Published in final edited form as:

Am J Addict. 2017 October ; 26(7): 689–696. doi:10.1111/ajad.12583.

Testing the Nicotine Dependence Measure mFTQ for Adolescent Smokers: A Multinational Investigation

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Abstract

Background and Objectives—As a measure of nicotine dependence among adolescent smokers, the modified Fagerström Tolerance Questionnaire (mFTQ; 7 items), has been successfully used in the United States (USA). Nonetheless, the validity and reliability of mFTQ at the international level is still needed. The current study is the first to test the validity and reliability of mFTQ in four countries: Thailand, Spain, the USA, and Russia.

Methods—In a cross-sectional survey, mFTQ, risk factors of nicotine dependence, and sociodemographic characteristics were assessed. Risk factors included age of first cigarette,

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Declaration of Interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

frequency of alcohol use, frequency of marijuana use, and number of cigarettes smoked yesterday. Salivary cotinine was also obtained in Thailand and Spain.

Results—For all four countries, mFTQ exhibited a single factor structure, as supported by previous work in the USA. For all studied countries except Thailand, mFTQ presented acceptable internal reliability. Overall, risk factors of nicotine dependence have predicted mFTQ scores across countries. Frequency of alcohol use in the USA and frequency of marijuana use in Thailand and Spain were not associated with mFTQ scores.

Discussion and Conclusions—mFTQ is a single-factor measure of nicotine dependence that shows acceptable internal consistency and validity across countries. Further work can advance the scale and tailor it to different cultures.

Scientific Significance—mFTQ can be a clinically practical international measure of nicotine dependence. This study provides initial support for the utility of the mFTQ among Thai, Spanish, American, and Russian adolescents. Further research is needed to test and advance mFTQ across cultures.

Introduction

Nicotine dependence is a complex mechanism involving multiple domains including physiological, behavioral, and psychological processes.[1] There is converging evidence that nicotine use among adolescents leads to executive cognitive function deficits that may not resolve.[2] Approximately 80% of adult daily tobacco smokers begin using before the age of 18 years and become addicted during adolescence.[2]

Of the many available instruments to measure adolescent nicotine dependence (e.g., the Cigarette Dependence Scale[3] and the Hooked On Nicotine Checklist[4]), the modified Fagerström Tolerance Questionnaire (mFTQ) has been frequently used.[5,6] mFTQ was adapted from the adult version of FTQ,[7,8] in order to be used among adolescents. mFTQ involves seven-items tapping on frequency of smoking behavior, inhalation, and difficulty to refrain from smoking at certain places and at certain times. The measure was modified to exclude a complex nicotine-scoring item, utilizes Likert-type responses for all items but one (smoking more during first two hours of day, binary coded), and was reworded slightly to be readily understandable among adolescents.[5] With studies conducted in the United States, mFTQ demonstrated satisfactory internal consistency,[6] and acceptable test-retest reliability over a two-months period.[9] Also, validation results demonstrated significant association between mFTQ and nicotine biomarkers (e.g., salivary cotinine concentration).[5] As a result, the scale has been used to study nicotine dependence among American adolescents in different contexts.[10-11]

While the scale was developed in the United States, researchers have begun to apply mFTQ in other countries such as Switzerland, Spain, and China.[12-14] Despite the success of this measure with American adolescents, there has been no investigation of the validity and reliability of mFTQ at the international level, and mFTQ has not yet been compared across countries. An international validation for mFTQ is needed to better understand possible differences or similarities among adolescent smokers across countries and ultimately

improve measurement. It is hence important to test mFTQ in other cultures where predictors of nicotine dependence may differ from the United States.[15]

For validity testing, it is important to consider how certain known predictors of nicotine dependence correlate with mFTQ. First, nicotine biomarkers such as salivary cotinine and expired carbon monoxide levels have shown a strong relationship with nicotine dependence and have been found to correlate with mFTQ in the United States.[5,16-18] Second, smoking history such as age of smoking initiation is one predictor of nicotine dependence. Early studies on nicotine dependence have confirmed that while controlling for current age, a younger age of smoking initiation (smoking the first cigarette) is associated with heavier daily consumption, longer smoking duration, and nicotine dependence.[19-22] Third, use of other drugs has been found to be a risk factor of nicotine dependence. Research shows common genetic vulnerability for nicotine, marijuana, and alcohol dependence,[23] and associations are found between marijuana or alcohol use and nicotine dependence among adolescents.[24] Finally, previous research has shown an association between extensiveness of smoking (measured by the number of cigarettes smoked yesterday) and nicotine dependence.[25] Previous research stemming from different countries supports that mFTQ is associated with different nicotine dependence predictors.[12-14] The testing of such relationships has allowed researchers to confirm the validity of nicotine dependence measures.[26]

