

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/325134711>

Concurrent alcohol and tobacco use among school-going adolescents in Namibia: Prevalence and risk factors

Article in *Journal of Psychology in Africa* · March 2018

DOI: 10.1080/14330237.2018.1455317

CITATION

1

READS

50

2 authors:



Karl Peltzer

Human Sciences Research Council (HSRC)

741 PUBLICATIONS 10,538 CITATIONS

[SEE PROFILE](#)



Supa Pengpid

Mahidol University

252 PUBLICATIONS 1,836 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



What Works in HIV and AIDS and the World of Work Initiatives in South Africa [View project](#)



title Overweight and obesity among primary schoolchildren in Nakhon Pathom, Thailand: Comparison of Thai, International Obesity Task Force and WHO growth references [View project](#)

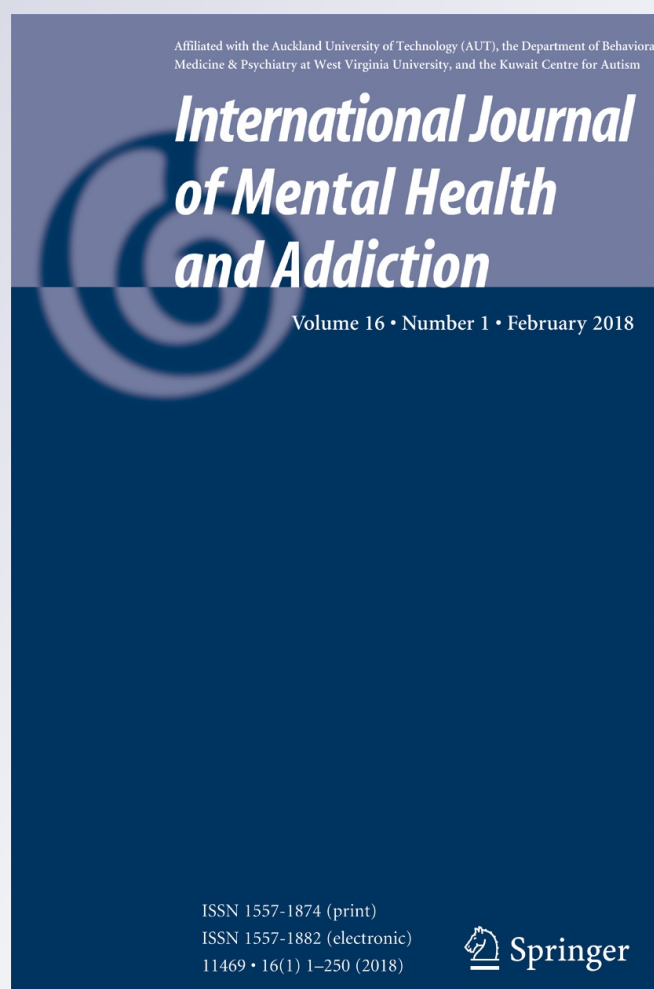
Concurrent Tobacco Use and Binge Drinking Among University Students in 30 Countries in Africa, Asia, Latin America, and the Caribbean

Karl Peltzer & Supa Pengpid

International Journal of Mental Health and Addiction

ISSN 1557-1874
Volume 16
Number 1

Int J Ment Health Addiction (2018)
16:164-174
DOI 10.1007/s11469-017-9850-z



Your article is protected by copyright and all rights are held exclusively by Springer Science+Business Media, LLC, part of Springer Nature. This e-offprint is for personal use only and shall not be self-archived in electronic repositories. If you wish to self-archive your article, please use the accepted manuscript version for posting on your own website. You may further deposit the accepted manuscript version in any repository, provided it is only made publicly available 12 months after official publication or later and provided acknowledgement is given to the original source of publication and a link is inserted to the published article on Springer's website. The link must be accompanied by the following text: "The final publication is available at link.springer.com".



Concurrent Tobacco Use and Binge Drinking Among University Students in 30 Countries in Africa, Asia, Latin America, and the Caribbean

Karl Peltzer^{1,2}  · Supa Pengpid^{3,4}

Published online: 1 December 2017

© Springer Science+Business Media, LLC, part of Springer Nature 2017

Abstract The aim of this study was to investigate concurrent tobacco use and binge drinking and the co-occurrence risks of each substance among university students in Africa, Asia, Latin America, and the Caribbean. A cross-sectional survey of 24,753 university students, 58.6% women and 41.4% men, mean age of 20.8 years (SD = 2.6) from 30 countries, was conducted in 2013–2015. Five percent of the university students had engaged in concurrent tobacco use and binge drinking, 17.7% in binge drinking only, and 8.0% in current tobacco use only. Overall, among past month tobacco users, 32.1% were frequent binge drinkers, and among binge drinkers, 45.6% were frequent tobacco users. Compared to students who neither smoked nor were binge drinkers, concurrent tobacco users and binge drinkers were more likely to be men (OR = 3.09, CI = 2.55, 3.74), were older (OR = 2.00, CI = 1.56, 2.36), had a wealthier family background (OR = 1.60, CI = 1.30, 1.96), were living in an upper middle or high-income country (OR = 0.27, CI = 0.10, 0.72), used illicit drugs (OR = 3.16, CI = 2.64, 3.83), were gambling (OR = 2.41, CI = 1.91, 3.04), had been in a physical fight (OR = 2.08, CI = 1.67, 2.59), had sustained an injury (OR = 1.25, CI = 1.03, 1.50), and lacked involvement in organized religious activity (OR = 0.40, CI = 0.32, 0.52). Prevention and treatment strategies should better incorporate the comorbidity of tobacco and alcohol use in their intervention programs.

