital status			0.34			0.08		
57 58 59					9					

Page	10	of	3
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1 2								
3		Unmarried	655 (49.2)	675 (50.8)		1066 (80.2)	264 (19.8)	
4 5		Married	17 (58.6)	12 (41.4)		27 (93.1)	2 (6.9)	
5 6 7		Academic year	_/ (00.0)	(,	0.59	_/ (001_)	_ (0.0)	0.66
7 8		, 1	240 (48 4)	256 (51 6)		394 (79 4)	102 (20 6)	
9		1		100 (01.0)))))) ())	FZ (20.0)	
10 11		2	145 (51.0)	136 (48.4)		224 (79.7)	57 (20.3)	
12		3	123 (49.0)	128 (51.0)		201 (80.1)	50 (19.9)	
13 14		4	164 (49.5)	167 (50.5)		274 (82.8)	57 (17.2)	
15		Currently living with			0.35			0.70
16 17		Parents	297 (49.9)	298 (50.1)		486 (81.7)	109 (18.3)	
18 10		Relatives	81 (45.0)	99 (55.0)		139 (77.2)	41 (22.8)	
20		Sibling	87 (56.1)	68 (43.9)		124 (80.0)	31 (20.0)	
21 22		Friend	162 (50.2)	161 (49.8)		258 (79.9)	65 (20.1)	
23		Spouse/partners	10 (47.6)	11 (52.4)		19 (90.5)	2 (9.5)	
24 25		Alone	26 (41 9)	36 (58 1)		50 (80 6)	12 (19 4)	
26		Other	Q (3Q 1)	14 (60.9)		17 (73.9)	6 (26 1)	
27 28				14 (00.5)	0.002	17 (75.5)	0 (20.1)	0.04
29		Perceived family econo	mic status		0.002			0.04
30 31		Well-off/quite	248 (55.7)	197 (44.3)		374 (84.0)	71 (16.0)	
32		well-off						
33 34		Neither poor nor	398 (47.0)	448 (53.0)		669 (71.1)	177 (20.9)	
35		well-off						
36 37		Poor	26 (38.2)	42 (61.8)		50 (73.5)	18 (26.5)	
38 30		Perceived academic per	formance		<0.001			<0.001
40		Very good	44 (77.2)	13 (22.8)		52 (91.2)	5 (5.8)	
41 42		Good	180 (59.0)	123 (40.6)		263 (86.8)	40 (13.2)	
43 44		Fairly good	301 (50.5)	295 (49.5		484 (81.2)	112 (18.8)	
45		Fair	138 (37.7)	228 (62.3)		275 (75.1)	91 (24.9)	
46 47		Poor	9 (24.3)	28 (75.7)		19 (51.4)	18 (48.6)	
48 49 50 51 52 53 54 55 56 57 58	252 253 254 255 256 257 258	Abbreviation: SD, stand Values are numbers of s continuous variables. [*] Defined by a Center for [†] Defined by a CES-D sco [‡] Chi-square test was use variables.	ard deviation subjects (%) fo Epidemiolog re of ≥23. ed for catego	or categorical or categorical y Studies Dep rical variables	variables o ression Sca 5; indepena	and means ± st Ile (CES-D) scor lent Student's t	andard devia e of ≥16. ∹test was use	tion (SD) for d for continuous
59		For por	er review only	- http://bmion	10	a/site/about/oui	delines vhtml	
60		i oi pee	LI TEVIEW UTILY	nttp://binj0p	ch.onj.con	i/ site/ about/ gui	Gennes.XIItilli	

