

ORIGINAL INVESTIGATION

The LWDS-10J: Reliability and Validity of the Lebanon Waterpipe Dependence Scale Among University Students in Jordan

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ABSTRACT

Introduction: While the Lebanon Waterpipe Dependence Scale (LWDS-11) has shown promise in assessing dependence on water pipe tobacco smoking (WTS) in Lebanon among adult users, it would be valuable to identify WTS addiction earlier and to explore reliability and validity of these items in other populations.

Methods: In 2010–2012, we conducted a multiyear survey of 5,853 students from 4 Jordanian universities. We measured WTS, sociodemographic data, and the LWDS-11 items. We conducted exploratory factor analysis with half of the sample and confirmed the resulting model using confirmatory factor analysis with the other half. We examined construct validity with regression models assessing associations between the modified scale and 5 constructs conceptually expected to be associated with dependence.

Results: WTS rates were 35% in the past 30 days and 56% ever. Principal-components analysis of LWDS items in the first half of the sample yielded 10 items representing 3 factors labeled physical dependence, relaxation/pleasure, and social aspects. Cronbach's α was .77 for the total scale and .75, .70, and .67 for each individual subscale. Confirmatory factor analysis in a structural equation modeling framework confirmed good fit (root mean squared error of approximation = 0.068 and comparative fit index = 0.937). Dependence according to the resulting scale (LWDS-10J) was strongly associated with each of the 5 expected constructs, whether the dependent variable was treated as categorical or continuous.

Conclusions: The LWDS-11 items exhibited a different factor structure in our sample. However, the modified scale (LWDS-10J) showed promising reliability and construct validity in this population.

INTRODUCTION

Annually, 5–6 million people worldwide die as a result of tobacco use. Cigarette smoking is the most studied form of tobacco use, but other methods are becoming common worldwide, including tobacco smoking using a water pipe (also called a hookah or narghile) (Knishkowsky & Amitai, 2005; Maziak, Ward, Afifi Soweid, & Eissenberg, 2004; Radwan, Mohamed, El-Setouhy, & Israel, 2003). Emerging literature suggests that a single water pipe tobacco smoking (WTS) session involves inhalation of 50–100 times the smoke volume inhaled with a single cigarette. Additionally, WTS contains many of the same toxicants as cigarette smoke, including carcinogenic polycyclic

aromatic hydrocarbons (Sepetdjian, Shihadeh, & Saliba, 2008), volatile aldehydes (Al Rashidi, Shihadeh, & Saliba, 2008), and carbon monoxide (Bacha, Salameh, & Waked, 2007). Compared with cigarette smoke, WTS smoke does not seem to be as concentrated with these toxins, but a single WTS session is still associated with inhalation of the tar of about 38 cigarettes, the carbon monoxide of 12 cigarettes, and the nicotine of about 2–3 cigarettes (Maziak et al., 2009; Neergaard, Singh, Job, & Montgomery, 2007; Shihadeh & Saleh, 2005).

Because of the relatively low relative nicotine yield, as well as propagation of myths in popular media de-emphasizing potential harms and addictiveness (Nakkash & Khalil, 2010; Nakkash, Khalil, & Afifi, 2011; Primack et al., 2012,

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2013), many WTS users worldwide do not believe that it can cause dependence (Aljarrah, Ababneh, & Al-Delaimy, 2009). However, reports from the Eastern Mediterranean Region suggest strong potential for dependence (Asfar, Ward, Eissenberg, & Maziak, 2005; Hammal, Mock, Ward, Eissenberg, & Maziak, 2008; Israel et al., 2003; Salameh, Khayat, Waked, & Dramaix, 2012). Additionally, other data suggest that someone who smokes tobacco from a water pipe once each day has the blood nicotine concentration of someone who smokes 10 cigarettes daily (Shafagoj, Mohammed, & Hadidi, 2002).