In the current study, we tested the validity and reliability of mFTQ for measuring nicotine dependence in adolescent smokers, through an international pilot study from four countries: Thailand, Spain, the United States of America (USA), and Russia. In particular, we tested the following hypotheses: mFTQ maintains a single dimension structure in different countries, mFTQ shows acceptable internal reliability across countries, and mFTQ is associated with different nicotine dependence predictors, regardless of the targeted country.

Methods

Procedure and Recruitment

Completion and testing of mFTQ was conducted as a result of a multi-site, international evaluation of a tobacco use cessation and prevention program for adolescents, called Project EX.[27-29] Among several countries participating in Project EX, four main countries are considered for validity and reliability testing: Thailand, Spain, the United States of America (USA), and Russia.[29] These four countries were included in this study because they all were involved in the international translation of Project EX, implemented the school-based clinic version of Project EX (all were smokers at baseline), and involved sample sizes greater than 100. A human subjects committee approved the research protocol in each country. Adolescents were eligible for mFTQ-testing study if they were of ages 12 through 19 years and have smoked at least one cigarette in the last 30 days.

For each country, the survey measures and the intervention program were translated to the language of the country, by country-specific, certified bilingual translators. In all four countries, a convenience sample was recruited, using varying methods. In Thailand, recruitment occurred in four schools in the Bangkok and Nakhon Pathom areas. Recruitment was conducted by teachers from each Thai school. In Spain, participants were recruited from

six schools within the province of Alicante, through class announcements, print advertisements, and handouts. An email address was provided to interested adolescents to join the study. In the USA, adolescents from twelve high schools were approached in southern California. Recruitment involved flyers, verbal classroom announcements, word of mouth, and school staff referral. Finally, in Russia, recruitment occurred at five summer recreational camps in the Bashkortostan Republic. Camp counselors announced the program as an indoor activity in which only smokers can participate.[29]

Measures

All survey measures were administered with pen and paper. Adolescents completed the survey individually, privately, and without researchers' intervention. Nicotine dependence was assessed using mFTQ,[6] a seven-item scale that asks participants to report on nicotine dependence-related indicators.[5] mFTQ items and response options are presented in Table 1. In addition to demographic characteristics (age and gender), the following four predictors of nicotine dependence were considered in the current study as validation measures:

Salivary cotinine level—Level of nicotine exposure measured through salivary cotinine has been deemed as an appropriate biochemical method for the validation of smoking behavior and nicotine dependence.[16,17] Due to budgetary concerns and restrictions placed on type of data collection by the Human Subjects Committees in some countries, salivary cotinine levels were obtained among adolescents only in Thailand and Spain (measured in ng/mL).

Age of smoking initiation—Participants from Spain and the USA were asked: “What was your age when you smoked your first cigarette?”.[30] Each collaborating country collected data on a different number of predictors of nicotine dependence. In particular, “age of smoking onset” was not measured by our collaborators in Russia and Thailand.

Frequency of alcohol use and marijuana use—Frequencies were measured using open-ended questions: “How many times have you used alcohol in the last month?” (Asked in all countries except for Spain) and “How many times have you used marijuana in the last month?” (Asked in all four countries).[31] Spain did not measure alcohol use due to research suggesting that this age group exhibits low frequency of alcohol use in Spain.

