

Alcohol use disorder identification test use in Muslim countries

A Al Mousawi.

PhD student in Chester University and Lecturer in Karbala Medical College.

Correspondence email: 1223159@chester.ac.uk or aalmousawi1@hotmail.com

Abstract

Background: Although alcohol consumption rates are low in the Middle East, there are pockets of high risk alcohol consumption especially among the youth. However, the main problem is the absence of trusted statistics related to alcohol use in these countries. This study is aimed at finding the possible bias in using Alcohol Use Identification Test (AUDIT) questionnaire among undergraduates in Karbala/Iraq and to determine alcohol consumption rates and the potential predictors.

Material and methods: A random sample (n=5446 students) answered a questionnaire based on AUDIT. The study objectives were to determine the effect of socio-cultural contexts on validity of AUDIT in a Muslim country. The analysis used descriptive and chi-squares test and regression analysis to assess significant associations at $p < 0.001$ level.

Results: Biased AUDIT findings might be estimated due to the high rates of guilt (54%) or knowing that others care about alcohol consumption (49%). Alcohol consumption lifetime incidence rate was 2% and was higher among male smokers. Risky drinking patterns was high (56%); however this might be biased due to socio-cultural reasons.

Conclusion: AUDIT use should consider socio-cultural environments. Alcohol consumption among university students is low as similar to the rates reported in neighbouring countries such as Jordan and Turkey. Risky drinking behaviour was alarmingly high which suggests that socio-cultural environment need should be considered in interpreting AUDIT results.

إستخدام إختبار الكشف عن إضطرابات تعاطي الكحول في الدول الإسلامية

الدكتور موساوي أ.

كلية الطب كربلاء

الملخص:

لمحة عن الموضوع: رغم أن نسب استهلاك المشروبات الكحولية منخفض في منطقة الشرق الأوسط إلا أنه توجد مجموعات تتبع طرق شرب جد خطيرة و خصوصا بين فئات الشباب إلا أنه يبدو أن المشكل الرئيس يتمثل في غياب إحصاءات رسمية موثوق بها حول تعاطي الكحول في هذه الدول. و تهدف هذه الدراسة إلى إيجاد تحيز لإستخدام إستبيان إختبار الكشف عن اضطرابات تعاطي الكحول بين طلاب البكالوريوس في مدينة كربلاء بالعراق لتحديد نسب استهلاك الكحول و المتنبآت المحتملة.

المادة و الطريقة: قامت عينة أختيرت بطريقة عشوائية تماما (طالب $n=5446$) بالإجابة بشكل طوعي عن إستبيان حول إختبار الكشف عن اضطرابات تعاطي الكحول. و غايات الدراسة هذه تحديد التأثيرات الإجتماعية و الثقافية على مصداقية إختبار الكشف عن اضطرابات تعاطي الكحول في بلد مسلم. و استخدم في الجزء التحليلي الطريقة إختبارات "كاي مربع" الوصفية و التحليل التراجعي لتقييم الشراكات الهامة على مستوى $p < 0.001$

النتائج: قد تكون نتائج التدقيق المحايز تقديرية و ذلك راجع للنسب العالية للإحساس بالذنب (54%) أو أن تجد الآخرين قلقون لموضوع استهلاك الكحول (49%). و كانت نسبة إنتشار طول عمر شرب الخمر 2% و كانت أعلى بين فئات المدخنين و الذكور. و كانت نسبة الشرب المحفوفة بالمخاطرة مرتفعة (56%) إلا أن هذه النسبة قد تكون متحيزة و ذلك راجع لأسباب إجتماعية و ثقافية.

الخلاصة: يجب على مستخدمي إختبار الكشف عن اضطرابات تعاطي الكحول ان يأخذوا في عين الحسبان المعايير الإجتماعية و الثقافية. و لوحظ أن إنتشار شرب الكحول بين فئات طلبة الجامعات ضئيل و يشبه النسب المسجلة في الدول المجاورة كالأردن و تركيا إلا أن الشرب المحفوف بالمخاطر أظهر نسب مرعبة مما يشير إلى أنه يتوجب الأخذ بالحسبان المعايير الإجتماعية و الثقافية عن محاولة تأويل نتائج إختبار الكشف عن اضطرابات تعاطي الكحول.