Therefore, documenting the addictive potential of WTS has become an important goal in tobacco control. For example, Auf et al. (2012) recently demonstrated that, according to a modified Fagerström Test for Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerström, 1991), WTS-only men (mean age = 47) in Egypt exhibited many of the same features of nicotine dependence attributed to cigarette smokers. Researchers in Lebanon developed a scale specifically intended to measure addiction to WTS. Although their scale utilized items adapted from the FTND, it also assessed psychosocial factors specific to WTS, which could be related to addiction. Those researchers found promising reliability and validity of this instrument, called the Lebanon Waterpipe Dependence Scale (LWDS), among 306 adult WTS users (mean age = 34) (Salameh, Waked, & Aoun, 2008).

However, there are two major gaps in the literature, which the current study intended to fill. First, to our knowledge, reliability and validity of this instrument has not been sufficiently explored outside of Lebanon. Second, it has been generally used in adult populations aged 30–50 (Salameh et al., 2008, 2012). It may also be valuable to explore reliability and validity of this instrument among younger populations who may be less experienced and/or intermittent users. Although early signs of addiction may be difficult to determine in such a group (Moran, Wechsler, & Rigotti, 2004), it would be particularly valuable to public health to identify potential addiction at this stage. Therefore, the primary purpose of this study was to explore the reliability and validity of the LWDS among a large population of university-aged late adolescents and young adults in Jordan.

METHODS

Participants and Procedures

Undergraduate students from two public (Jordan University of Science and Technology, JUST, and Yarmouk University) and two private (Irbid National University and Jerash Private University) universities in Jordan were recruited for this study. Data were collected under the supervision of collaborating faculty members at JUST. To be included in the study, participants had to be at least 18 and enrolled as undergraduate students in one of the four universities.

To recruit as representative a sample as possible, we obtained the number of students enrolled in each university from registration offices and determined corresponding representative sample sizes. We then stratified students in each university by discipline (e.g., medicine, science, and arts) and university. In these universities, students are randomly divided into class sections, and sections with between 10 and 100 students were eligible. From a list of all sections, we used a random number table to select sections to be sampled from each

discipline. To ensure roughly equal numbers of students from each level (first–fourth), selection of sections from the random number table was repeated until requisite equal numbers were attained. Data were collected using this method for each of 3 years, 2010–2012. Students were instructed not to take the survey more than once. A total of 5,941 students were recruited based on this procedure.

The surveys were administered in classrooms in the participating universities in April and May of 2010, 2011, and 2012, during a 5-week period for each year. For each section of students selected, prior permission of instructors was obtained to conduct the survey during class section time. Survey administrators were research personnel (including OFK and KHA) who emphasized that responses would be anonymous and confidential. Participants signed informed consent forms along with the completed surveys. Individuals took 20 min to complete the survey and were paid approximately 2 Euros for their participation. Institutional review boards (IRBs) of JUST and Virginia Commonwealth University approved the study. Based on these IRB approvals, administrative approvals were obtained from other participating institutions.

Measures

The survey instrument was constructed by investigators from both the United States and Jordan during discussions in Irbid, Jordan, in 2008–2009. It was subsequently translated into Arabic and modified based on the results of four focus group discussions with single-gender, representative groups of students in Jordan in 2009–2010. The revised Arabic instrument was pilot tested in Jordan with 50 students, and the survey was administered in Arabic (Khabour et al., 2012).

Many of the measures used in the survey were adapted from previous studies on water pipe use conducted in the United States and in the Eastern Mediterranean Region (Afifi, Yeretzi, Rouhana, Nehlawi, & Mack, 2010; Azab et al., 2010; Dar-Odeh et al., 2010; Mandil et al., 2010; Maziak, Fouad, et al., 2004; Memon et al., 2000; Saade, Warren, Jones, & Mokdad, 2009; Tamim et al., 2003), while others were constructed for the purpose of this study. Items were Likert type and higher scores indicated greater endorsement of the statement, unless otherwise noted.