Number of cigarettes smoked yesterday—In order to test for recall bias during validation, an association is tested between number of cigarettes smoked yesterday (the day before survey taking) and mFTQ scores. Participants from all four countries were asked: “How many cigarettes did you smoke yesterday?”.[25]

Statistical Analysis

All analyses were conducted using STATA Version 14. Each country's sample was represented in a separate dataset and the datasets were analyzed separately. Each item of mFTQ was scored using the original scoring, without modification:[6] scores from 1 to 4 for the first six items and a score from 1 to 2 for the seventh item (Table 1). All items were reverse-coded to indicate higher nicotine dependence for higher scores. The seventh item

(i.e., morning smoking) has been regarded by previous research as a robust predictor of nicotine dependence.[32] For this reason, to obtain a final score, the average score of the first 6 items was multiplied by the seventh dichotomous item on morning smoking. Unlike previous mFTQ scoring,[5] the current scoring weighs heavier on the morning smoking item and allows for the formation of a larger distribution in the scores, leading mFTQ scores to range from 1 to 8.

In order to determine the factor structure of the scale for each country, a polychoric correlation matrix from the item-responses was obtained and factor analyzed using exploratory factor analysis. Items that had factor loadings above 0.30 and had cross-loadings equal to or below 0.10 on any other factor were considered acceptable.[33]

In order to determine internal reliability, Cronbach's alphas for mFTQ were calculated for each country. In addition, seven Cronbach's alphas were computed when each of the seven items of mFTQ was removed from the scale. Item-rest correlations (correlations between each item and the rest of the scale) allowed to confirm the internal consistency of the scale. Previous studies on FTQ, mFTQ, and the Fagerstrom Test for Nicotine Dependence (FTND; a revised version of the FTQ) report Cronbach's alphas between 0.58 and 0.75.[6,34,35] As a result, in our current testing, a Cronbach's alpha in this range or above will be considered acceptable.

Validity testing of mFTQ for each country was conducted on the basis of the associations between mFTQ scores and the following five predictors where available: salivary cotinine level, age of smoking initiation, frequency of alcohol use, frequency of marijuana use, and number of cigarettes smoked yesterday. In each country and for each measured predictor, multiple regression analysis was conducted to test if the predictor correlates with mFTQ. Regression models controlled for age and gender, in order to support previous research reporting age and gender-related differences in nicotine dependence.[20,35] The Huber/White sandwich estimator was used to correct all variance estimates for heteroskedasticity.

Results

Study Flow and Participant Characteristics

Table 2 presents respondents' socio-demographic characteristics for each country. In Thailand, 210 adolescents took part in the study, of which 185 were smokers (M_{age}=15.12, SD_{age}=1.44, 97% male). All Thai smokers except one completed mFTQ. In Spain, 1,544 adolescents participated in the study, of which 235 were smokers (M_{age}=16.01, SD_{age}=1.32, 50% male). Approximately 79% (n=185) of Spanish smokers completed mFTQ. There was no significant difference between those who did and those who did not complete mFTQ with respect to age, F(1, 232)<0.001, p=0.95, or gender, χ^2= 0.11, p=0.75. In the USA, 1,097 participated in the study, of which 410 were smokers (M_{age}=16.68, SD_{age}=0.99, 65% male). Approximately 82% (n=337) of American smokers completed mFTQ. There was a significant difference between those who did and those who did not complete mFTQ with respect to age, F(1, 406)=4.58, p<0.05, but not gender, χ^2=2.10, p=0.15. Finally, in Russia, 164 adolescents took part in the study, of which 163 were smokers (M_{age}=16.84, SD_{age}=1.64, 52% male). All Russian smokers completed mFTQ. There was a significant

difference between countries with respect to mFTQ scores, F(3, 877)=8.76, $p<0.001$, age, F(1, 899)=74.90, $p<0.001$, gender $\chi^2= 116.80$, $p<0.001$, salivary cotinine levels, F(1, 412)=12.61, $p<0.001$, average number of cigarettes per day, F(3, 961)=3.50, $p<0.05$, frequency of alcohol use F(2, 748)=16.80, $p<0.001$, and frequency of marijuana use F(3, 964)=51.27, $p<0.001$. The difference in the ratio of all participants to smokers and the differences in participant characteristics between countries is due to the different recruitment methods and recruitment locations.