✉ Karl Peltzer
karl.peltzer@tdt.edu.vn

¹ Department for Management of Science and Technology Development, Ton Duc Thang University, Ho Chi Minh City, Vietnam

² Faculty of Pharmacy, Ton Duc Thang University, Ho Chi Minh City, Vietnam

³ Department of Research and Innovation, University of Limpopo, Turfloop, Sovenga 0727, South Africa

⁴ ASEAN Institute for Health Development, Mahidol University, Salaya, Phutthamothon, Nakhon Pathom 73170, Thailand

Keywords Concurrent tobacco use · Binge drinking · University students · Africa · Asia · America

Tobacco and alcohol use can contribute to significant morbidity and mortality but less is known of their concurrent use reducing potential appropriate prevention efforts (Jackson et al. 2005; Weitzman and Chen 2005). Concurrent (not temporarily at the same time but during a specified period) tobacco and alcohol use is particularly harmful in terms of morbidity and mortality, compared to singular use of alcohol and tobacco (Marrero et al. 2005; Pelucchi et al. 2006). Tobacco use increases alcohol use (Barrett et al. 2006) and alcohol use increases tobacco use (McKee et al. 2006). Almost 35% of persons with an alcohol use problem also have a tobacco use disorder (Grant et al. 2004), and individuals with a substance use disorder “smoke two to four times the rate of the general population” (Schroeder 2017). “Individuals of all ages who reported using nicotine products of any kind were significantly more likely than nonusers to report alcohol, marijuana, other drug, and poly-substance use and to meet diagnostic criteria for a substance-use disorder” (Richter et al. 2017). Co-occurrence risks between tobacco use and alcohol use seem to be greatest with higher consumption rates of each substance (Kalman et al. 2010; Schmid et al. 2007; Weitzman and Chen 2005). Further, it seems that alcohol and tobacco use strongly correlate in emerging adulthood (Cance et al. 2017). In a national adult population sample in the USA, the prevalence rates of co-use of tobacco and alcohol and comorbidity between nicotine dependence and alcohol use disorders were peaked among the youth (Falk et al. 2006). Among a nationally representative sample of university students in the USA, 44–59% of drinkers smoked (Weitzman and Chen 2005). There is a lack of studies of concurrent tobacco and alcohol use in young adults in low- and middle-income countries.

Previous studies in high-income countries found the following risk factors for concurrent tobacco and alcohol use, including male gender (Cance et al. 2017), White race (Cance et al. 2017), fraternity/sorority affiliation (Cance et al. 2017), higher family income (Cance et al. 2017), lower socioeconomic status (Twyman et al. 2016), and lack of social support (Twyman et al. 2016). Additional risk factors include having mental distress (Horn et al. 2000), depression (as reviewed by Weitzman and Chen 2005), posttraumatic stress disorder (PTSD) (Forbes et al. 2015), gambling (Barnes et al. 2015), physical aggression (Matuszka et al. 2017), and injury (as reviewed by Weitzman and Chen 2005).

The goal of this study was to investigate concurrent tobacco use and binge drinking and the co-occurrence risks of each substance among university students in 30 countries in Africa, Asia, Latin America, and the Caribbean.

Methods

Sample and Procedure

In a cross-sectional survey, a questionnaire on various health behaviors was self-administered among university students in 30 countries: Bangladesh ($n = 800$), Barbados ($n = 564$), Cambodia ($n = 1357$), Cameroon ($n = 627$), China ($n = 1184$), Colombia ($n = 816$), Egypt ($n = 831$), Grenada ($n = 422$), India ($n = 800$), Indonesia ($n = 981$), Ivory Coast ($n = 824$), Jamaica ($n = 762$), Kyrgyzstan ($n = 837$), Laos ($n = 806$), Madagascar ($n = 800$), Malaysia ($n = 1023$),

Mauritius ($n = 501$), Myanmar ($n = 491$), Namibia ($n = 503$), Nigeria ($n = 820$), Pakistan (813), Philippines ($n = 782$), Russia ($n = 799$), Singapore ($n = 894$), South Africa ($n = 888$), Thailand ($n = 1658$), Tunisia ($n = 960$), Turkey ($n = 800$), Venezuela ($n = 564$), and Vietnam ($n = 817$).

The sample size was calculated for each country using Epi-Info Version 7.1 (centers for disease control and prevention, Atlanta, GA, USA). The expected frequency based on the only one study founded in the literature among university students in the USA, 44–59% of drinkers smoked (Weitzman and Chen 2005). Sample size was calculated using STATCAL for the population survey, with the expected frequency of 50% the minimum sample size at confidence level of 99% was calculated as 663.