1 2 3	250										
4 5	259	Health risk behaviors									
6 7	261	As shown in Table 2, a significantly higher proportion of students with depressive symptoms									
, 8 9 10	201										
	262	reported consuming unnealing rood requently, such as high-fat shack (p = 0.001 for depressive									
11	263	symptoms; $p < 0.001$ for severe depressive symptoms), margarine, butter, or meat fat ($p = 0.02$									
12 13	264	for depressive sympton	ns; <i>p</i> < 0.001	1 for severe	e depressiv	ve symptoms	s). A signifi	cantly lower			
14 15	265	proportion of students	with depr	essive sym	ptoms rep	oorted consu	iming of h	ealthy food			
16	266	frequently, such as frui	ts and vege	etables (<i>p</i> =	0.009 for	depressive s	ymptoms; <i>µ</i>	o= 0.007 for			
17	267	severe depressive symptoms), or lean protein ($p < 0.001$ for depressive symptoms; $p = 0.03$ for									
19 20	268	severe depressive symp	toms). A si	gnificantly h	igher prop	portion of st	udents with	n depressive			
21 22	269	symptoms reported not	having dese	ert over the	past week	(<i>p</i> = 0.003 fo	r depressive	e symptoms;			
23	270	p= 0.008 for severe depressive symptoms). Moreover, a significantly higher proportion of									
24 25	271	students with depressive symptoms perceived that their body size was very overweight or very									
26 27	272	underweight ($p < 0.001$ for both depressive symptoms and severe depressive symptoms)									
28 29	273	and chief and severe depressive symptoms and severe depressive symptoms.									
30	273	Table 2 Comparisons of health risk behaviors among university students with and without depressive									
31	275	symptoms									
33 34		Health and health risk	Depressive	symptoms	Severe depressive symptoms [†]						
35 36		behaviors	No	Yes	P-value [‡]	No	Yes	P-value [‡]			
37 38		Current tobacco smokers	5 (33.3)	10 (66.7)		12 (80.0)	3 (20.0)	0.97			
39		Self-perception regarding a	alcohol use		0.25			0.004			
40 41		Non drinker	425 (50.7)	413 (49.3)		681 (81.3)	157 (18.7)				
42 43		Occasional drinker	247 (47.4)	271 (52.6)		412 (78.7)	106 (21.3)				
44		Regular drinker	0 (0.0)	3 (100)		0 (0.0)	3 (100)				
45 46		Current illicit drug users	0 (0.0)	4 (100)	0.05	1 (25.0)	3 (75.0)	0.03			
47 48		Condom use at last sex	39 (47.0)	44 (53.0)	0.95	73 (88.0)	10 (12.0)	0.08			
49 50		Diagnosed with an STI	4 (40.0)	6 (60.0)	0.75	110 (84.0)	21 (16.0)	0.67			
50		Thought of ending life	40 (24.8)	121 (75.2)	<0.001	84 (52.2)	77 (47.8)	<0.001			
52 53		Attempted to end life	5 (20.0)	20 (80.0)	0.63	11 (44.0)	14 (56.0)	0.47			
54		Frequency of esting fact fo	od per week		0 / 0			0.24			

0.24

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0.49

Frequency of eating fast food per week

59

0 time	410 (49.3)	421 (50.7)		679 (81.7)	152 (18.3)	
1-2 times	231 (50.7)	225 (49.3)		360 (78.9)	96 (21.1)	
3 times or more	31 (43.1)	41 (56.9)		54 (75.0)	18 (25.0)	
Frequency of daily soft dri	nk consumptio	on	0.31			0.01
0 time	105 (46.5)	121 (53.5)		178 (78.8)	48 (21.2)	
1-2 times	399 (51.2)	380 (48.8)		647 (83.1)	132 (16.9)	
3 times or more	168 (47.5)	186 (52.5)		268 (75.7)	86 (24.3)	
Frequency of weekly high-	fat snack cons	sumption	0.001			<0.001
0 time	162 (52.8)	145 (47.2)		260 (84.7)	47 (15.3)	
1-2 times	443 (51.0)	426 (49.0)		711 (81.8)	158 (18.2)	
3 times or more	67 (36.6)	116 (63.4)		122 (66.7)	61 (33.3)	
Frequency of weekly desse	ert consumpti	on	0.003			0.008
0 time	106 (40.6)	155 (59.4)		192 (73.6)	69 (26.4)	
1-2 times	434 (52.7)	389 (47.3)		676 (82.1)	147 (17.9)	
3 times or more	132 (48.0)	143 (52.0)		225 (81.8)	50 (18.2)	
Frequency of weekly fruit/	vegetable cor	sumption	0.009			0.007
0 time	50 (37.3)	84 (62.7)		94 (70.1)	40 (29.9)	
1-2 times	390 (51.7)	365 (48.3)		617 (81.7)	138 (18.3)	
3 times or more	232 (49.4)	238 (50.6)		382 (81.3)	88 (12.7)	
Frequency of weekly lean	protein consu	mption	<0.001			0.03
0 time	57 (34.8)	107 (65.2)		119 (72.6)	45 (27.4)	
1-2 times	453 (51.8)	421 (48.2)		714 (81.7)	160 (18.3)	
3 times or more	162 (50.5)	159 (49.5)		260 (81.0)	61 (19.0)	
Amount of margarine/but	ter/meat fat c	onsumption	0.02			<0.001
None/very little	296 (52.4)	269 (47.6)		471 (83.4)	94 (16.6)	
Some	339 (48.7)	357 (51.3)		558 (80.2)	138 (19.8)	
A lot	37 (37.8)	61 (62.2)		64 (65.3)	34 (34.7)	
Self-perception about bod	y size		<0.001			<0.001
About right	275 (55.4)	221 (44.6)		428 (86.3)	68 (13.7)	
Very overweight	27 (34.2)	52 (65.8)		55 (69.6)	24 (30.4)	
Very overweight Slightly overweight	27 (34.2) 161 (48.9)	52 (65.8) 168 (51.1)		55 (69.6) 247 (75.1)	24 (30.4) 82 (24.9)	