Factor Structure and Internal Reliability

The factor loading pattern of mFTQ items for each country is illustrated in Table 3. For all four countries, mFTQ exhibited a single factor structure, as supported by the original validation study.[6] Among Thai smokers, item 4 (“hate-to-give-up cigarette”) loaded lowest at 0.222, and item 7 (“morning smoking”) loaded highest at 0.636. The single-factor structure of the Thai sample explained 85.76% of the variance. Among Spanish smokers, item 4 still loaded lowest, but at an acceptable loading of 0.405. Item 1 (“Cigarettes/day”) loaded highest at 0.670. The single-factor structure of the Spanish sample explained 94.22% of the variance. Among American smokers, item 7 (“Morning smoking”) loaded lowest, but at an acceptable loading of 0.362. Item 3 (“Time to first cigarette”) loaded highest at 0.858. The single-factor structure of the American sample explained 99.21% of the variance. Finally, among Russian smokers, items 1 and 2 (“Inhale?”) loaded lowest at 0.337 and 0.330, respectively. Item 3 (“Time to first cigarette”) loaded highest at 0.754. The single-factor structure of the Russian sample explained 98.08% of the variance.

Internal Consistency

The Cronbach's alpha for mFTQ ranged between 0.562 and 0.748 (Table 3). However, for each country, Cronbach's alpha can be improved when dropping certain items from the scale. For Thailand, dropping item 4 can increase Cronbach's alpha from 0.562 to 0.634, bringing alpha to an acceptable value. For Spain, dropping item 4 can only increase Cronbach's alpha from 0.673 to 0.692. For the USA, Cronbach's alpha is close to the one obtained in the original study of mFTQ ($\alpha=0.75$).[6] Dropping item 7 can only increase Cronbach's alpha from 0.748 to 0.759. For Russia, dropping item 2 can only increase Cronbach's alpha from 0.703 to 0.708.

Validation of mFTQ

For each country, a series of multiple regression models were conducted to validate the scale, where available, with salivary cotinine levels, age of smoking initiation, frequency of alcohol use, frequency of marijuana use, and number of cigarettes smoked yesterday predicting mFTQ (Table 4). Overall, all considered risk factors of nicotine dependence have predicted mFTQ scores. The following are some results to be noted, controlling for age and gender.

Salivary cotinine level was significantly related to mFTQ for both Thailand and Spain. Age of smoking initiation was found to be marginally associated with mFTQ for Spain, but significantly associated with mFTQ for the USA. Frequency of alcohol use in the last month was significantly related to mFTQ for Thailand and Russia. There was no significant

association between frequency of alcohol use and mFTQ for the American population. Frequency of marijuana use in the last month was significantly related to mFTQ for the USA and Russia. There was no significant relationship between frequency of marijuana use and mFTQ for Thailand or Spain. Finally, number of cigarettes smoked yesterday was significantly related to mFTQ for all countries (Table 4).

Discussion

There are some options available for measuring nicotine dependence among adolescents, and most of them have been developed with American adolescents. While such measures have received preliminary support, there is ample research to be conducted before a nicotine dependence measure can be applied among youths from outside the USA. The current study is the first to internationally test mFTQ for reliability and validity. Overall, our findings suggest that mFTQ presents acceptable internal reliability and validity in measuring adolescent nicotine dependence across countries, which adds credence to the value of mFTQ: (1) mFTQ maintains a single dimension structure in all four countries, (2) the scale shows overall acceptable internal reliability across countries, similar to previous testing in the USA,[3] and (3) mFTQ score is associated with several nicotine dependence predictors, depending on the country of study (i.e., if the variable was measured for the specific country).

As supported by research with American adolescents,[5] the current testing showed mFTQ to be unidimensional across all four studied countries. While mFTQ measure presents different aspects of adolescent nicotine addiction, it still holds a single-factor structure. Except for item 4 (hate-to-give-up cigarette) with Thai adolescents, all items showed acceptable factor loadings, and the item response distributions were similar across countries. Future work can examine why item 4 in Thailand did not show an acceptable factor loading. By inspecting internal reliability, Cronbach's alpha values remained acceptable across countries.