Research assistants administered the questionnaire (in the language of the study population) at the end of a teaching class (inclusion criteria: all students present in class). In each study country, undergraduate students were surveyed in classrooms selected through a cluster random sample procedure (one university department randomly selected from each faculty as a primary sampling unit, and for each selected department randomly ordered undergraduate courses). All students attending the selected class were invited to participate in the study. Participation rates in all universities or countries were more than 90%, except for Indonesia 69% and Myanmar 73%. The study was conducted from 2013 to 2015. Informed consent was obtained from participating students. Ethics approvals for the study protocol were obtained from institutional review boards from all participating institutions. The study questionnaire was pilot tested in each participating country and country language on a sample of 25–30 university students who did not form part of the final sample.

Measures

Tobacco use was assessed with the questions: (1) “Do you currently use one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)?” Response options were “yes” or “no”. (2) “In the past month, how often have you used one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)?” Response options were once or twice, weekly, almost daily, and daily (WHO 1998). Current or past month tobacco use was defined as once or twice, weekly, almost daily, or daily tobacco use in the past month.

Binge alcohol use was measured with the question “how often do you have (for men) five or more and (for women) four or more drinks on one occasion?” Response options were “0 = never, 1 = less than monthly, 2 = monthly, 3 = weekly and 4 = daily or almost daily” (Babor et al. 2001). Any binge drinking was defined as less than monthly to daily or almost daily.

Concurrent Tobacco and Alcohol Use

Based on the above measures on tobacco use and binge alcohol use, concurrent was defined as any tobacco use during the period of the past 1 month and any binge drinking during the period of the past 12 months.

Sociodemographic variables: age, gender, and subjective socioeconomic status. *Country income* was assessed using World Bank classifications (World Bank 2017).

Social support was measured with three questionnaire items from the “Social Support Questionnaire” (Brock et al. 1996) (Cronbach alpha 0.91).

Religiousness was assessed by the “Duke University Religion Index (DUREL),” with one item on organized religious activity (Koenig et al. 1997).

Illicit drug use was assessed with a question, “In the past 12 months, how often have you taken any drugs other than those prescribed by health care providers?” Response options ranged from 1 = 0 times to 4 = 10 or more times (Yi et al. 2017).

Gambling behavior was measured with five items of the “*South Oaks Gambling Screen* (SOGS)” (lottery, cards, gambling machines, horses and sports betting, and casino games) (Lesieur and Blume 1987). Response options ranged from 1 = not at all to 3 = once a week or more (Cronbach alpha was 0.75). Gambling was classified by any weekly gambling activity.

The “*Centre for Epidemiologic Studies Depression Scale* (CES-D: 10 item)” was utilized to measure depressive symptoms (Andresen et al. 1994) (Cronbach alpha = 0.74).

Posttraumatic stress disorder (PTSD) was measured with Breslau’s 7-item screening questionnaire on PTSD symptoms experienced during the past month (Kimerling et al. 2006) (Cronbach alpha = 0.76).

Physical activity was measured using the “*International Physical Activity Questionnaire* (IPAQ) short version, for the last 7 days (IPAQ-S7S)” (Craig et al. 2003) and classified according to IPAQ manual into low, moderate, and high physical activity (IPAQ 2016).

Having been in a physical fight was measured with the question, “During the past 12 months, how many times were you in a physical fight?” Response options ranged from “0 times” to “12 or more times” (CDC 2016).

Injury. Study respondents were asked, “During the past 12 months, how many times were you seriously injured?” (Serious injury was classified as “when it makes you miss at least one full day of usual activities (such as university, sports, or a job) or requires treatment by a doctor or nurse.”) A response of “0” represented not and “1” one or more times having sustained a serious injury (CDC 2016).

Data Analysis

Data were analyzed using STATA software version 13.0 (“Stata Corporation, College Station, Texas, USA”). Descriptive statistics were used to compute the frequency of the study variables of the study population. Differences in proportions were estimated by using Pearson chi-square statistics. We used a two-level, mixed-effects logistic regression with random intercept to account for the effect of clustering in the 30 study countries, to calculate the odds ratios with 95% confidence interval (CI) in order to estimate the associations between the potential determinants (sociodemographic characteristics and psycho-social variables) and concurrent past month tobacco and past 12-month binge drinking, tobacco use only, and binge drinking only. Missing data were excluded from the analysis.

Results

Sample Characteristics

The total sample included 24,753 university students, 58.6% women and 41.4% men, with a mean age of 20.8 years (SD = 2.6) from 30 countries. More than half of the students (53.9%) were residing in low- or lower middle-income countries, 64.0% had high social support, and 26.1% engaged in high-organized religious activity. Almost two in five of the students were physically inactive, 23.8% had sustained a serious injury in the past year, 21.8% had PTSD symptoms, 12.8% severe depression symptoms, 12.1% had been in a physical fight in the past

12 months, 7.2% engaged in gambling in the past week, and 4.4% had used illicit drugs in the past 12 months. Five percent of the university students had engaged in concurrent tobacco use and binge drinking, 17.7% in binge drinking only, 8.0% in current tobacco use only, and 73% had not engaged in tobacco use and binge drinking (see Table 1).

Co-occurrence of Tobacco and Alcohol Use

Overall, among past month tobacco users, 8.0% never engaged in binge drinking, 16.7% infrequently (less than in the past month) were binge drinking, and 32.1% were frequent (monthly, weekly, or daily or almost daily) binge drinkers. Among past month male and female tobacco users 40.4% and 20.5%, respectively, were frequent binge drinkers. Overall, among binge drinkers 42.5% were infrequent and 45.6% were frequent tobacco users, these proportions were similar for male and female students (see Table 2).