Keywords: Alcohol Use Identification Test, Risky drinking patterns, Alcohol consumption

Introduction

Globally, alcohol use disorders affect more than 76.3 million out of two billion people who consume alcohol.¹ In 2004, the World Health Organization (WHO) estimated that alcohol was responsible for 2.5 million deaths in the world each year.² Alcohol consumption is the world's third largest risk factor for disease and disability and was responsible for 3.8% of global mortality (6.3% in men and 1.1% in women) in 2011.^{3,4,5} Additionally, alcohol-attributable deaths occur relatively early in life thus resulting in losing many years due to premature mortality; and are often very disabling.

Alcohol consumption incidence in the Eastern Mediterranean Region is the lowest compared to other World Health Organization regions as alcohol consumption is prohibited in Islam and is officially banned in most Muslim countries. However, the main problem is the absence of official trusted statistics related to alcohol (and substance) use in these countries.^{5,6}

Alcohol is not banned in Iraq and there are shops that sell alcohol for bars and night clubs. However, alcohol consumption was banned for a few years in the 1990s and after the 2003 invasion, alcohol remains difficult to buy especially in religious cities. These factors have made and continue to make medication abuse more common and more socially acceptable.⁷ There are presently a few studies about substance use in Iraq, which have mostly investigated smoking. Alcohol consumption is officially permitted in Iraq, although it is religiously prohibited by Islam; the religion of the majority.⁸ One small household survey in 2004 reported alcohol consumption incidence at 5.4%.⁹ A national household survey¹⁰ reported substance (alcohol and illicit drug) use disorders incidence rate as 0.9%.

For assessment of alcohol consumption and alcohol use disorders, a long-standing debate continued about the indices used for determining its harm. The development of AUDIT by WHO was a great success in this respect. AUDIT was developed by WHO in 1989 as a simple method of screening for excessive drinking through a collaborative project performed in primary healthcare facilities in six countries.¹¹ It showed high reliability as Cronbach's α was calculated at 0.78 for consumption, 0.84 for drinking problems and 0.94 for the entire scale in the US.¹² It was found to be valid to identify participants with alcohol-related problems with a sensitivity of 94% and a specificity of 92% in a college student sample in Nigeria.¹³ A cut-off value of eight, yields a sensitivity of 0.90 and a specificity of 0.80.

However, the socio-cultural factors are important determinants of predictors of alcohol consumption trends, attitudes and beliefs. The rationale for this study was to explore the possible bias resulting from application of the

same standard questions used in AUDIT questionnaire in a Muslim country (i.e.Iraq).

Material and Methods

Objectives: Main objective is to determine potential bias in AUDIT application in a Muslim community. In addition, the study is aimed to find the prevalence of alcohol consumption among Karbala/ Iraq University students and their associations with participants' demography and other related predictors to help in forwarding proper control programmes.

Ethical considerations: Ethical approval was obtained from Karbala University and all responses were anonymous. Besides, the students were informed that completing the questionnaire meant participating in the survey.

Participants: In 2010, a total of 5446 students in Karbala/Iraq University participated voluntarily in a cross-sectional study. A random sample of the study halls was selected where the students were asked to fill a questionnaire during lecture hours.

Measures and tools: The questionnaire included questions about demographic variables in addition to substance (tobacco, alcohol and illicit drug) use. AUDIT was used for alcohol consumption in one of the sections of the questionnaire. The study was part of a larger project and the results of other questionnaires will be published later.

Procedure: The study was conducted in mid October-December 2010. In each of the eleven colleges, students were visited in the lecture halls which were almost fixed. Handouts were distributed and an introductory speech was given by the researcher stressing the voluntary participation, confidentiality and anonymity of the study.