Despite the stable single-factor structure, some differences between the countries must be noted. Factor loadings were relatively high for Spanish and American adolescents, with an average factor loading of 0.64. However, mFTQ presented highest internal reliability among American adolescents (Crobach's alpha=0.75). Also, for each country, mFTQ appeared to have a different set of unique items that operationalize nicotine dependence. Internal reliability testing indicated that for each country, several items appeared to be unique (i.e., item-rest correlation below 0.50): Item 4 for Thailand and Spain, items 1 (cigarettes/day), 2 (frequency of inhalation), and 7 (morning smoking) for the USA, and items 1, 2, 6 (smoke if ill), and 7 for Russia. These results indicate that different indicators of nicotine dependence can be unique for different countries.

Validity-testing also presented some differences across countries. Each risk factor of nicotine dependence has shown differences in predicting mFTQ. For instance, while frequency of marijuana use was associated with mFTQ for the USA and Russia, it was not predictive of mFTQ for Thailand or Spain. This result calls for further research on cultural differences with respect to drug addictions. Nonetheless, overall, all predictors of nicotine dependence (where available) have predicted mFTQ for some or all countries. mFTQ is slightly

measuring different constructs in each country. Indeed, this can help explain the variability between countries, found in the associations between mFTQ and the validity measures. Future work may conduct between-country comparisons of mFTQ scores by first assessing differential item functioning.

Our results show that mFTQ items are naturally unique because each presents a different indicator of nicotine dependence: smoking frequency, time of day of smoking, inhalation frequency, and ability to refrain from smoking. In the future, we plan to investigate further the nature of each indicator as a unique dimension of nicotine dependence. Still, in its current version and across countries, mFTQ has shown a stable factor structure and an acceptable internal reliability.

Some limitations and their implications for future research must be noted. Despite the findings, it may be possible that mFTQ is measuring different dimensions of dependence in each country. The psychometric properties of each item may differ between countries. Such differential effect in item functioning can explain the variability between countries in associations during validity-testing. Future work may need to further assess differential item functioning. Also, we refrained from statistically comparing the countries to each other through a single sample. This is mainly because the countries did not match in age (other than selecting high school-age youth who were smokers), gender, smoking behavior, or distribution in nicotine dependence scores for mFTQ. Considering the large differences in participant demographic characteristics and behaviors, as well as the different methods of recruitment from each country, it becomes methodologically unsound to compare the country samples to each other. Future research may consider matching participants from different countries in order to conduct inter-cultural comparisons with respect to mFTQ scores. By further studying mFTQ across countries, it may become possible to develop an international version of the measure. Samples from each country are not necessarily representative of the country's population of smokers. Instead, they are representative of the region of recruitment. Another limitation is that there are other measures (e.g., the Cigarette Dependence Scale and the Hooked on Nicotine Checklist) there were not included in the study. Comparison of the mFTQ with these other measures would be a valuable future research topic. Also, we did not include psychosocial measures or mental health variables, as these were not measured across countries. Still, the current study is only exploratory, and future work may consider a more representative sample for each country in order to conduct a global testing of the measure and compare it to other measures. Finally, this study was cross-sectional in design, and thus prospective relationships between mFTQ and main outcomes of interest (e.g., cessation) cannot be established. The current paper is a first step to internationally test the validity and reliability of mFTQ. Longitudinal designs examining the impact of mFTQ over time are needed to confirm the predictive validity of the measure for nicotine and tobacco use outcomes.

Scientific Significance

With an internationally validated scale, scientists can develop programs for the reduction of nicotine dependence that can be implemented and evaluated globally. Through multi-site randomized controlled trials, the measurement of nicotine dependence becomes reliable and

valid. mFTQ was initially developed to be a short measure of nicotine dependence that can be readily applied in a clinical setting. Health care professionals working with pediatric patients can use mFTQ to detect meaningful addiction levels among children and adolescents who use tobacco and ultimately take necessary steps based on dependence levels. Notably, the relative brevity of mFTQ is an obvious plus as most clinicians, regardless of the country they are practicing medicine, appear to be unlikely to use long scales burdensome to their patients and difficult to interpret. Following additional multi-cultural research, mFTQ can be applied in clinical settings from different countries, including Thailand, the USA, Russia, and Spain. With mFTQ, health care professionals do not only learn about the extent of addiction, but they can also identify the source of dependence that is unique to the adolescent patient (e.g., inhalation, early smoking, and inability to refrain). With such information on hand, it becomes possible to take patient-centered actions for treatment.