Associations with Substance Use Categories

In adjusted mixed-effects logistic regression analysis, being male, older age, having a wealthy family background, residing in an upper middle- or high-income country was associated with

Table 1 Description of sample, independent variables and substance use categories

Variable	Sample	No tobacco/ binge drinking <i>N</i> (%)	Tobacco use only <i>N</i> (%)	Binge drinking only <i>N</i> (%)	Concurrent binge drinking and tobacco use <i>N</i> (%)
All	24,753	18,080 (73%)	1571 (8.0)	3891 (17.7)	1240 (5.0)
Age (years)					
17–20	7825 (31.6)	6153 (78.6)	351 (5.4)	1027 (14.3)	294 (3.8)
20–21	9667 (39.1)	6984 (72.2)	669 (8.7)	1522 (17.9)	492 (5.1)
22–30	7261 (29.3)	4914 (67.7)	551 (10.1)	1342 (21.5)	454 (6.3)
Gender					
Women	14,389 (58.6)	11,428 (79.4)	491 (4.1)	2106 (15.6)	364 (2.5)
Men	10,161 (41.4)	6439 (63.4)	1076 (14.3)	1772 (21.6)	874 (8.6)
Family wealth					
Poor	12,201 (49.4)	8939 (73.3)	486 (5.2)	2264 (20.2)	512 (4.2)
Wealthy	12,496 (50.6)	9063 (72.5)	1078 (10.6)	1627 (15.2)	728 (5.8)
Country income					
Upper middle/high	11,407 (46.1)	7376 (64.7)	427 (5.5)	2809 (27.6)	795 (7.0)
Low or lower middle	13,346 (53.9)	10,675 (80.0)	1144 (9.7)	1082 (9.2)	445 (3.3)
Social support					
Low	8115 (36.0)	5751 (70.9)	654 (10.2)	1247 (17.8)	463 (5.7)
High	14,411 (64.0)	10,357 (71.9)	863 (7.7)	2458 (19.2)	733 (5.1)
Organized religious activity					
Low	8686 (38.5)	6889 (79.3)	616 (8.2)	901 (11.6)	280 (3.2)
Medium	7972 (35.4)	5350 (67.1)	444 (7.7)	1748 (24.6)	430 (5.4)
High	5883 (26.1)	3952 (67.2)	457 (10.4)	1016 (20.5)	458 (7.8)
Illicit drug use	1092 (4.4)	606 (3.2)	82 (4.4)	217 (6.7)	196 (16.7)
Gambling	1261 (7.2)	602 (47.7)	102 (14.5)	337 (35.9)	220 (17.4)
In physical fight	2645 (12.1)	1457 (55.1)	388 (21.0)	430 (22.8)	369 (14.0)
Depression	3179 (12.8)	2216 (69.7)	250 (10.1)	481 (17.8)	232 (7.3)
PTSD	4699 (21.8)	3199 (68.1)	396 (11.0)	774 (19.5)	339 (7.0)
Physical inactivity	8997 (39.8)	5662 (74.9)	341 (5.7)	1269 (18.3)	287 (3.8)
Injury	5328 (23.8)	3449 (21.5)	411 (27.0)	1033 (28.3)	434 (36.3)

Table 2 Co-occurrence of tobacco and alcohol use

Variable	All <i>N</i> (%)	Male <i>N</i> (%)	Female <i>N</i> (%)	Statistic <i>P</i> value
Past month tobacco users				
Binge drinking				
Never	1571 (8.0)	1076 (14.3)	491 (4.1)	< 0.001
Infrequent (< past month)	439 (16.7)	285 (24.0)	153 (10.6)	
Frequent (past month)	801 (32.1)	589 (40.4)	211 (20.5)	
All	2811 (11.3)	1950 (19.2)	855 (5.9)	
Binge drinkers				
Tobacco use				
None	3891 (17.7)	1772 (21.6)	2106 (15.6)	< 0.001
Infrequent (one or twice or weekly in the past month)	582 (42.5)	381 (44.2)	200 (39.6)	
Frequent (almost daily or daily)	658 (45.6)	493 (45.3)	164 (46.9)	
All	5131 (20.7)	2646 (26.0)	2470 (17.2)	

concurrent tobacco use and binge drinking. In addition, lower involvement in organized religious activity, illicit drug use, gambling, having been in a physical fight, having sustained an injury and depression symptoms was associated with concurrent tobacco use and binge drinking.

Further, being male, older age, having a wealthy family background, illicit drug use, having been in a physical fight, and having PTSD symptoms were associated with tobacco use only and with binge drinking only. In addition, residing in an upper middle- or high-income country, lack of organized religious activity, gambling, having depression symptoms, and having sustained a serious injury in the past 12 months was associated with binge drinking only (see Table 3).

Discussion

The study found among a large sample of university students across 30 mainly low- and middle-income countries a 5% prevalence of concurrent tobacco use and binge drinking, which may be lower than reports from youth populations in high-income countries (Cance et al. 2017; Matuszka et al. 2017; Schmid et al. 2007). Globally, rates of alcohol and tobacco use among students seem to be higher in high-income countries (Europe, North America, Australia) than in low- and middle-income countries, which may be attributed to cultural and religious reasons resulting in higher abstention rates in developing countries (United Nations 2003).