Water Pipe Tobacco Use

Participants were asked to report having smoked water pipe tobacco, even a puff, in the past 30 days and ever. These are commonly used as salient endpoints (Barnett et al., 2013; Maziak, Ward, et al., 2004; Primack, Fertman, Rice, Adachi-Mejia, & Fine, 2010; Primack, Walsh, Bryce, & Eissenberg, 2009).

Demographics

Individuals reported university attended, age, and sex. Because socioeconomic status has been linked with tobacco use in similar populations, we assessed this construct using paternal education and monthly household income (Afifi et al., 2010; Azab et al., 2010; Dar-Odeh et al., 2010; Mandil et al., 2010; Maziak, Fouad, et al., 2004; Memon et al., 2000; Saade et al., 2009; Tamim et al., 2003; Ward et al., 2006). For monthly household income, we asked participants to select the most appropriate category from three choices: 0–500, 501–900, and 901 or more Jordanian Dinar (JD), where 1 JD is equivalent to

approximately 1.09 Euros. We also assessed urbanity (i.e., living in a city or a village) and living arrangements (i.e., living with parents or with others) because these factors have been associated previously with WTS (Khabour et al., 2012).

Water Pipe Dependence

The LWDS items were used to assess participant dependence on water pipe tobacco use. Only participants who answered “yes” to having ever smoked tobacco from a water pipe were instructed to answer the 11 survey items used to build the scale. All items have been previously published (Salameh et al., 2008). For example, one item asks “How much time after you wake up do you smoke water pipe?” with response choices of 5 min or less (3 points); 6–30 min (2 points); 31–60 min (1 point); and more than 60 min (0 points). Because each of the items was worth 0–3 points, the original total scale yielded a score of 0–33. For our primary analyses, we collapsed these continuous values into tertiles. We also conducted all analyses using a continuous score.

Characteristics Expected to be Associated With Dependence

Prior work in this area has sought to determine construct validity of dependence scales by identifying certain characteristics assumed to be associated with dependence, such as the average number of “heads” or “bowls” used per session (Salameh et al., 2008). Therefore, we selected five variables, which we expected to be associated with dependence. These variables included age of initiation (middle school and earlier, high school, or college and beyond), number of water pipes owned (none, one, or more than one), length of an average smoking session (<30, 30–60, or >60 min), average sessions per week, and the number of average heads per session. Each of the last two variables was measured as a continuous variable. We selected these particular variables because prior work has associated increased risk of tobacco dependence with factors such as earlier onset of use, easy accessibility, and use of higher dosages (Kendler, Myers, Damaj, & Chen, 2013; Kleinjan et al., 2012; Lovato, Watts, & Stead, 2011; O’Loughlin et al., 2003).

Analysis

To ascertain factor structure in this population, we performed exploratory factor analysis on half of the sample and confirmatory factor analysis on the other half. To divide the sample, we created a normally distributed random variable with mean = 0 and $SD = 1$ and split the data above and below the zero value. We used the first dataset for exploratory factor analysis using principal-components analysis. We examined eigenvalues, the scree plot, and proportion of the data explained by each factor in order to determine the ideal number of factors (DeVellis, 2003). We then recondensed principal-components analysis while forcing this number of factors and adjusting the factor weightings using Varimax rotation (Cureton & Mulaik, 1975). We examined the resulting factor loading pattern to characterize the resulting factors conceptually. We computed Cronbach’s α for the total scale and for each subscale.

We then performed confirmatory factor analysis with the second dataset. We used structural equation modeling to examine the fit of the second dataset to the specific model suggested by exploratory factor analysis performed on the first dataset. We included covariance among each pair of factors in our model. We focused on two key fit indices: root mean squared

error of approximation and comparative fit index. We considered good fit to be root mean squared error of approximation < 0.08 and comparative fit index > 0.90 (MacCallum, Browne, & Sugawara, 1996).