Acknowledgments

Funding for this study was provided in part by grants from U.S.-NCI [P150 CA84735-01], NIDA [DA020138, K12-DA000167],TRDRP [11RT-0209]; China-Wuhan Public Health Bureau and CDC; India-Public Health Foundation of India [PHFI]; Israel and partners-USAID-MERC [M27-081]; Spain-Spanish Department of Economy and Competitiveness [PSI2011-26819]; Russia-Bashkortostan State Medical University [BSMU]; Thailand-Faculty of Public Health, Mahidol University, Tobacco Control Research and Knowledge Management Center.

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Table 1
Items and Distribution by Country for mFTQ

Item scores and total scores	Thailand	Spain	USA	Russia
	n (%)			
mFTQ scores				
1 - <3	116 (63.04)	161 (81.73)	249 (74.18)	120 (73.62)
3 - <5	28 (15.22)	22 (11.17)	59 (17.51)	15 (9.20)
5 - <7	39 (21.19)	14 (7.10)	24 (7.12)	22 (13.49)
7 - ≤8	1 (0.55)	0 (0)	4 (1.19)	6 (3.69)
How many cigarettes a day do you smoke?				
1 Over 26 cigarettes a day	1 (0.54)	0 (0)	8 (2.45)	10 (6.13)
2 About 16–25 cigarettes a day	7 (3.78)	8 (3.67)	25 (7.65)	20 (12.27)
3 About 1–15 cigarettes a day	133 (71.89)	142 (72.08)	233 (71.25)	116 (71.17)
4 Less than 1 a day	44 (23.78)	35 (17.77)	61 (18.65)	17 (10.43)
Do you inhale?				
1 Always	52 (28.11)	157 (79.70)	201 (60.18)	43 (26.54)
2 Quite often	24 (12.97)	25 (12.69)	67 (20.06)	72 (44.44)
3 Seldom	98 (53.51)	12 (6.09)	44 (13.17)	29 (17.90)
4 Never	10 (5.41)	3 (1.52)	22 (6.59)	18 (11.11)
How soon after you wake up do you smoke your first cigarettes?				
1 Within the first 30 minutes	29 (16.20)	38 (22.22)	72 (23.00)	18 (11.39)
2 More than 30 minutes after waking but before noon	63 (35.20)	37 (21.64)	65 (20.77)	47 (29.75)
3 In the afternoon	52 (29.05)	76 (44.44)	98 (31.31)	54 (34.18)
4 In the evening	35 (19.55)	20 (11.70)	78 (24.92)	39 (24.68)
Which cigarette would you hate to give up?				
1 First cigarette in the morning	73 (42.44)	85 (46.96)	82 (26.62)	29 (18.13)
2 Any other cigarette before noon	31 (18.02)	44 (24.31)	17 (5.52)	45 (28.13)
3 Any other cigarette in the afternoon	36 (20.93)	18 (9.94)	79 (25.65)	30 (18.75)
4 Any other cigarette in the evening	32 (18.60)	34 (18.78)	130 (42.21)	56 (35.00)
Do you find it difficult to refrain from smoking in places where it is forbidden (buses library, movies etc.)?				
1 Yes, very difficult	9 (4.89)	11 (5.67)	32 (9.70)	25 (15.34)
2 Yes, somewhat difficult	49 (26.63)	20 (10.31)	35 (10.61)	42 (25.77)
3 No, not usually difficult	63 (34.24)	48 (24.74)	62 (18.79)	32 (19.63)
4 No, not at all difficult	63 (34.24)	115 (59.28)	201 (60.91)	64 (39.26)
Do you smoke if you are so ill that you are in bed most of the day?				
1 Yes, always	3 (1.63)	7 (3.63)	18 (5.37)	22 (13.58)
2 Yes, quite often	10 (5.43)	14 (7.25)	36 (10.75)	35 (21.60)
3 No, not usually	101 (54.89)	50 (25.91)	93 (27.76)	58 (35.80)
4 No, never	70 (38.04)	122 (63.21)	188 (56.12)	47 (29.01)

Item scores and total scores	Thailand	Spain	USA	Russia
	n (%)			
F7: Do you smoke more in the first 2 hours than during the rest of the day?				
1 Yes	62 (33.70)	19 (9.64)	43 (12.76)	34 (20.86)
2 No	122 (66.30)	178 (90.36)	294 (87.24)	129 (79.14)

Note. For score calculation, all items are reverse coded; the total score for mFTQ is calculated as the mean score of items 1 through 6, multiplied by the score for item 7. Missing values are not included in this table.