However, this study found a high co-occurrence of tobacco and alcohol use, among past month tobacco users, 32.1% were frequent binge drinkers, and among frequent binge drinkers, 45.6% were daily or almost daily tobacco users. These proportions may be similar to American students where 44–59% of drinkers smoke (Weitzman and Chen 2005). Yet, the proportion of daily or almost daily tobacco users was higher among binge drinkers than the proportion of frequent binge drinkers among tobacco users. This finding seems to be contrary to previous studies (Schmid et al. 2007) that found reverse results where more current tobacco users also consumed alcohol than current alcohol users also smoked. In agreement with previous studies (Kalman et al. 2010; Pengpid et al. 2016; Schmid et al. 2007; Weitzman and Chen 2005), this study also found that co-occurrence risks between tobacco and alcohol use seem to be greatest

Table 3 Associations with substance use categories

Variable	Tobacco use only	Binge drinking only	Concurrent binge drinking and tobacco use	
	Adjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Gender				
Women (62.3%)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Men (37.7%)	3.05 (2.55, 3.65)***	2.02 (1.78, 2.29)***	4.02 (3.53, 4.59)***	3.09 (2.55, 3.74)***
Age (years)				
17–20 (32.3%)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
20–21 (39.9%)	1.44 (1.14, 1.83)**	1.12 (0.96, 1.30)	1.42 (1.20, 1.67)***	1.57 (1.23, 1.99)***
22–30 (27.8%)	2.00 (1.56, 2.56)***	1.39 (1.19, 1.63)***	1.94 (1.63, 2.30)***	2.00 (1.56, 2.56)***
Family wealth				
Poor (63.0%)	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Wealthy (37.0%)	1.37 (1.10, 1.71)**	1.20 (1.04, 1.38)**	1.45 (1.27, 1.67)***	1.60 (1.30, 1.96)***
Country income				
Upper middle/high	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Low or lower middle	0.95 (0.38, 2.38)	0.22 (0.08, 1.27)**	0.42 (0.20, 0.90)*	0.27 (0.10, 0.72)**
Social support				
Low	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
High	0.92 (0.78, 1.09)	1.12 (0.98, 1.27)	0.79 (0.69, 0.89)***	0.91 (0.75, 1.09)
Organized religious activity				
Low	1 (Reference)	1 (Reference)	1 (Reference)	1 (Reference)
Medium	0.99 (0.81, 1.22)	0.92 (0.79, 1.07)	0.66 (0.57, 0.76)***	0.73 (0.60, 0.90)**
High	0.83 (0.66, 1.03)	0.53 (0.45, 0.63)***	0.40 (0.34, 0.48)***	0.40 (0.32, 0.52)***
Illicit drug use	2.80 (2.16, 3.62)***	1.66 (1.43, 1.93)***	3.13 (2.78, 3.52)***	3.16 (2.64, 3.83)***
Gambling	1.14 (0.84, 1.55)	1.49 (1.19, 1.87)***	3.33 (2.80, 3.96)***	2.41 (1.91, 3.04)***
In physical fight	2.25 (1.80, 2.81)***	1.49 (1.25, 1.78)***	3.58 (3.11, 4.13)***	2.08 (1.67, 2.59)***
Depression	1.15 (0.92, 1.45)	1.22 (1.02, 1.46)*	1.68 (1.44, 1.96)***	1.32 (1.04, 1.68)*
PTSD	1.53 (1.25, 1.87)***	1.21 (1.05, 1.40)**	1.48 (1.29, 1.70)***	1.17 (0.95, 1.45)
Physical inactivity	1.09 (0.91, 1.31)	1.06 (0.94, 1.19)	0.79 (0.68, 0.93)**	1.02 (0.85, 1.23)
Injury	1.19 (0.97, 1.45)	1.26 (1.11, 1.41)***	1.78 (1.57, 2.02)***	1.25 (1.03, 1.50)*
Random effects parameters	1.21 (0.63, 2.26)	1.52 (0.83, 2.81)		1.44 (0.74, 2.81)

OR odds ratio, CI confidence interval

*** $P < 0.001$; ** $P < 0.01$; * $P < 0.05$

with higher consumption rates of each substance. Further, we found, in agreement with previous studies (Cance et al. 2017), that binge drinking without tobacco use was more prevalence than tobacco use without binge drinking in this emerging adulthood population. Possible reasons for the higher co-occurrence risks with higher consumption rates of each substance may include that concurrent alcohol use, and/or prior alcohol exposure, may change the reinforcing effects of nicotine, and that each drug becomes a pharmacological cue for the expectation of the other (Littleton et al. 2007). In addition, biological factors may play a role, with tobacco and nicotine mechanisms acting on common mechanisms in the brain, creating complex interactions (Funk et al. 2007).