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2						
3 4		Very underweight	18 (25.7)	52 (74.3)	44 (62.9)	26 (37.1)
5	276	Abbreviations: STI, sexuall	y transmitted	infections.		
5	277	Values are numbers of sub	jects (%).	-		
7	278	*Defined by a Center for Ep	idemiology St	udies Depression	Scale (CES-D) score of	[£] ≥16.
3	279	[†] Defined by a CES-D score	of ≥23.	-		
)	280	[‡] Chi-square test was used	or Fisher's exa	ict test was used o	as appropriate.	
10	281	-				
12 13	282	Self-rated health (SF-12)			
14 15	283	Table 3 shows that sig	gnificantly hi	igher proportio	n of students with	n depressive symptoms
16 17	284	perceived that their ge	neral health	status was poo	r (<i>p</i> < 0.001 for bot	h depressive symptoms
18 19	285	and severe depressive s	ymptoms). A	significantly hig	gher proportion of s	tudents with depressive
20	286	symptoms reported hig	her levels of	limitation in so	everal daily activition	es, such as limitation in
22	287	moderate activities (p	< 0.001 for	depressive sy	mptoms; <i>p</i> = 0.02	for severe depressive
23 24	288	symptoms), climbing sev	veral flights o	of stairs (p< 0.00)1 for depressive sy	mptoms), or other kinds
25 26	289	of activities in the past f	our weeks as	a result of thei	r physical or emotic	onal health problems (p<
27 28	290	0.001 for both depressiv	ve symptoms	and severe dep	oressive symptoms)	. Further, they reported
29	291	higher levels of problem	is in several c	other physical ar	nd emotional health	aspects in the past four
31 32	292	weeks, such as a feelin	g that they l	had accomplish	ed less than they v	vould like (<i>p</i> < 0.001 for
32 33	293	both depressive sympto	ms and seve	re depressive sy	mptoms), pain inte	rferes with their normal
34 35	294	work (<i>p</i> < 0.001 for bot	h depressive	symptoms and	severe depressive	symptoms), having less
36 37	295	energy (<i>p</i> < 0.001 for b	oth depress	ive symptoms	and severe depres	sive symptoms), down-
38 39	296	hearted and blue (p< 0.	.001 for both	n depressive syr	nptoms and severe	depressive symptoms),
40 11	297	and that their physical	health inter	feres with their	· social acts (p< 0.0	001 for both depressive
12	298	symptoms and severe d	epressive syn	nptoms).		
+5 4 4	299					

Table 3 Comparisons of self-rated health (SF-12) among university students with and without depressive

symptoms

Self-rated health (SF-12)	Depressive	symptoms		Severe depressive symptom		coms [†]
	No	Yes	P-value [‡]	No	Yes	P-value [‡]
Self-perception on general h	ealth status		<0.001			<0.001
Very good	106 (64.2)	59 (35.8)		147 (89.1)	18 (10.9)	
Good	380 (58.5)	270 (41.5)		566 (87.1)	84 (12.9)	

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Neither good nor poor	176 (38.0)	287 (62.0)		351 (75.8)	112 (24.2)	
Poor	10 (12.3)	71 (87.7)		29 (35.8)	52 (64.2)	
Limitation in moderate activi	ties on a typi	cal day	<0.001			0.02
Greatly limited	20 (28.2)	51 (71.8)		50 (70.4)	21 (29.6)	
Mildly limited	291 (45.6)	347 (54.4)		505 (79.2)	133 (20.8)	
Not limited	361 (55.5)	289 (44.5)		538 (82.8)	112 (17.2)	
Limitation in climbing severa	l flights of sta	irs	<0.001			0.24
Greatly limited	64 (35.8)	115 (64.2)		140 (78.2)	39 (21.8)	
Mildly limited	323 (47.8)	353 (52.2)		536 (79.3)	140 (20.7)	
Not limited	285 (56.5)	219 (43.5)		417 (82.7)	87 (17.2)	
Limitation in other kinds of	271 (37.8)	446 (62.2)	<0.001	516 (72.0)	201 (28.0)	<0.001
activities in past 4 weeks						
Accomplished less than you	377 (61.9)	232 (38.1)	<0.001	553 (50.6)	197 (26.3)	<0.001
would like in past 4 weeks						
as a result of emotional						
health						
Accomplished less than you	304 (67.3)	148 (32.7)	<0.001	675 (74.4)	232 (25.6)	<0.001
would like in past 4 weeks						
as a result of physical						
health						
Did activities less carefully	378 (41.8)	526 (58.2)	<0.001	677 (74.9)	227 (25.1)	<0.001
than usual in past 4 weeks						
Pain interferes with your nor	mal work in p	ast 4 weeks	<0.001			<0.001
Not at all	141 (75.8)	45 (24.2)		176 (94.6)	10 (5.4)	
A little bit	401 (57.6)	295 (42.4)		635 (91.2)	61 (8.8)	
Moderately	106 (32.9)	216 (31.4)		216 (67.1)	106 (32.9)	
Quite a bit	23 (16.5)	116 (83.5)		62 (44.6)	77 (55.4)	
Extremely	1 (6.3)	15 (93.8)		4 (25.0)	12 (75.0)	
Feeling calm and peaceful in	past 4 weeks		0.33			0.06
A lot of the time	22 (42.3)	30 (57.7)		38 (73.1)	14 (26.9)	
Most of the time	68 (53.5)	59 (46.5)		92 (72.9)	35 (27.6)	
A good bit of time	115 (50.9)	111 (49.1)		188 (83.2)	38 (16.2)	