Analysis: Data was input into a pre-designed database with data management and analysis using standard statistical tools (SPSS-17). Data input validity was checked through re-entering 10% of the questionnaire forms and internal reliability was checked between different questions. Descriptive analysis was performed to find rates and percentages of the study variables. Response rates were estimated and analysed to determine non-respondents' trends. Determining associations were followed depending on chi-squared test as most variables were categorical with regression analysis at a significant level of $p < 0.001$. The stringent level was chosen to compensate for the multiple analyses conducted.

Results

The response rate for the questions in this section was high (78-100%), among the total participants (n=5446) while the response rate of those who actually consumed alcohol was higher (86-89%).

The gender distribution showed almost equal numbers and the demographic characteristics of the sample are shown in Table 1.

Table 1. The demographic distribution of Karbala University students in 2010

Variable		Category	Frequency	Percentage
Gender		Male	2496	45.8
		Female	2950	54.2
Age category		17 – 20 Years	2226	40.9
		21 – 25 Years	2444	44.9
		over 25 Years	509	9.3
		Missing	267	4.9
College	Humanities and Social Sciences	College of Administration and Economics	1673	30.7
		College of Education	831	15.3
		College of Law	544	10.0
		College of Islamic Sciences	339	6.2
	Natural Sciences	College of Science	791	14.5
		College of Agriculture	198	3.6
		College of Medicine	236	4.3
		College of Veterinary Med	121	2.2
		College of Pharmacy	188	3.5
		College of Engineering	365	6.7
		College of Sport Education	160	2.9

Study year	1	1131	20.8
	2	1589	29.2
	3	1413	25.9
	4	1237	22.7
	5*	76	1.4
Place of birth	Urban	4637	85.1
	Rural	776	14.2
	Missing	33	0.6
	Total	5446	100

* Fifth year students were not included in further analysis as they were presented in two colleges only

The internal reliability of the ten questions in the alcohol section (AUDIT) was tested and Cronbach's α was .663. The least consistent was the question about guilt and when this was removed the internal reliability increased (Cronbach's α = .726).

The total number of students who reported consumption of any alcoholic beverage was 116 (103 males and 13 females). The consumption of alcohol was very low (2.2%) among the total number of those who answered the questionnaire. This situation is not alarming in a country where Muslim population is high.

Under-reporting might have contributed to this low prevalence within the social context surveyed, especially for females. Under-reporting is unpredictable and cannot be calculated in cross-sectional studies. However, low reporting in a national survey is common.¹⁰ The outstanding feature was that more than half (56%) of those who consumed alcohol were at risk (AUDIT score ≥ 8 , Table 2). The mean AUDIT score (9.79, SD= 6.19) was also high, suggesting that this sample consisted of frequent alcohol users and therefore, experienced alcohol use problems. Half (50%) of those who consumed alcohol reported having previous alcohol abuse problems (Table 2).

Table 2. Alcohol drinking risk level frequency distribution among those who consumed alcohol (n=116) among Karbala University students in 2010

Variable	Categories	Frequency	Percentage
Alcohol consumption level according to AUDIT score (in brackets)	Sensible drinking (<8)	33	44.0
	Hazardous drinking (8-15)	27	36.0
	Harmful drinking (16-19)	8	10.7
	Possible dependence (≥ 20)	7	9.3
	Total	75*	100.0
Number of Standard Units of alcohol consumed on a typical day of drinking	1 to 2 units	71	61.2
	3-4 units	22	19.0
	5-6 units	11	9.5
	7-9 units	5	4.3
	10 or more units	7	6.0
	Total	116	100.0
Frequency of alcohol drinking	Once monthly or less	40	40.8
	2-4 times a month	26	26.5
	2-3 times a week	12	12.2
	4 or more times a week	20	20.4
	Total	98	100
Frequency of drinking 6 Units or more on one occasion	Less than monthly	11	22.0
	Monthly	16	32.0
	Weekly	14	28.0
	Daily or almost daily	9	18.0
	Total	50	100.0
The cut off point for risky alcohol consumption for AUDIT questions ≥ 8			

More than half (54.4%) of those who consumed alcohol reported guilt and almost a similar number (49.1%) reported that others were concerned about their drinking.