As also found in previous studies (Cance et al. 2017), this study found that sociodemographic factors, including male gender, older age, having a wealthy family background, and residing in an upper middle- or high-income country were associated with concurrent tobacco use and binge drinking. The higher prevalence of concurrent tobacco use and binge drinking among older than younger university students may be related to developing

routine tobacco use at late adolescence, while the development of alcohol use pattern may occur at a later age (Matuszka et al. 2017; Weitzman and Chen 2005). The link between better economic background and concurrent tobacco and alcohol use in this study in low- and middle-income countries may be explained by an increased affordability of the two substances (Miskulin et al. 2010), but previous studies in high-income countries found lower socioeconomic status to be associated with concurrent tobacco and alcohol use (Bonevski et al. 2014; Twyman et al. 2016). The latter finding is in agreement with our study that students from a poorer family background and residing in an upper middle- or high-income country were more likely to engage in binge drinking only. However, Bonevski et al. (2014) found that higher socioeconomic status was associated with alcohol use alone in Australia, and while in this study students coming from a wealthy family background were more likely to engage in tobacco use only, lower socioeconomic status was associated with tobacco use alone in the Australia study (Bonevski et al. 2014). In addition, a form of lack of social support, i.e., lower participation in organized religious activity was in this study associated with binge drinking only and concurrent tobacco and alcohol use. Similar results were found in a previous study (Twyman et al. 2016).

As found in previous studies (Barnes et al. 2015; Matuszka et al. 2017; Richter et al. 2017; as reviewed by Weitzman and Chen 2005), this study found an association between illicit drug use, gambling, having been in a physical fight, having sustained an injury and concurrent tobacco use and binge drinking. Moreover, having sustained an injury was in this study associated with binge drinking only but not with tobacco use only. Having been in a physical fight can be seen as a proxy for physical aggression. This study confirms the increased prevalence of aggressive behavior among concurrent tobacco users and binge drinkers, which may be attributed to addictive psychoactive effects of the two substances (Matuszka et al. 2017; Von der Pahlen et al. 2008).

Further, this study found an association between mental distress (depression and in bivariate analysis PTSD) and concurrent tobacco use and binge drinking, as found in previous studies (Forbes et al. 2015; Horn et al. 2000, as reviewed by Weitzman and Chen 2005). Overall, this study found that most factors (sociodemographic, social, and health variables) associated with concurrent tobacco use and binge drinking in this study were also associated with tobacco use only and binge drinking only. This result was also found in a survey among socioeconomically disadvantaged adults in Australia (Twyman et al. 2016). However, while having depression and PTSD symptoms were associated with binge drinking only, only PTSD symptoms were associated with tobacco use only. This could mean that in addressing risk factors for conjoint tobacco and alcohol users, they could be similar to addressing risk factors for tobacco use only and binge drinking only.

Study Strengths and Limitations

The strengths of this multi-country study include the large sample size recruited from 33 universities in 30 countries in Africa, Asia, Latin America, and the Caribbean with diverse sociocultural characteristics and the use of uniform methods and measures across the study sites.

This study also had several limitations. First, the key variables, such as tobacco and alcohol use, were self-reported. In addition, the different types of tobacco or nicotine use, including e-cigarettes, were not assessed and should be studied in future investigations to better understand

the effect of poly-nicotine use. Second, the generalizability of the study findings is questionable given that the data were collected from university students in one or two universities in each participating country. The final limitation concerns the cross-sectional nature of the study, which limited our ability to establish causality. Longitudinal studies concerning tobacco and alcohol use beginning in early adolescence are needed.

Conclusions

Although the prevalence of current tobacco use only and any binge drinking only in this university student population across three continents in predominantly low- and middle-income countries may not be as high as in some high-income countries, this study found a high prevalence of co-occurrence of tobacco use and binge drinking. Among those university students across three continents who are economically better off, being a concurrent tobacco user and binge drinker appeared to be associated with poorer mental health and other problem behavior such as illicit drug use, gambling, and physical fighting. Future studies should also report the co-occurrence of tobacco and alcohol use and treatment seeking behavior in order to better monitor concurrent substance use indicators. Prevention and treatment programs should better incorporate the comorbidity of tobacco and alcohol use in their intervention strategies.

Acknowledgments The following colleagues participated in this student health survey, contributed to data collection and design of the study, and need to be considered co-authors (locations and names of universities in parentheses) Bangladesh: Gias Uddin Ahsan (Dhaka, North South University); Barbados: T. Alafia Samuels (Bridgetown, University of the West Indies); Cambodia: Khuondyla Pal (Phnom Penh, Royal University of Phnom Penh and Battambang, University of Battambang); Cameroon: Jacques Philippe Tsala (Yaounde, University of Yaounde I); China: Tony Yung and Xiaoyan Xu (Hong Kong, Chinese University of Hong Kong and Chengdu, Sichuan Normal University); Colombia: Carolina Mantilla (Pamplona, Universidad de Pamplona); Egypt: Alaa Abou-Zeid (Cairo, Cairo University); Grenada: Omowale Amuleru-Marshall (St. George, St. George's University); India: Krishna Mohan (Visakhapatnam, Gitam University); Indonesia: Ema Rochmawati (Yogyakarta, Universitas Muhammadiyah Yogyakarta), Indri Hapsari Susilowati (Jakarta, Universitas Indonesia); Ivory Coast: Issaka Tiembre (Abidjan, Université Félix Houphouët Boigny de Cocody); Jamaica: Caryll James (Kingston, University of the West Indies); Kyrgyzstan: Kyrgyz State Medical Academy); Laos: Vanphanom Sychareun (Vientiane, University of Health Sciences); Madagascar: Onya H Rahamefy (Antananarivo, University of Antananarivo); Malaysia: Wah Yun Low (Kuala Lumpur, University of Malaya); Mauritius: Hemant Kumar Kassean (Réduit, Moka, University of Mauritius); Myanmar: Hla Win (Yangon, University of Medicine 1); Namibia: Pempelani Mufune (Windhoek, University of Namibia); Nigeria: Solu Olowu (Ile-Ife, Obafemi Awolowo University); Pakistan: Rehana Rehman Aga Khan University Philippines: Alice Ferrer (Miagao, University of the Philippines Visayas); Russia: Peoples' Friendship University of Russia; Singapore: Mee Lian Wong (Singapore, National University of Singapore); South Africa: Tholene Sodi and Shai Nkoana (Polokwane, University of Limpopo); Thailand: Niruwan Tumbull (Maha Sarakham, Mahasarakham University); Tawatchai Apidechkul (Chiang Rai, Mae Fah Laung University); Tunisia: Hajer Aounallah-Skhirri (Tunis, Université de Tunis El Manar); Turkey: Neslihan Keser Özcan (Istanbul, Istanbul University); Venezuela: Yajaira M Bastardo (Caracas, Universidad Central de Venezuela); Vietnam: Thang Nguyen Huu (Hanoi, Hanoi Medical University).