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Some of the time	278 (46.8)	316 (53.2)		477 (80.3)	117 (17.7)	
A little of the time	170 (51.8)	158 (48.2)		274 (83.5)	54 (16.5)	
None of the time	19 (59.4)	13 (40.6)		24 (75.0)	8 (25.0)	
Having a lot of energy in pas	t 4 weeks		<0.001			<0.001
A lot of the time	46 (61.3)	29 (38.7)		66 (88.0)	9 (12.0)	
Most of the time	111 (68.9)	50 (31.1)		149 (92.5)	12 (7.5)	
A good bit of time	245 (56.8)	186 (43.2)		383 (88.9)	48 (11.1)	
Some of the time	207 (41.5)	292 (58.5)		364 (72.9)	135 (27.1)	
A little of the time	57 (33.7)	112 (66.3)		116 (68.6)	53 (31.4)	
None of the time	6 (25.0)	18 (75.0)		15 (62.5)	9 (37.5)	
Feeling down-hearted and b	lue in past 4 w	veeks	<0.001			<0.001
A lot of the time	7 (21.9)	25 (78.1)		14 (43.8)	18 (56.3)	
Most of the time	8 (8.3)	88 (91.7)		36 (37.5)	60 (62.5)	
A good bit of the time	42 (17 9)	171 (80 3)		117 (54 9)	96 (45 1)	
Some of the time	222 (46 7)	253 (53.3)		117 (34.5) 112 (86 7)	63 (13 3)	
A little of the time	222(+0.7)	233 (33.3) 141 (29 E)		412 (00.7)	05 (E 2)	
A little of the time	20 (01 2)	0 (10.0)		409 (94.7)	20 (5.5)	
None of the time	39 (81.3)	9 (18.8)		45 (93.8)	3 (0.3)	0.004
Physical health interferes so	cial act in past	4 weeks	<0.001			<0.001
A lot of the time	4 (33.3)	8 (66.7)		6 (50.0)	6 (50.0)	
Most of the time	10 (23.3)	33 (76.7)		18 (41.9)	58 (58.1)	
Some of the time	146 (38.1)	237 (61.9)		275 (71.8)	108 (28.2)	
A little of the time	355 (53.7)	306 (46.3)		568 (85.9)	93 (14.1)	
None of the time	157 (60.4)	103 (39.6)		226 (26.9)	34 (13.2)	
	. ,	. ,			. ,	

Values are numbers of subjects (%) for categorical variables.

Defined by a Center for Epidemiology Studies Depression Scale (CES-D) score of ≥ 16 .

[†]Defined by a CES-D score of \geq 23.

^{*}Chi-square test was used for categorical variables or Fisher's exact test was used as appropriate.

Adverse childhood experiences (ACEs)

As shown in Table 4, a significantly higher proportion of students with depressive symptoms reported having been hit, slapped, or kicked by a parent or guardian (p< 0.001 for both depressive symptoms and severe depressive symptoms); that people in their family had said hurtful or insulting things to them (p< 0.001 for both depressive symptoms and severe

depressive symptoms); and that someone had tried to touch them or make them touch him/her in a sexual way (p= 0.001 for depressive symptoms; p< 0.001 for severe depressive symptoms). In contrast, significantly lower proportion of students with depressive symptoms reported that there had been someone to take care of them and take them to medical care when they got sick (p= 0.04 for depressive symptoms; p= 0.03 for severe depressive symptoms), and someone who helped them feel that they were loved and important (p=0.03 for depressive symptoms; p < 0.001 for severe depressive symptoms).

Table 4 Comparisons of adverse childhood experiences among university students with and without