To assess convergent construct validity of the scale, we examined bivariable associations between the five candidate items and the dependence scale obtained via exploratory factor analysis and confirmatory factor analysis. For primary analyses, we collapsed the dependence scale into tertiles to reflect low, medium, and high risk of dependence. For the categorical candidate variables (age of initiation, number of water pipes owned, and average session length), we computed associations using chi-square and Cramer’s V statistics to determine magnitude of associations. For each of the two continuous variables (sessions per week and heads per session), we used analysis of variance. In order to examine the robustness of our results, we also performed all analyses using the dependence scale as a continuous variable. For these analyses, we conducted bivariable linear regressions with the square root of the dependence score as the outcome variable and each of the candidate measures as the individual independent variables. The outcome variable was transformed using the square root based on distribution of the data. We computed standardized beta coefficients for these regression analyses to allow comparison of effect sizes.

Finally, as an exploratory aim, we performed multivariable analyses with the transformed dependence scale as the dependent variable and all key sociodemographic factors described in the Measures section above—university, age, sex, paternal education, monthly household income, urbanity, and living arrangement—as the independent variables. Again, we computed standardized beta coefficients for these regression analyses to allow comparison of effect sizes.

Individuals with missing data were not included in analyses; however, this was unlikely to drive results because missing data were between 0.2% and 2.3% for each of the analyses. For all analyses, we defined statistical significance with a two-tailed alpha of .05. Statistical analyses were conducted using Stata 13.0 (StataCorp, College Station, TX, 2013).

RESULTS

Of the 5,941 students selected for participation, we received evaluable data from 5,853 (99%) individuals, all of whom were included in the final sample of the study. Of the participants, 44% were male and 56% were female, and mean age was 21.2 years ($SD = 2.8$). For about one third (31%) of participants, their fathers had completed high school, and for another third (38%) they had completed college. Nearly half of students (45%) reported a monthly household income \leq 500 JD (~547 Euros). Participants were nearly evenly divided between living in a city versus a village (57% vs. 43%), and the vast majority (84%) lived with their parents (Table 1). Use of water pipes to smoke tobacco was 35% (95% $CI = 34\%–36\%$) in the past 30 days and 56% (95% $CI = 55\%–57\%$) ever.

Principal-components analysis with the 11 LWDS items using the first dataset yielded three eigenvalues > 1.0 and a scree plot, which visually suggested a three-factor solution. Because of prior work suggesting four factors (Salameh et al., 2008), we first attempted to force a four-factor solution. However, this solution was not robust, as no items loaded highest on the fourth factor. However, when we forced the three-factor

Table 1. Demographic and Environmental Characteristics of the Sample of Jordanian University Students (2010–2012)

Participant characteristic	N (Column % ^a)
University	
Jordan University of Science and Technology	1,990 (34)
Yarmouk University	2,737 (47)
Irbid National University	507 (9)
Jerash Private University	615 (10)
Age	
18–19	1,336 (23)
20	1,176 (20)
21	1,211 (21)
22	1,019 (17)
23 or more	1,096 (19)
Sex	
Male	2,562 (44)
Female	3,280 (56)
Paternal education	
Did not complete high school	945 (16)
Completed high school	1,829 (31)
Completed college	2,244 (38)
Completed advanced degree (e.g., MA, PhD)	813 (14)
Monthly household income	
0–500 JD ^b	2,646 (45)
501–900 JD	1,616 (28)
901 or more JD	1,557 (27)
Urbanity	
City	3,262 (57)
Village	2,511 (43)
Living arrangement	
With parents	4,880 (84)
Other	940 (16)

Note. ^aValues may not add up to 100 due to rounding.

^b1 Jordanian Dinar (JD) = about 1.09 Euros.