Funding Partial funding for this study was provided by the South African Department of Higher Education.

Compliance with Ethical Standards All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all participants for being included in the study.

Conflict of Interest The authors declare that they have no conflicts of interest.

References

- Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: evaluation of a short form of the CES-D (Center for Epidemiologic Studies Depression Scale). *American Journal of Preventive Medicine*, *10*, 77–84.
- Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., & Monteiro, M. G. (2001). *AUDIT: the Alcohol Use Disorder Identification Test*. Geneva: World Health Organization.
- Barnes, G. M., Welte, J. W., Tidwell, M. C., & Hoffman, J. H. (2015). Gambling and substance use: co-occurrence among adults in a recent general population study in the United States. *International Gambling Studies*, *15*(1), 55–71.
- Barrett, S. P., Tichauer, M., Leyton, M., & Pihl, R. O. (2006). Nicotine increases alcohol self-administration in nondependent male smokers. *Drug and Alcohol Dependence*, *81*, 197–204.
- Bonevski, B., Regan, T., Paul, C., Baker, A. L., & Bisquera, A. (2014). Associations between alcohol, smoking, socioeconomic status and comorbidities: evidence from the 45 and Up Study. *Drug and Alcohol Review*, *33*(2), 169–176. <https://doi.org/10.1111/dar.12104>.
- Brock, D., Sarason, I., & Pierce, G. (1996). Simultaneous assessment of perceived global and relationship-specific support. *Journal of Social and Personal Relationships*, *13*, 143–152.
- Cance, J. D., Talley, A. E., Morgan-Lopez, A., & Fromme, K. (2017). Longitudinal conjoint patterns of alcohol and tobacco use throughout emerging adulthood. *Substance Use & Misuse*, *52*(3), 373–382. <https://doi.org/10.1080/10826084.2016.1228677>.
- Centers for Disease Control and Prevention (CDC). (2016). Global School-based Student Health Survey (GSHS). Retrieved on 3 June 2017 from <http://www.cdc.gov/gshs/>.
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., . . . , Oja, P. (2003). International Physical Activity Questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, *35*(8), 1381–95.
- Falk, D. E., Yi, H. Y., & Hiller-Sturmhöfel, S. (2006). An epidemiologic analysis of co-occurring alcohol and tobacco use and disorders: findings from the National Epidemiologic Survey on Alcohol and Related Conditions. *Alcohol Research & Health*, *29*(3), 162–171.
- Forbes, M. K., Flanagan, J. C., Barrett, E. L., Crome, E., Baillie, A. J., Mills, K. L., & Teesson, M. (2015). Smoking, posttraumatic stress disorder, and alcohol use disorders in a nationally representative sample of Australian men and women. *Drug and Alcohol Dependence*, *156*, 176–183. <https://doi.org/10.1016/j.drugalcdep.2015.09.007>.
- Funk, D., Marinelli, P. W., & Lê, A. D. (2007). Biological processes underlying co-use of alcohol and nicotine: neuronal mechanisms, cross-tolerance, and genetic factors. *Alcohol Research & Health*, *29*(3), 186–190.
- Grant, B. F., Hasin, D. S., Chou, S. P., Stinson, F. S., & Dawson, D. A. (2004). Nicotine dependence and psychiatric disorders in the United States: results from the national epidemiologic survey on alcohol and related conditions. *Archives of General Psychiatry*, *61*, 1107–1115.
- Horn, K., Gao, X., Williams, J., Helmkamp, J., Furbee, M., & Manley, W. (2000). Conjoint smoking and drinking: a case for dual-substance intervention among young emergency department patients. *Academic Emergency Medicine*, *7*(10), 1126–1134.
- International Physical Activity Questionnaire (IPAQ) Research Committee (2016). International physical activity questionnaire. Retrieved at <https://sites.google.com/site/theipaq/scoring-protocol>. Accessed 20 Oct 2016.
- Jackson, K. M., Sher, K. J., & Schulenberg, J. E. (2005). Conjoint developmental trajectories of young adult alcohol and tobacco use. *Journal of Abnormal Psychology*, *114*(4), 612–626.
- Kalman, D., Kim, S., DiGirolamo, G., Smelson, D., & Ziedonis, D. (2010). Addressing tobacco use disorder in smokers in early remission from alcohol dependence: the case for integrating smoking cessation services in substance use disorder treatment programs. *Clinical Psychology Review*, *30*(1), 12–24. <https://doi.org/10.1016/j.cpr.2009.08.009>.
- Kimerling, R., Ouimette, P., Prins, A., Nisco, P., Lawler, C., Cronkite, R., & Moos, R. H. (2006). Brief report: utility of a short screening scale for DSM-IV PTSD in primary care. *Journal of General Internal Medicine*, *21*, 65–67.
- Koenig, H. G., Parkerson Jr., G. R., & Meador, K. G. (1997). Religion index for psychiatric research. *American Journal of Psychiatry*, *154*, 885–886.
- Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (SOGS): a new instrument for the identification of pathological gamblers. *American Journal of Psychiatry*, *144*, 1184–1188.
- Littleton, J., Barron, S., Prendergast, M., & Nixon, S. J. (2007). Smoking kills (alcoholics)! shouldn't we do something about it? *Alcohol and Alcoholism*, *42*(3), 167–173.
- Marrero, J. A., Fontana, R. J., Fu, S., Conjeevaram, H. S., Su, G. L., & Lok, A. S. (2005). Alcohol, tobacco and obesity are synergistic risk factors for hepatocellular carcinoma. *Journal of Hepatology*, *42*, 218–224.

