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Journal of Addiction Medicine and Therapy

Research Article

Development and Evaluation of a New Self-Rating Test to Assess the Psychological Dependence on Smoking (TAPDS)

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Submitted: 07 October 2015

Accepted: 18 November 2015

Published: 20 November 2015

ISSN: 2333-665X

Keywords

- Smoking
- Physical and psychological dependences
- Nicotine dependence
- Diagnosis
- Self-rating test
- Soking cessation

Abstract

The interactions among the psychosocial, sensory, and pharmacologic reinforcing mechanisms of nicotine are complex, and not easy to measure. The approach that has dominated the field of tobacco dependence assessment is based on models of physical dependence.

In Mexico the only scale applied is the Fagerström Test for Nicotine Dependence (FTND); therefore there is a need to have a better knowledge of Latin smokers whose psychological motivations have not been properly studied yet.

We developed an initial 30 items self-rating questionnaire based on semantic nets, analysis of "goodbye letters" and smokers interviews with a Likert scale that was given to 200 smokers not enrolled in any cessation treatment, together with the FTND. The collected data was statistically analyzed by using an Exploratory Factorial Analysis (EFA), a Principal Component Analysis (PCA) with the Bartlett's sphericity Test and the Kaiser-Mayer-Olkin Test (KMO) which allowed us to extract 5 items with a factorial charge less than 0.35. The Internal reliability of the resultant 25 items questionnaire was assessed with Cronbach's alpha, obtaining a value of α=0.847. The clusters obtained in the questionnaire were: 1) emotional modulator, 2) personality-image, 3) indifference, and 4) social acceptance. A low correlation was found with the FTND (r =0.5). A shorter 8 items version was applied to other 100 smokers and compared with the long (25 items) one, the correlation obtained was r=0.94 ($p<0.001$).

The Test to Assess the Psychological Dependence on Tobacco Smoking (TAPDS) has potential as a diagnostic tool for individualizing behavioral intervention in treating tobacco smoking.

ABBREVIATIONS

AUTOS: Autonomy over Tobacco Scale; CDS: Cigarette Dependence Scale; CR: Cognitive Restructuring; EFA: Exploratory Factorial Analysis; FTND: Fagerström Test for Nicotine Dependence; FTQ: Fagerström Tolerance Questionnaire; GN-SBQ: Glover-Nilsson Smoking Behavioral Questionnaire; HONC: Hooked on Nicotine Checklist; HSI: Heaviness of Smoking Index; KMO: Kaiser-Mayer-Olkin Test; NDSS: Nicotine Dependence Syndrome Scale; PCA: Principal Component Analysis; TAPDS: Test to Assess the Psychological Dependence on Tobacco Smoking; TCC: Tobacco Cessation Clinic; TDS: Tobacco Dependence Screener; TTFC: Time to Fist Cigarette; WISDM: Wisconsin Inventory of Smoking Dependence; DANDY: Development and Assessment of Nicotine Dependence in Youth Study; DSM: Diagnostic and Statistical Manual of Mental Disorders; ICD: International Classification of Diseases; M-NRQ: The Michigan Nicotine Reinforcement Questionnaire; S^3: The Social Smoking Situations

INTRODUCTION

At present, over 1,300 million people in the world are current smokers. Within 20 years, tobacco dependence could become the world's single largest cause of premature death. The global tobacco epidemic kills nearly 6 million people each year, of which more than 600 000 are non-smokers dying from breathing second-hand smoke [1,2]. Unless we act, the epidemic, which has killed 100 million deaths from tobacco in the 20th century, will kill one billion people this century. It will not be possible to reduce tobacco-related deaths over the next 30-50 years, unless adult smokers are encouraged to quit [3,4].

Cigarettes and some other products containing tobacco are highly engineered so as to create and maintain dependence, and many of the compounds they contain and the smoke they produce are pharmacologically active, toxic, mutagenic and carcinogenic. The dominance of cigarettes over the past 100 years ("the cigarette century") threatens to persist for another century [5].

In view of the addictiveness of tobacco products, many tobacco-users will need support in quitting. Support for smoking cessation or "treatment of tobacco dependence" refers to a range of techniques including motivation, advice and guidance, counseling, telephone and Internet support, and appropriate pharmaceutical aids, all of which aim to encourage and help tobacco users to stop using tobacco and to avoid subsequent relapse. The success of these interventions depends on their synergistic use in a broader context of a comprehensive tobacco-control strategy [6].

Evidence has shown that cessation is the only intervention with the potential to reduce tobacco-related mortality in the short and medium-term. An emphasis on prevention of tobacco consumption will, in the short run, only have a limited positive effect on tobacco-related morbidity and mortality, as prevention strategies do not affect existing tobacco consumers [7].