solution suggested by the initial principal-components analysis and performed Varimax rotations to standardize the loadings, six items loaded most strongly on Factor 1 ($\alpha = .75$), two items loaded most strongly on Factor 2 ($\alpha = .70$), and two items loaded most strongly on Factor 3 ($\alpha = .67$). Only one item was eliminated from the scale (“Are you ready not to eat in exchange for a water pipe?”) because it did not uniquely load on any single factor. Conceptually, the six items loading on the first factor were all related to physical dependence (e.g., difficulty stopping WTS, wanting to use WTS even when ill); thus, this factor was labeled “physical dependence.” The two items loading on Factor 2 were related to positive physical sensations associated with WTS including relaxation and pleasure; thus, this factor was labeled “relaxation/pleasure.” Finally, the two items loading on Factor 3 were potentially psychological or social in nature (e.g., smoking to improve morale or to please others); thus, this factor was labeled “psychosocial.” Items and factor loadings are presented in Table 2. Confirmatory factor analysis conducted within the second dataset confirmed good fit of the data (root mean squared error of approximation = 0.068 and comparative fit index = 0.937). We deemed the resulting scale the LWDS-10J in order to distinguish it from the original 11-item scale while still deferring to the LWDS

upon which it was based. The J in LWDS-10J indicates that these data originated in Jordan.

There were significant associations between all WTS use characteristics and risk of dependence according to the LWDS-10J (all $p < .001$), with effect sizes ranging from 0.10 to 0.32. For example, age of initiation was older among low risk participants compared with high risk participants, with 60% initiating in college or later (vs. 45%) and only 10% initiating in middle school or earlier (vs. 19%). The majority (72%) of high risk participants owned at least one water pipe, compared with only 20% of those in the low risk group. On average, high risk participants had 3.7 smoking sessions per week smoking 1.8 heads per session, compared with those in the low risk group who had 1.4 sessions per week smoking 1.1 heads per session (Table 3).

In multivariable analyses (Table 4), the LWDS-10J was associated with being a student at Jerash Private University ($b = 0.067$, $p = .003$) and inversely associated with being female ($b = -0.0160$, $p < .001$) and having parents who completed college or more ($b = -0.089$, $p = .002$).

DISCUSSION

This study demonstrated that over half of a large sample of university students in Jordan had ever smoked tobacco from a water pipe, and more than one third had done so in the past 30 days. Second, it demonstrated that the factor structure of the LWDS among this population was slightly different than in the adult population previously studied (Salameh et al., 2008). Specifically, the data in the current population suggested a 10-item scale with a three-factor structure representing “physical dependence,” “relaxation/pleasure,” and “psychosocial aspects.” Third, as evidenced by strong associations between the LWDS-10J and expected variables, the overall scale seems to have good convergent construct validity in this population.

Overall WTS usage rates were comparable to previously documented prevalence rates in Jordan (Azab et al., 2010; Dar-Odeh et al., 2010; Khabour et al., 2012) and to rates found among university students in neighboring countries (Knishkowsky & Amitai, 2005; Mohammed, Zhang, Newman, & Shell, 2010; Tamim et al., 2003).

In the original validation sample for the LWDS-11, four factors were identified: nicotine dependence, negative reinforcement, psychological craving, and positive reinforcement (Salameh et al., 2008). Much of what we found was similar. For example, all four items in the original “nicotine dependence” factor were appropriately retained in our first factor labeled “physical dependence.” However, two of the three items in the original “psychological craving” factor (“Do you smoke when you are seriously ill?” and “Do you smoke water pipe alone?”) were retained on our physical dependence factor. There is face validity to the fact that, in this population, smoking alone may indicate physical dependence. For example, because tobacco use in college tends to be a highly social experience, those who smoke alone may in particular be physically dependent (Moran et al., 2004).

Our second factor (relaxation/pleasure) retained two items, “You smoke water pipe to relax your nerves” and “You smoke water pipe for pleasure.” In the adult validation sample, the former item was retained in the “negative reinforcement” factor while the latter was retained in the “positive reinforcement” factor. Although the precise reasons for these differences are

Table 2. Factor Structure for Dependence Items Among Jordanian University Students (2010–2012)^a

Item	Factor 1	Factor 2	Factor 3
	Physical dependence	Relaxation/pleasure	Psychosocial
Number of times you could stop water pipe for > 7 days	0.70		
Percent of your income you would spend on water pipe	0.43		
Number of days you could spend without water pipe	0.82		
Number of water pipes smoked per week	0.68		
Smoke water pipe when seriously ill	0.53		
Smoke water pipe alone	0.54		
Smoke water pipe to relax nerves		0.79	
Smoke water pipe for pleasure		0.82	
Smoke water pipe to improve morale			0.84
Smoke to please others (conviviality)			0.81
Cronbach's alpha	.75	.70	.67

Note. ^aFactor loadings were rotated using the Varimax procedure. This exploratory factor analysis was conducted in one half of the sample. The remaining half was reserved for confirmatory factory analysis.