Alcohol consumption was significantly high among male smokers and those who study in the evening and the numbers increased with age. It was higher among students in the Colleges of Humanities and Social Sciences than those in the Natural Science College.

Alcohol consumption was significantly associated with trauma, smoking

(OR =7.16), male gender (OR=10.52), SHS exposure (more with higher SHS exposure) and students who take evening classes (OR of day time students=0.51) and the reasons are believed to be socio-cultural factors. When smoking output variables were excluded to elaborate any possible effect caused by the basic variables, the model showed that the consumption of alcohol was significantly higher for males than for females (OR = 10.52) but higher for students with increased exposure to smoking. The incidence of alcohol consumption was lower for day time students than for those students who took evening classes (OR= 0.51, Table 3). Smoking was excluded because it was the only shown significant variable.

Table 3. Logistic regression model results of alcohol consumption with all potential variables without smoking output variables (reference category: those who did not consume alcohol)

Variable	Odds ratios	Wild test significance	Likelihood Ratio significance
Gender (reference category: female)	10.52 (4.47-24.78)		< 0.001
Type of the study (reference category: evening study group)	0.51 (0.32-0.82)		0.005
Days exposed to smoking (reference category: those exposed to smoke on all 7 days in the past week)			< 0.001
0 day smoke exposure	0.39 (0.16-0.94)	0.036	
1-2 days smoke exposure	0.32 (0.18-0.57)	< 0.001	
3-4 days smoke exposure	0.35 (0.16-0.75)	0.007	
5-6 days smoke exposure	0.19 (0.05-0.79)	0.023	
Model fitting Chi-sq (6) = 101.73, P < 0.001			
Goodness of fit probability Pearson Chi-sq (2795) = 2850.88, P = 0.226			

Discussion

Alcohol consumption levels found in this study were consistent with those conducted previously. Al-Hasnawi et al¹⁰ reported in a national household survey that the incidence of alcohol abuse was 0.7% while alcohol dependence was 0.2% in 2006/ 2007. Alcohol consumption rate was 5.4% (5.4% for males and 0.0% for females) among households in a northern city in Iraq (Duhok) in 2003-2004. The reason behind higher consumption rate than the present study is believed to be the age of the participants and inclusion of Christians in the sampling (about 5%).⁹

Similarly, a few studies have been done in the neighbouring countries. However, the rates reported in most reviews were higher than this study probably due to socio-cultural differences and use of different methodology. A report from the EMRO countries in 2006 showed that 22%-50% of university students have consumed alcohol and the numbers have increased especially in vulnerable pockets who usually consumed in a hazardous pattern.¹⁴ Lifetime consumption rates were: (17%) in Jordan,¹⁵ 7-22% in Egypt,¹⁶ 6% in Iran¹⁷ and 42% in Israel.¹⁸ Much higher rates were reported in the developed countries: (>80%) in Europe¹⁹ and (85%) in the US.²⁰

The socio-cultural context in Karbala as a religious place is a reason for low numbers of alcohol consumption especially among females. Females were 11% among those who consumed alcohol. No females consumers were reported from the northern city in Iraq (Duhok).^{7,9} A higher incidence may be reported if the study was conducted in another city in Iraq such as Baghdad. However, it was not possible to conduct a survey in Baghdad due to safety reasons.

In spite of the low incidence, the rate of risky consumption (AUDIT score ≥ 8) was high (56%), when compared with the rate of 7.4% reported among medical students in Turkey,²¹ and 8.5 % of adults in the United States.²² Only a minority (15%) met the criteria for an AUD across 36 medical schools surveyed in the United States in 2000.²²

A study in the US analysed two decades of surveys about alcohol consumption among undergraduate students and concluded that alcohol consumption rates were very high (>80%) and approximately two out of five American college students were heavy drinkers, defined as having had five or more drinks daily for a period of two weeks.²³

The significant predictors of alcohol consumption were consistent with those found in studies conducted in neighbouring countries and in developed countries. Gender difference is mainly related to socio-cultural factors where male consumers are more accepted in society, while association with smoking was reported by many studies in Iraq,²⁴ and other countries.^{21,25,26}

The higher rates among the evening study groups may be due to their older age or their socio-economic level.