Table 2

Participant Characteristics

Characteristics	Thailand	Spain	USA	Russia
mFTQ score	3.08 (1.52)	2.61 (0.98)	2.52 (1.25)	2.92 (1.59)
Age	15.12 (1.44)	16.01 (1.32)	16.68 (0.99)	16.84 (1.64)
Gender, *n* (%) males	179 (96.76)	118 (50.21)	266 (64.88)	85 (52.15)
Cotinine level (ng/mL)	2.40 (1.47)	2.39 (3.50)	-	-
Average number of cigarettes per day	6.34 (10.98)	3.95 (4.70)	6.14 (11.81)	6.54 (4.32)
Age of smoking initiation	-	13.17 (2.03)	12.92 (2.50)	-
Frequency of alcohol use in past month	13.22 (28.40)	-	11.88 (19.82)	1.99 (3.77)
Frequency of marijuana use in past month	1.52 (10.16)	6.84 (18.07)	21.58 (32.88)	0.26 (1.42)

Note. Except for gender, all other variables are presented with mean and standard deviation, M (SD).

Table 3
Factor Analysis and Internal Consistency/Reliability of mFTQ by Country

Factor analysis				
Items	**Thailand**	**Spain**	**USA**	**Russia**
	Factor loadings			
1. Cigarettes/day	**0.579**	**0.670**	**0.611**	**0.337**
2. Inhale?	**0.414**	**0.577**	**0.559**	**0.330**
3. Time to 1st cigarette	**0.620**	**0.819**	**0.858**	**0.754**
4. Hate-to-give-up cigarette	0.222	**0.405**	**0.672**	**0.672**
5. Forbidden cigarettes	**0.583**	**0.635**	**0.679**	**0.678**
6. Smoke if ill	**0.463**	**0.762**	**0.721**	**0.642**
7. Morning smoking	**0.636**	**0.628**	**0.362**	**0.709**
Internal Consistency				
Items	**Thailand**	**Spain**	**USA**	**Russia**
	α (r)†			
1. Cigarettes/day	0.504 (0.445)	0.648 (0.035)	0.722 (0.287)	0.704 (0.249)
2. Inhale?	0.553 (0.237)	0.663 (0.192)	0.751 (0.358)	0.708 (0.261)
3. Time to 1st cigarette	0.441 (0.471)	0.574 (0.547)	0.651 (0.698)	0.638 (0.517)
4. Hate-to-give-up cigarette	0.634 (0.071)	0.692 (0.287)	0.706 (0.528)	0.644 (0.506)
5. Forbidden cigarettes	0.485 (0.379)	0.619 (0.399)	0.709 (0.498)	0.627 (0.550)
6. Smoke if ill	0.525 (0.315)	0.584 (0.537)	0.695 (0.558)	0.657 (0.451)
7. Morning smoking	0.509 (0.412)	0.667 (0.295)	0.759 (0.227)	0.685 (0.443)
Scale Cronbach's alpha††	0.562	0.673	0.748	0.703

Note.

†Presents Cronbach's alpha of scale if the item is dropped, followed by the item-rest correlation in parentheses.

††Presents Cronbach's alpha of the full scale. Factor loadings above 0.30 are presented in bold.

Table 4
Indicators of Nicotine Dependence by Country Predicting mFTQ Scores

Predictors	Thailand	Spain	USA	Russia
Salivary Cotinine (ng/mL)	0.33***	0.40***	-	-
Age of smoking initiation	-	-0.16†	-0.18***	-
Frequency of alcohol use last month	0.21*	-	0.05	0.50**
Frequency of marijuana use last month	0.06	0.06	0.16**	0.26***
Number of cigarettes smoked yesterday	0.42***	0.50***	0.22**	0.49***

Note. Numbers indicate standardized β values from multiple regression models, controlling for age and gender.

*** $p<0.001$;

** $p<0.01$;

* $p<0.05$;

† $p<0.1$