Table 3. Assessment of Construct Validity via Associations Between Water Pipe Use Characteristics and Risk of Dependence Among Jordanian College Students (2010–2012)^a

Water pipe use characteristic	All participants (<i>n</i> = 2,577) %	Risk of dependence according to LWDS-10J ^b				<i>p</i> ^d value	<i>V</i> ^d	Association with LWDS-10J as continuous ^c	
		Low (<i>n</i> = 953) %	Moderate (<i>n</i> = 771) %	High (<i>n</i> = 853) %	<i>b</i> ^e			<i>p</i> value	
Age of initiation					<.001	0.10			
Middle school and earlier	14	10	13	19			REF	REF	
High school	33	31	34	36			-0.106	<.001	
College or later	53	60	53	45			-0.223	<.001	
Number of water pipes owned					<.001	0.32			
None	55	80	55	28			REF	REF	
One	34	18	37	50			0.247	<.001	
More than one	11	2	8	22			0.247	<.001	
Average session length					<.001	0.21			
<30 min	51	68	49	34			REF	REF	
30–60 min	31	20	37	39			0.364	<.001	
>60 min	18	12	14	27			0.404	<.001	
Average sessions per week, <i>M</i> (<i>SD</i>)	2.6 (2.0)	1.4 (1.0)	2.0 (1.5)	3.7 (2.3)	<.001		0.543	<.001	
Average heads per session, <i>M</i> (<i>SD</i>)	1.3 (0.8)	1.1 (0.4)	1.3 (0.7)	1.8 (1.2)	<.001		0.393	<.001	

Note. LWDS = Lebanon Waterpipe Dependence Scale.

^aPercentage values may not add up to 100 due to rounding.

^bLWDS-10J was divided into tertiles using the automated function within Stata 13.0 (Statacorp, College Station, TX, 2013). Scores were scaled to range from 0 to 10. In the low category, mean score was 0.75 (*SD* = 0.38, minimum = 0, maximum = 1.2). In the moderate category, mean score was 1.93 (*SD* = 0.34, minimum = 1.25, maximum = 2.43). In the high category, mean score was 4.28 (*SD* = 1.41, minimum = 2.59, maximum = 9.70).

^cThese analyses involved bivariable regression using the independent variable noted and the dependent variable as the square root of the LWDS-10J. This transformation was necessary because of the distribution of the dependent variable.

^d*p* Values were computed using chi-square analyses for categorical independent variables and analysis of variance for continuous independent variables. Cramer's *V* was used as a measure of effect size for the analyses with categorical variables.

^eBeta coefficients were standardized in order to allow comparison of effect sizes.

unclear, prior research in adolescent populations has demonstrated that they link relaxation and pleasure as they are related to tobacco use (Stanton, Mahalski, McGee, & Silva, 1993).

Our third factor retained two items: "You smoke water pipe to improve your morale" and "You smoke to please others." In our university population, in which psychological and social factors are so strongly intertwined based on developmental

concerns (Erikson, 1968), it makes sense that a single factor may encompass both concerns. For example, "improvement of morale" may seem primarily psychological in nature, but in the university setting this often involves social activity. Similarly, smoking "to please others" may seem primarily social; however, it may also be psychological in that adolescent self-esteem is commonly linked to pleasing others (Erikson, 1968).