AUDIT use in Muslim countries

It is important to consider the socio-cultural environmental effect during the analysis of the AUDIT questionnaire in Muslim countries. The socio-cultural context in Muslim countries drives those who consume alcohol to express a high rate of guilt and reports that others cared about their drinking; which is not the case in non-Muslim contexts. These two indicators could have a profound effect on AUDIT score and may lead to a “false” positive AUDIT score. Although a large number of published studies compared AUDIT score validity in different socio-cultural environments, 13,27,28,29,30,31,32 none of the reviews reported this weakness. A higher number of males had a positive AUDIT score in this study and this was similar to other reported studies in the neighbouring countries.²¹

Subjects of study and smoking among males were significant reasons of alcohol consumption in many reviewed studies.^{21,25} The gender specific incidence is the expected norm given the socio-cultural context in the EMRO countries. The gateway theory anticipates association with smoking as explained in section 8.5.9.^{33,34,35,36,37,38,39}

The risk factors associated with alcohol consumption by high school students in Iran were: old age (OR=1.55), having a general risk taking behaviour (OR=1.70), smoking (Nicotine dependent OR=3.70), self destructive nature (OR=1.22), high socio-economic level (OR=1.62) and life time use of illicit drugs (OR=5.72). Research revealed that incidence of alcohol use and drug abuse was in the increase among secondary school students i.e.10.1% and 2.2% for alcohol use and drug abuse, respectively. However, a clear limitation in this study was that the researchers considered non reporting as ‘never having used drugs’ with no clear explanation for this miscalculation.²⁵

References

1. World Health Organization. Global Status Report on Alcohol Geneva, Switzerland: 2004.
2. World Health Organization. Global strategy to reduce harmful use of alcohol. Italy: 2010.
3. World Health Organization. Global health risks: Mortality and burden of disease attributable to selected major risks. France: 2009.

4. World Health Organization. Global health risks: Mortality and burden of disease attributable to selected major risks report. France: 2009.
5. World Health Organization. Global status report on alcohol and health. Geneva, Switzerland: 2011.
6. Radovanovic Z, Pilcher CWT, Al-Nakib T, Shihab-Eldeen A. On substance abuse in Kuwait (1992-1997): Evidence from toxicological screening of patients. *Journal of Substance Abuse*. 2000;12(4):363-71. Doi: [http://dx.doi.org/10.1016/S0899-3289\(01\)00057-8](http://dx.doi.org/10.1016/S0899-3289(01)00057-8)
7. Al-Hasnawi SM. Substance Use Disorders in Iraq. *Addiction*. 2005;100:1567-9.
8. United Nations Office for the Coordination of Humanitarian Affairs. The Integrated Regional Information Networks (IRIN). Iraq country profile: United Nations Office for the Coordination of Humanitarian Affairs. The Integrated Regional Information Networks (IRIN). 2012. Available from: <http://www.irinnews.org/country/iq/iraq>.
9. Abdulrahman M, Abdulghany, A. Kurdistan Regional Government. Ministry of Health. Duhok Health Directorate. Final report on non-communicable diseases risk factors survey in Duhok District. 2004.
10. Alhasnawi S, Sadik S, Rasheed M, Baban A, Al-Alak MM, Othman AY, et al. The prevalence and correlates of DSM-IV disorders in the Iraq Mental Health Survey (IMHS). *World Psychiatry*. 2009;8(2):97-109.
11. Babor TF, Higgins-Biddle, J.C., Saunders, J.B., Monteiro, M.G. The Alcohol Use Disorders Identification Test: Guidelines for use in primary care. Geneva, Switzerland: 2001.
12. O'Hare T, Sherrer MV. Validating the Alcohol Use Disorder Identification Test With College First-Offenders. *Journal of Substance Abuse Treatment*. 1999;17(1):113-9. Doi: [http://dx.doi.org/10.1016/S0740-5472\(98\)00063-4](http://dx.doi.org/10.1016/S0740-5472(98)00063-4)
13. Adewuya AO. Validation of the alcohol use disorders identification test (audit) as a screening tool for alcohol-related problems among Nigerian university students. *Alcohol and Alcoholism*. 2005 Nov-Dec;40(6):575-7. PubMed PMID: 16115823. Doi: <http://dx.doi.org/10.1093/alcalc/agh197>