- Matuszka, B., Bacsikai, E., & Czobor, P. (2017). Physical aggression and concurrent alcohol and tobacco use among adolescents. *International Journal of Mental Health and Addiction*, *15*, 90–99.
- McKee, S. A., Krishnan-Sarin, S., Shi, J., Mase, T., & O'Malley, S. S. (2006). Modeling the effect of alcohol on smoking lapse behavior. *Psychopharmacology*, *189*, 201–210.
- Miskulin, M., Petrović, G., Miskulin, I., Puntarić, D., Milas, J., & Dahl, D. (2010). Prevalence and risk factors of alcohol abuse among university students from eastern Croatia: questionnaire study. *Collegium Antropologicum*, *34*(4), 1315–1322.
- Pelucchi, C., Gallus, S., Garavello, W., Bosetti, C., & La Vecchia, C. (2006). Cancer risk associated with alcohol and tobacco use: focus on upper aero-digestive tract and liver. *Alcohol Research & Health*, *29*, 193–198.
- Pengpid, S., Peltzer, K., Puckpinyo, A., & Thammaaphiphol, K. (2016). Conjoint moderate or high risk alcohol and tobacco use among male out-patients in Thailand. *South African Journal of Psychiatry*, *22*(1), a763. <https://doi.org/10.4102/sajpsychiatry.v22i1.763>.
- Richter, L., Pugh, B. S., Smith, P. H., & Ball, S. A. (2017). The co-occurrence of nicotine and other substance use and addiction among youth and adults in the United States: implications for research, practice, and policy. *American Journal of Drug and Alcohol Abuse*, *43*(2), 132–145. <https://doi.org/10.1080/00952990.2016.1193511>.
- Schmid, B., Hohm, E., Blomeyer, D., Zimmermann, U. S., Schmidt, M. H., Esser, G., & Laucht, M. (2007). Concurrent alcohol and tobacco use during early adolescence characterizes a group at risk. *Alcohol and Alcoholism*, *42*(3), 219–225.
- Schroeder, S. A. (2017). Epilogue to special issue on tobacco and other substance use disorders: links and implications. *American Journal of Drug and Alcohol Abuse*, *43*(2), 226–229. <https://doi.org/10.1080/00952990.2016.1261406>.
- Twyman, L., Bonevski, B., Paul, C., Bryant, J., West, R., Siahpush, M., et al. (2016). Factors associated with concurrent tobacco smoking and heavy alcohol consumption within a socioeconomically disadvantaged Australian sample. *Substance Use and Misuse*, *51*(4), 459–470. <https://doi.org/10.3109/10826084.2015.1122065>.
- United Nations (2003). World youth report, chapter 6: Youth and Drugs. Available at <http://www.un.org/esa/socdev/unyin/documents/ch06.pdf>. Accessed 10 Sept 2017.
- Von der Pahlen, B., Santilla, P., Johansson, A., Varjonen, M., Jern, P., Witting, K., & Kenneth Sandnabba, N. (2008). Do the same genetic and environmental effects underlie the covariation of alcohol dependence, smoking, and aggressive behaviour? *Biological Psychology*, *78*(3), 269–277. <https://doi.org/10.1016/j.biopsycho.2008.03.013>.
- Weitzman, E. R., & Chen, Y. Y. (2005). The co-occurrence of smoking and drinking among young adults in college: national survey results from the United States. *Drug and Alcohol Dependence*, *80*(3), 377–386.
- World Bank. (2017). Countries and economies, 2017. Available at <http://data.worldbank.org/country>. Accessed 5 June 2017.
- World Health Organization (WHO). (1998). *Guidelines for controlling and monitoring the tobacco epidemic*. Geneva: WHO.
- Yi, S., Peltzer, K., Pengpid, S., & Susilowati, I. H. (2017). Prevalence and associated factors of illicit drug use among university students in the association of Southeast Asian nations (ASEAN). *Substance Abuse Treatment, Prevention, and Policy*, *12*(1), 9. <https://doi.org/10.1186/s13011-017-0096-3>.