19		
20	321	depressive symptoms

	Adverse childhood	Depressive symptoms			Severe depressive symptoms [†]		
	experiences	No	Yes	P-value [‡]	No	Yes	P-value [‡]
	Had been hit, slapped,	200 (38.2)	323 (61.8)	<0.001	384 (73.4)	139 (26.6)	<0.001
	kicked, by a						
	parent/guardian						
	People in my family had	297 (39.0)	464 (61.0)	<0.001	558 (73.3)	203 (26.7)	<0.001
	said hurtful or insulting						
	things to me						
	Someone had tried to	87 (39.2)	135 (60.8)	0.001	159 (71.6)	63 (28.4)	<0.001
	touch me or make me						
	touch them in a sexual way						
	There had been someone	636 (50.2)	632 (49.8)	0.04	1028 (81.1)	240 (18.9)	0.03
	to take care me and take						
	me to medical care when I						
	got sick						
	There had been someone	647 (50.1)	644 (49.9)	0.03	1050 (81.3)	266 (19.6)	<0.001
	who helped me feel that I						
	was loved and important						
2 3 4 5	Values are numbers of subje [*] Defined by a Center for Epid [†] Defined by a CES-D score of [‡] Chi-square test was used.	cts (%). emiology Stud ∑≥23.	lies Depression	Scale (CES-I	D) score of ≥16		
			16				
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1 2		
2 3 4 5	326	
	327	Risk factors of depressive symptoms
6 7	328	Results of multivariate logistic analyses are shown in Table 5. After controlling for potential
8 9	329	confounding factors, the odds of depressive symptoms increased significantly with self-
10 11	330	reported poor academic performance (depressive symptoms: AOR=7.31, 95% CI=2.24-23.86;
12 13	331	severe depressive symptoms: AOR=7.38, 95% CI=1.75-10.94) and high consumption of
14 15	332	unhealthy food, including high-fat snack, margarine, butter, or meat fat (depressive symptoms:
15 16 17	333	AOR=1.72, 95% CI=1.08-2.76; severe depressive symptoms: AOR=2.13, 95% CI=1.15-3.95). The
17	334	odds decreased significantly with the perception that their body size was slightly underweight
19 20	335	compared to the perception that their body size was very overweight (depressive symptoms:
21 22	336	AOR= 0.54, 95% CI= 0.29-0.99; severe depressive symptoms: AOR= 0.37, 95% CI= 0.18-0.77).
23 24 25 26 27 28 29	337	Regarding self-rated health, the odds of depressive symptoms increased significantly
	338	with the perception that their general health status was poor (depressive symptoms: AOR=
	339	2.99, 95% CI=1.28-7.00; severe depressive symptoms: AOR=5.43, 95% CI=2.19-13.46) and the
	340	report of higher level of limitation in moderate activities (depressive symptoms: AOR= 0.30
30 31	341	(95% CI= 0.16-0.58), higher level of pain interference with their normal work (depressive
32 33	342	symptoms: AOR= 10.43, 95% CI= 1.05-10.94; severe depressive symptoms: AOR= 10.02, 95% CI=
34 35	343	1.99-9.28), and higher level of feeling down-hearted and blue (depressive symptoms: AOR=
36 37	344	6.69, 95% CI= 1.87-23.90; severe depressive symptoms: AOR= 8.72, 95% CI= 1.69-14.86).
38	345	For ACEs, the odds of depressive symptoms increased significantly with the report of
40	346	having been hit, slapped, or kicked by a parent or guardian (depressive symptoms: AOR= 1.39,
41 42 43 44	347	95% CI= 1.04-1.86) and that people in their family had said hurtful or insulting things to them
	348	(depressive symptoms: AOR= 1.82, 95% CI= 1.37-2.42; severe depressive symptoms: AOR= 2.18,
45 46	349	95% CI=1.46-3.24) during their childhood. In contrast, the odds of depressive symptoms
47 48	350	decreased significantly with the report that there had been someone to take care of them and
49 50	351	take them to medical care when they got sick (depressive symptoms: AOR= 0.51, 95% CI= 0.30-
50 51 52	352	0.86; severe depressive symptoms: AOR= 0.26, 95% CI= 0.13-0.52).

354 Table 5 Factors associated with depressive symptoms and severe depressive symptoms

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Variables in the final model	Depressive symptoms	†	Severe depressive symptoms [‡]		;	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value		
Perceived academic performance	ce					
Very good	Reference		Reference			
Good	2.28 (1.01-5.15)	0.04	1.22 (0.35-4.19)	0.76		
Fairly good	3.51 (1.58-7.78)	0.002	2.15 (0.65-7.11)	0.21		
Fair	5.30 (2.35-11.93)	<0.001	2.52 (0.75-8-43)	0.13		
Poor	7.31 (2.24-23.86)	0.001	7.38 (1.75-10.94)	0.006		
Frequency of weekly high-fat sn	ack consumption					
0 time	Reference		Reference			
1-2 times	0.99 (0.72-1.37)	0.95	1.25 (0.78-1.99)	0.36		
3 times or more	1.72 (1.08-2.76)	0.02	2.13 (1.15-3.95)	0.02		
Frequency of weekly lean prote	in consumption					
0 time	Reference		Reference			
1-2 times	0.52 (0.34-0.79)	0.002	0.69 (0.41-1.18)	0.17		
3 times or more	0.62 (0.38-0.96)	0.04	0.80 (0.44-1.47)	0.48		
Amount of margarine/butter/m	eat fat consumption					
None/very little			Reference			
Some			0.98 (0.66-1.46)	0.91		
A lot			1.92 (1.02-3.64)	0.04		
Self-perception about body shap	be					
Very overweight	Reference					
Slightly overweight	0.56 (0.31-1.07)	0.08	0.65 (0.32-1.14)	0.25		
About right	0.58 (0.32-1.05	0.07	0.45 (0.22-0.93)	0.03		
Slightly underweight	0.54 (0.29-0.99)	0.04	0.37 (0.18-0.77)	0.008		
Very underweight	0.92 (0.38-2.25)	0.86	0.38 (0.14-0.99)	0.04		
Self-perception on general heal	h status					
Very good						
Good	1.05 (0.68-1.64)	0.82	1.19 (0.60-2.38)	0.62		
Fair	1.58 (0.99-2-51)	0.05	1.47 (0.73-2.96)	0.28		
Poor	2.99 (1.28-7.00)	0.01	5.43 (2.19-13.46)	<0.001		
imitation in moderate activities	s on a typical day					