Table 4. Multivariable Associations Between Sociodemographic Variables and Risk of Dependence Among Jordanian College Students According to the LWDS-10J (2010–2012)

Sociodemographic variable	<i>b</i> ^a	<i>p</i> value
University		
Jordan University of Science and Technology	REF	REF
Yarmouk University	−0.010	.68
Irbid National University	−0.026	.25
Jerash Private University	0.067	.003
Age		
18–19	REF	REF
20	−0.002	.95
21	0.010	.68
22	−0.006	.82
23 and more	−0.044	.09
Sex		
Male	REF	REF
Female	−0.160	<.001
Paternal education		
Did not complete high school	REF	REF
Completed high school	−0.041	.14
Completed college or more	−0.089	.002
Monthly household income		
0–500 JD ^b	REF	REF
501–900 JD	−0.032	.15
901 or more JD	−0.029	.23
Urbanity		
City	REF	REF
Village	0.028	.16
Living arrangement		
With parents	REF	REF
Other	−0.025	.24

Note. LWDS = Lebanon Waterpipe Dependence Scale.

^aBeta coefficients were standardized in order to allow comparison of effect sizes.

^b1 Jordanian Dinar (JD) = about 1.09 Euros.

The item “Are you ready not to eat in exchange for a water pipe?” was not retained in any subscale because it did not uniquely load on any of the factors. Our population may have had varying interpretations of this item. Indeed, the loading of this item on its primary factor was also relatively weak in the original validation study (0.44), indicating that this item may have had varying possible meanings for different individuals in that population as well (Salameh et al., 2008). Although the item related to the percent of income one would spend on WTS met our predetermined criteria for inclusion in the physical dependence factor, its loading on this factor was relatively low (0.43). This may be because the percent of income one is willing to spend on an activity is related to many elements other than dependence, such as personality characteristics.

We found that all five candidate constructs were significantly associated with the dependence scale, whether it was represented in tertiles or as a continuous variable, suggesting that these results were robust. Second, this suggests that the scale may be useful in populations such as these not only to distinguish between general categories of dependence but also to determine the degree of dependence within categories. This extends the potential usefulness of this scale, which previously

has been used primarily to distinguish between major categories of dependence. Similarly, it is noteworthy that the scale distinguished levels of dependence even in a population with relatively infrequent use (about 1–4 WTS sessions per week). It would be particularly useful to be able to screen for dependence in intermittent users (Moran et al., 2004).

It is worth noting that there were some differences in the strength of associations between the LWDS-10J and the five expected constructs. For example, association between the dependence scale and age of initiation was weaker compared with the other variables. It is established that, with regard to alcohol and cigarette smoking, earlier age of onset is associated with increased risk of dependence. It would be useful for future longitudinal studies to examine in particular the prospective risk of dependence based on different age of initiation. It would also be useful for future studies to examine other constructs, such as use of multiple different types of tobacco, which are potentially linked with dependence.

Limitations

Despite careful attention to random selection of our sample within each of the four target universities, its external generalizability is limited because our study did not involve all universities in Jordan. Similarly, although we attempted to make the sample generally representative, the study was not designed to be strictly representative. Because our sample was disproportionately female, and because males are more likely to smoke tobacco, the actual rate of use of these substances in Jordanian universities as a whole is likely to be higher than we report here. Another limitation is that, because the survey was anonymous and spanned 3 years, we were not able to ensure that an individual did not take it twice. However, we do not expect that this changed results, both because we asked students during the consent process not to take the survey if they had taken it previously, and, because the incentive was relatively low (2 Euros), they would have had little incentive to take it more than once. Finally, it is a limitation that our study was conducted at one point in time and relied upon retrospective report. For example, our assessment of age of initiation of WTS use was based on recall. While we expect that these responses were generally accurate, especially because we categorized this information broadly (e.g., high school vs. college), a more rigorous prospective design may be valuable for future work.

CONCLUSIONS

In conclusion, this study finds WTS rates are very high among Jordanian university students. It also suggests that, while the LWDS exhibits a different factor structure in this population than it did among an adult population in Lebanon, the scale still exhibits promising reliability and construct validity in this population.

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DECLARATION OF INTERESTS

None declared.

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