14. World Health Organization. East Mediterranean Regional Office. Public health problems of alcohol consumption in the region. Cairo, Egypt: 2006.
15. Suleiman RA, Shareef, M, Kharabsheh,S,Abu Danoon, M. Substance Use Among University and College Students in Jordan. *Arab Journal of Psychiatry (AJP)*. 2003;14(2):94-105.
16. Soueif MI, Hannourah MA, Darweesh ZA, El-Sayed AM, Yunis FA, Taha HS. The use of psychoactive substances by female Egyptian university students, compared with their male colleagues on selected items. *Drug and Alcohol Dependence*. 1987;19(3):233-47.
Doi: [http://dx.doi.org/10.1016/0376-8716\(87\)90043-3](http://dx.doi.org/10.1016/0376-8716(87)90043-3)
17. Ahmadi J, Maharlooy N, Alishahi M. Substance abuse: Prevalence in a sample of nursing students. *Journal of Clinical Nursing*. 2004;13(1):60-4.
Doi: <http://dx.doi.org/10.1046/j.1365-2702.2003.00841.x>
18. Brook U, Feigin R, Sherer M, Geva D. Prevalence, attitudes and knowledge of high school pupils towards drugs and other addictions: implications for school health education in Israel. *Patient Education and Counseling*. 2001;43(2):199-204.
Doi: [http://dx.doi.org/10.1016/S0738-3991\(00\)00163-4](http://dx.doi.org/10.1016/S0738-3991(00)00163-4)
19. Wicki M, Kuntsche E, Gmel G. Drinking at European universities? A review of students' alcohol use. *Addictive Behaviors*. 2010;35(11):913-24.
Doi: <http://dx.doi.org/10.1016/j.addbeh.2010.06.015>
20. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. Monitoring the Future national survey results on drug use, 1975-2011. Volume II.College students and Adults ages 19-50. 2012 Contract No.: NIH Publication No. 09-7402.
21. Akvardar Y, Demiral Y, Ergor G, Ergor A. Substance use among medical students and physicians in a medical school in Turkey. *Social Psychiatry and Psychiatric Epidemiology*. 2004;39(6):502-6.
Doi: <http://dx.doi.org/10.1007/s00127-004-0765-1>
22. Falk D, Yi, H.-y., Hiller-Sturmhöfel, S. An Epidemiologic Analysis of Co-Occurring Alcohol and Drug Use and Disorders: Findings From the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC). *Alcohol Research and Health*. 2008;31(2):100-10.