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3 4		Greatly limited	Reference		Reference	
5		Mildly limited	0.39 (0.20-0.74)	0.004	0.64 (0.29-1.34)	0.23
6 7		Not limited	0.30 (0.16-0.58)	<0.001	0.63 (0.30-1.36)	0.24
8		Pain interferes with your norma	l work in past 4 weeks			
9 10		Not at all	Reference		Reference	
11		A little hit	1 68 (1 08-2 61)	0.02	1 01 (0 46-2 22)	0 99
12 13		Madarataly	2 10 (1 80 E 10)	<0.02	2.60(1.69.7.11)	0.001
14			5.10 (1.89-5.10)	<0.001	5.09 (1.06-7.11)	0.001
15 16		Quite a bit	4.14 (2.13-8.05)	<0.001	4.68 (2.01-10.92)	<0.001
17		Extremely	10.43 (1.05-10.94)	0.04	10.02 (1.99-9.28)	0.005
18 19		Feeling down-hearted and blue	in past 4 weeks			
20		None of the time	Reference		Reference	
21 22		A little of the time	0.52 (0.63-3.66)	0.35	1.02 (0.24-4.29)	0.98
23		Some of the time	3.42 (1.42-8.23)	0.006	1.83 (0.45-7.45)	0.40
24 25		A good bit of the time	7.70 (3.02-19.66)	<0.001	6.01 (1.45-4.85)	0.01
26 27		Most of the time	20.71 (6.47-66.37)	<0.001	9.04 (2.31-13.71)	0.002
28		A lot of the time	6 69 (1 87-23 90)	0.003	8 72 (1 69-14 86)	0.01
29 30			0.05 (1.07 25.50)	0.005	0.72 (1.03 14.00)	0.01
31		nau been nit, siappeu, kickeu, b			Defense	
32 33		NO	Reference	0	Reference	
34		Yes	1.39 (1.04-1.86)	0.03	1.11 (0.75-1.65)	0.59
35 36		People in my family had said hu	rtful or insulting things to m	ne		
37		No	Reference		Reference	
38 39		Yes	1.82 (1.37-2.42)	<0.001	2.18 (1.46-3.24)	<0.001
40		There had been someone to tak	e care of me and take me to	o medical care	e when I got sick	
41 42		No	Reference		Reference	
43 44		Yes	0.51 (0.30-0.86)	0.01	0.26 (0.13-0.52)	<0.001
45 46 47 48 49 50 51	355 356 357 358 359 360	Abbreviations: AOR, adjusted of [*] Variables in the table were th logistic regression model after so [†] Defined by a Center for Epidem [‡] Defined by a CES-D score of ≥23	lds ratio; CI, confidence intene ne ones that remained sta everal steps of model fitting iology Studies Depression S 3.	erval. itistically sign g. cale (CES-D) s	ificant in the final m core of ≥16.	ultivariate
52 53 54 55 56	361	DISCUSSION				
57 58			19			
59		For peer review	only - http://bmiopen.hmi.co	m/site/about/	uidelines yhtml	
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This study explored the prevalence of depressive symptoms and unearthed a number of social and behavioral factors correlated with the symptoms among university students in Cambodia. The proportion of students with depressive symptoms and severe depressive symptoms was 50.6% and 19.6%, respectively. The salient factors comprised cultural and socio-economic dimensions (socio-economic background and lack of general and medical care by family during their childhood), individual behaviors and attitudes (poor academic accomplishment, consumption of unhealthy food, negative perception about their body and their general health status, and limited physical activeness), and nurture-related facets (physical violence and psychological abuse by family during their childhood).

The bivariate outcomes display that students from the provincial university (UB) and a poorer family were more susceptible to depressive symptoms. Albeit not manifesting in the multivariate model, these factors are corroborated by the existing scholarship. Various studies revealed that university students from rural areas and low socio-economic backgrounds were predisposed to higher depression.^{1 16 28 55 56} This could be explained by an economic situation where students with a rural background tended to stipulate a poorer family status. Plus, financial vulnerability could further exacerbate depression in students from low-income families. A meta-analysis of 60 studies unveiled that people in the lowest socio-economic quintile had 1.81 the probability of depression compared with those in the highest socio-economic guintile.⁵⁷ A global study on 17,348 university students from 23 high-, middle-, and low-income countries also uncovered that higher depressive symptoms were recorded among students in low-income countries and economies with greater income inequality.¹⁶ The Cambodian economy has been growing rapidly in terms of income per capita; yet, income gaps between the rich and the poor and between rural and urban areas remain large.⁵⁸ The gaps in income and material growth, which typify economic conditions, may induce people's mental health problems. In another word, poor economic status may bring about low self-esteem and self-confidence, which would lead to depression.

Our multivariate results depict that students with depressive symptoms, regardless of severity, tended to report poor academic performance and higher consumption of unhealthy food. These findings conform to a systematic review of 24 studies⁶ and studies in Asia, such as

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China,⁷ which pinpoint low scholastic merit and suicidal ideation as consistent correlates of depression in university students probably as a culmination of poor concentration and solitude. On the consumption of unhealthy food, the transition from adolescence to adulthood, and thus the changes in lifestyle such as living arrangements and independence, might have rendered university students to indulge in unhealthy food, as pinpointed by a meta-analysis of 39 studies in China.⁷ As afore-mentioned, more than half of our sample were not living with their parents; therefore, it might have been hard for them to maintain healthy daily food. Conversely, depression might have made students care-free about themselves and consequently eat unhealthily.¹⁷ This implies that nutrition education for both physical and mental health, stressing healthy food for the body and mind, is imperative for university students.

Students with depressive symptoms, regardless of magnitude, also tended to have a negative perception about their body and their general health status. These findings confirms the general perception among depressed people who are not gratified with their body and health.¹⁷ although these relationships require a cautious interpretation given that CES-D also measures some aspects of negative self-perception. Further, depressed students were more likely to have limited physical activeness, more pain interference with their normal work, and more dismay or sorrow. These findings are consistent with findings from previous studies in different populations and settings.^{59 60} However, the interpretation of these complex relationships must be made with caution given that the nature of the data does not allow causal relationship to be established.

Finally, students with depressive symptoms, disregard of severity, were more likely to encounter physical violence by their parent or guardian, psychological abuse by their family members, and lack of general and medical care by their family when they were growing up. As for the physical violence and psychological abuse, this finding tends to acquiesce with a study in Cambodia that postulates that exposure to violence within family is associated with depression in high school students.^{38 39} On the lack of general and medical care by family, a Chinese study on 5,245 students at six universities found that students who had a poor parental relationship were more vulnerable to depression.⁶¹ Also, a global study on 17,348 university students from 23 high, middle-, and low-income countries iterated that university students with less

420 individualistic cultures, particularly in Asia, reported higher extents of depressive symptoms.¹⁶
421 Students of these cultures longed for more familial and societal ties and assistance, and thus
422 felt depressed once this social capital was unavailable.¹⁶ This highlights a significant role of
423 family bonds and scaffolding in association with depression among university students. The lack
424 of social support from the family presumably would only be a factor for students living
425 independently. But, for those living with relatives, friends, or spouse, they would still have such
426 support.

A study on a sample of 2,671 respondents in nine provinces and a capital city in 2012 revealed that Cambodia greatly needs more and better counseling and mental health services.⁶² The study also pointed out the shortage of skilled professionals in the field of mental health, particularly those with high clinical and counseling skills to treat mental disorders. In 2012, Cambodia had only 49 trained psychiatrists and 45 psychiatric nurses working in mental health facilities and private practices for a population of approximately 15 million.^{62 63} This number equates to approximately 0.2 psychiatrists per 100,000 population, which is similar to the average in Southeast Asia.⁶³ Many health staff lack training, supervision, and experience in these areas. Only about 300 doctors completed basic mental healthcare training.⁶⁴ At university level, the 2012 study called for more awareness raising for self-care and burnout prevention and mental health counseling services for staff and students.⁶² Given the paucity of mental health services in general, let alone at universities, our findings fuel the needs for more and better mental healthcare in Cambodia. Further to medical care, universities should provide measures, such as student loans and healthy canteens, to mitigate some key predictors of depression among students, such as financial hardship and poor diets.

This study contains certain limitations. First, it examined students at only two public universities, one in the capital city and the other in a province. Hence, its findings cannot be generalized at a national level. Second, the cross-sectional design did not enable an establishment of the causal linkages between depressive symptoms and the related factors. Given the temporal order and the cross-sectional nature of the data, causal relationships between the variables could not be derived. Potential bi-directionality of the associations could occur either way. For instance, physical inactivity could cause depression. Nonetheless, the

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reverse could also be true—that depression could lead to inactivity, and of course both could be true simultaneously, where depressive symptoms worsen with physical inactivity, making physical activity less likely. Third, this study employed self-reported data, which might have been subject to over-reporting and under-reporting caused by the negative cognitive biases associated with depression as well as possible recall bias. Future studies should attempt to use more objective data (e.g., linking participants' responses to university records of academic performance) to increase validity of the information. Nonetheless, the quality of the data was ensured by thorough training of the enumerators and field supervisors on the study protocols and data collection method. Finally, the main outcome measure (CES-D) and some other measures, such as ACEs and SF-12, were modified from other research and have not been validated in the Cambodian settings. Therefore, the interpretation of the findings must be made with caution. Notwithstanding these malfeasances, the findings of this study offer first and foremost implications for policy development and future research in the Cambodian context.

9 463

464 CONCLUSIONS

This study identified social and behavioral factors associated with depressive symptoms among Cambodian students at two universities. While causation could not be drawn between these factors and depression, we surmise that these factors were inter-twined, and thus need to be addressed in an integrated and holistic fashion.