23. O'Malley PM, Johnston LD. Epidemiology of alcohol and other drug use among American college students. *J Stud Alcohol Suppl.* 2002 Mar;(14):23-39.
PubMed PMID: 12022728. Epub 2002/05/23. eng.
Doi: <http://dx.doi.org/10.15288/jsas.2002.s14.23>
24. Al Mousawi A. The Prevalence of Smoking Among Karbala/Iraq University Students in Iraq in 2005. *Tobacco Use Insights.* 2014;7:9-14.
Doi: <http://dx.doi.org/10.4137/TUI.S12238>
25. Mohammadpoorasl A, Fakhari A, Rostami F, Vahidi R. Predicting the initiation of substance abuse in Iranian adolescents. *Addictive Behaviors.* 2007;32(12):3153-9.
Doi: <http://dx.doi.org/10.1016/j.addbeh.2007.07.014>
26. Baba TA, Ganai AM, Qadri SS, Margoob MA, iqbal qm, khan za. An Epidemiological study on Substance Abuse among college students of north India (Kashmir valley). *Int J Med Sci Public Health.* 2013;2(3):540-5.
Doi: <http://dx.doi.org/10.5455/ijmsph.2013.080420131>
27. Santis R, Garmendia ML, Acu-a G, Alvarado ME, Arteaga O. The Alcohol Use Disorders Identification Test (AUDIT) as a screening instrument for adolescents. *Drug and Alcohol Dependence.* 2009;103(3):155-8.
Doi: <http://dx.doi.org/10.1016/j.drugalcdep.2009.01.017>
28. Kawada T, Inagaki H, Kuratomi Y. The alcohol use disorders identification test: reliability study of the Japanese version. *Alcohol.* 2011;45(3):205-7.
Doi: <http://dx.doi.org/10.1016/j.alcohol.2010.08.012>
29. Zaidan Z, Dorvlo A, Viernes N, Al-Suleimani A, Al-Adawi S. Hazardous and Harmful Alcohol Consumption Among Non-Psychotic Psychiatric Clinic Attendees in Oman. *International Journal of Mental Health and Addiction.* 2007;5(1):3-15.
Doi: <http://dx.doi.org/10.1007/s11469-006-9046-4>
30. Almarri TSK, Oei TPS, Amir T. Validation of the Alcohol Use Identification Test in a Prison Sample Living in the Arabian Gulf Region. *Substance Use & Misuse.* 2009;44(14):2001-13.
PubMed PMID: 20001691.
<http://dx.doi.org/10.3109/10826080902848533>

31. Neumann T, Spies C. Use of biomarkers for alcohol use disorders in clinical practice. *Addiction*. 2003;98:81-91.
Doi: <http://dx.doi.org/10.1046/j.1359-6357.2003.00587.x>
32. Reinert DF, Allen JP. The Alcohol Use Disorders Identification Test (AUDIT): A Review of Recent Research. *Alcoholism: Clinical and Experimental Research*. 2002;26(2):272-9.
Doi: <http://dx.doi.org/10.1111/j.1530-0277.2002.tb02534.x>
33. Beenstock M, Rahav G. Testing Gateway Theory: do cigarette prices affect illicit drug use? *Journal of Health Economics*. 2002;21(4):679-98.
Doi: [http://dx.doi.org/10.1016/S0167-6296\(02\)00009-7](http://dx.doi.org/10.1016/S0167-6296(02)00009-7)
34. Degenhardt L, Dierker L, Chiu WT, Medina-Mora ME, Neumark Y, Sampson N, et al. Evaluating the drug use “gateway” theory using cross-national data: Consistency and associations of the order of initiation of drug use among participants in the WHO World Mental Health Surveys. *Drug and Alcohol Dependence*. 2010;108(1-2):84-97.
Doi: <http://dx.doi.org/10.1016/j.drugalcdep.2009.12.001>
35. Levy DE, Biener L, Rigotti NA. The natural history of light smokers: A population-based cohort study. *Nicotine & Tobacco Research*. 2009 Feb;11(2):156-63.
36. Lindsay GB, Rainey J. Psychosocial and Pharmacologic Explanations of Nicotine’s “Gateway Drug” Function. *Journal of School Health*. 1997;67(4):123-6.
Doi: <http://dx.doi.org/10.1111/j.1746-1561.1997.tb03430.x>
37. Torabi MR, Bailey WJ, Majd-Jabbari M. Cigarette smoking as a predictor of alcohol and other drug use by children and adolescents: evidence of the “gateway drug effect”. *The Journal of school health*. 1993;63(7):302-6.
Doi: <http://dx.doi.org/10.1111/j.1746-1561.1993.tb06150.x>
38. Anthony JC, Petronis KR. Early-onset drug use and risk of later drug problems. *Drug and Alcohol Dependence*. 1995;40(1):9-15.
Doi: [http://dx.doi.org/10.1016/0376-8716\(95\)01194-3](http://dx.doi.org/10.1016/0376-8716(95)01194-3)
39. Swadi H. Individual risk factors for adolescent substance use. *Drug and Alcohol Dependence*. 1999;55(3):209-24.
Doi: [http://dx.doi.org/10.1016/S0376-8716\(99\)00017-4](http://dx.doi.org/10.1016/S0376-8716(99)00017-4)