These findings render three major implications. First, given the current educational reform and labor market that demand better quality and ergo more competition among university students, the correlates of depressive symptoms could not be more critical for tackling for the time being. Failure to ameliorate these factors would jeopardize the gualification and career development of this populace and finally the human capital for nation-building. Second, these findings warrant an acceleration of on-campus counseling services for university students throughout the course of studentship. Efforts should be invested in comprehensive screening and intervention programs to diagnose those susceptible students early, offer immediate treatment, and cater appropriate support. Universities could play very

33 BMJ Open: first published as 10.1136/bmjopen-2017-019918 on 28 September 2018. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies. Page

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> important roles in taking this research forwards by providing future research outputs to improve mental health of the students that would in turn improve their academic outcomes. Ultimately, the jurisdiction of refining students' mental state should go beyond universities to families and pertinent governmental bodies at large, provided we are to assist the young to overcome their academic challenges and enjoy a prosperous post-graduation life. Further research could delve into changing lifestyles and their associations with depressive symptoms among a larger sample of university students. Furthermore, validation studies are required to develop and validate reliable instruments for use in Cambodian populations.

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Contributions SY, KP and TS conceived research questions, designed the study and developed the research protocol and tools. SY and CN analyzed the data and interpreted the results and drafted the manuscript. KP, PC and RY supported the protocol and tools development and were responsible for training and data collection. All authors contributed to the writing and approved the final manuscript.

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Competing interests None declared

1 2		
3 4	506	Ethics approval The National Ethics Committee for Health Research of the Ministry of Health,
5	507	Cambodia approved this study (Reference no. 082NECHR), and a written informed consent was
7	508	obtained from each participant.
8 9	509	
10 11	510	Data sharing statement Data used for this analysis are available upon request from the
12 13	511	Principal Investigator (Dr. Siyan Yi) at siyan@doctor.com . The data cannot be made publicly
14 15	512	available due to ethical restriction.
16 17	513	
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	Item No	Recommendation				
Title and abstract	1	(<i>a</i>) Indicate the study's design with a commonly used term in the title or the abstract				
		Confirmed (Lines 1-54)				
		(b) Provide in the abstract an informative and balanced summary of what was done				
		and what was found. Confirmed (Lines 30-54)				
Introduction						
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported				
Duoingi o unidi futionale	-	Confirmed (Lines 67-108)				
Objectives	3	State specific objectives, including any prespecified hypotheses. Confirmed (Lines				
	-	107-108)				
Methods	$\boldsymbol{\mathcal{N}}$					
Study design	4	Present key elements of study design early in the paper. Confirmed (Line 112)				
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment,				
0		exposure, follow-up, and data collection. Confirmed (Line 112-114)				
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of				
1		participants. Confirmed (Lines 130-138)				
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect				
		modifiers. Give diagnostic criteria, if applicable. Confirmed (Lines 157-202)				
Data sources/	8*	For each variable of interest, give sources of data and details of methods of				
measurement		assessment (measurement). Describe comparability of assessment methods if there is				
		more than one group. Confirmed (Lines 157-202)				
Bias	9	Describe any efforts to address potential sources of bias. Confirmed (Lines 130-138)				
Study size	10	Explain how the study size was arrived at. Confirmed (114-120)				
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable,				
		describe which groupings were chosen and why. Confirmed (Lines 204-218)				
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding.				
		Confirmed (Lines 213-217)				
		(b) Describe any methods used to examine subgroups and interactions. (Not				
		applicable)				
		(c) Explain how missing data were addressed (Not applicable)				
		(d) If applicable, describe analytical methods taking account of sampling strategy.				
		(Not applicable)				
		(e) Describe any sensitivity analyses. (Not applicable)				
Results						
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially				
		eligible, examined for eligibility, confirmed eligible, included in the study,				
		completing follow-up, and analysed. Confirmed (Lines 232)				
		(b) Give reasons for non-participation at each stage (Not applicable)				
		(c) Consider use of a flow diagram (Not applicable)				
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and				
		information on exposures and potential confounders. Confirmed (Lines 231-244)				
		(b) Indicate number of participants with missing data for each variable of interest.				
		(Not applicable)				
Outcome data	15*	Report numbers of outcome events or summary measures. Confirmed (238-239)				
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and				
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		their precision (eg, 95% confidence interval). Make clear which confounders were
	_	adjusted for and why they were included. Confirmed (213-217, 240-355)
		(<i>b</i>) Report category boundaries when continuous variables were categorized. (Not applicable)
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a
		meaningful time period. (Not applicable)
Other analyses	17	Report other analyses done-eg analyses of subgroups and interactions, and
		sensitivity analyses. (Not applicable)
Discussion		
Key results	18	Summarise key results with reference to study objectives. Confirmed (Lines 358-
		366)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or
		imprecision. Discuss both direction and magnitude of any potential bias. Confirmed
		(Lines 436-455)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations,
		multiplicity of analyses, results from similar studies, and other relevant evidence.
		Confirmed (Lines 367-435)
Generalisability	21	Discuss the generalisability (external validity) of the study results. Confirmed (Lines
		436-438)
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if
		applicable, for the original study on which the present article is based. Confirmed
		(Lines 490-492)

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.