The interactions among the psychosocial, sensory, and pharmacologic reinforcing mechanisms involved in smoking are complex [8] and their relative roles unknown. Since the mid-60s, researchers have advanced a number of conceptual formulations of smoking motivation and developed assessment instruments based on these formulations.

Several typologies have been constructed to describe smokers according to when and why they smoke and their ability to refrain from smoking [9]. One of the most commonly used typologies are the Reasons for Smoking Scale and Russell`s Classification of Smoking by Motives. In this later, there are five types of smoking which are not mutually exclusive: psychosocial smoking, indulgent smoking, tranquilization smoking, stimulation smoking and addictive smoking. It is based on a model of smoking motivation in which specific reasons for smoking fell along a continuum of pharmacological and non pharmacological rewards for smoking [10].

All "regular" smokers may be dependent in varying degrees, upon nicotine. Dependence is defined as a compulsive use [11] with psychoactive effects, reinforcement of consume conduct, use stereotyped patterns, relapse, recurrent anxiety, tolerance, abstinence and withdrawal syndrome [12]. Dependence is often invoked to explain motivation to use drug and the difficulty in sustaining abstinence. However, there is little agreement as to its definition, its cardinal manifestations, or its underlying processes. Despite variation in the definition of dependence, there is general agreement that an inability to achieve sustained abstinence from drug use is a central feature [13].

Physical dependence includes a compulsive use of nicotine and is referred as the appearance of physical symptoms, called altogether "abstinence syndrome" after retrieving the consumption of tobacco, better said, nicotine. The most frequently used instruments to assess physical dependence are the Fagerström Tolerance Questionnaire (FTQ) [14], and its short version the FTND [15] which are used worldwide.FTQ was initially developed with the aim to providing a tool to tailor smoking cessation treatments to the level of dependence of each smoker [14], but serious limitations of FTQ and FTND have been reported [16].The FTQ items inquire about the patterns of cigarette consumption, focusing on the need to replace nicotine after an overnight abstinence [17].

Another tests to evaluate physical dependence are the Cigarette Dependence Scales (CDS-12 CDS-5), they cover the main elements in DSM-IV and ICD-10 definitions of dependence [16].

The Nicotine Dependence Syndrome Scale (NDSS) is designed to yield continuous measures of dependence: craving and withdrawal, behavioral preference of smoking, tolerance, regularity of smoking and rigidity of smoking patterns [18].

The Glover-Nilsson Smoking Behavioral Questionnaire (GN-SBQ) is designed to rate psychological dependence [19], and the level in which behavioral patterns play a role in tobacco smoking dependence and predict craving levels [19,20].

The Development and Assessment of Nicotine Dependence in Youth study (DANDY-1) was the first measure of diminished autonomy over tobacco, as a useful index of addiction, later the Hooked on Nicotine Checklist (HONC) confirmed the rapid loss of autonomy in smokers [21,22,23,24] and its ability to predict the likelihood of both continued smoking and successful cessation [25,26]. The Autonomy Over Tobacco Scale (AUTOS) is based on the Autonomy Theory which states that addiction begins when symptoms appear that make quitting difficult or unpleasant [27].

The Wisconsin Inventory of Smoking Dependence Motives (WISDM-68) is a multidimensional measure of dependence [28]. The Michigan Nicotine Reinforcement questionnaire (M-NRQ), evaluate positive and negative reinforcement consequences of smoking [29].Recently, Racicot & McGrath [30] developed the Social Smoking Situations (S^3) Scale to measure contextual exposure to smoking during adolescence.

For all the above, we can recognize different approaches to evaluate both physiological and psychological tobacco dependence and also a number of conceptual formulations of smoking invoking various hypothetical constructs to explain smoking patters, existing considerable overlap with respect to specific motives [15-31] (Table 10).

It is then surprising that with such a variety of scales in Mexico with more than 17 million smokers [32], the only used

Table 1: Associated words for the stimulus "Tobacco smoking", semantic values and percentages.

	Defining	Semantic Value	Percentage (%)
1.	Pleasure	102	100
2.	Sickness	99	97.05
3.	Death	69	67.64
4.	Addiction	66	64.70
5.	Parties or meetings	57	55.88
6.	Anxiety	42	41.17
7.	Depression or sadness	42	41.17
8.	Dependence	40	39.21
9.	Harm	33	32.35
10.	Vice	30	29.41
11.	Problems	25	24.50
12.	Cancer	24	23.52
13.	Smell	24	23.52
14.	Health	21	20.58
15.	Anger	21	20.58
16.	Smoke	19	18.62
17.	Money	17	16.66
18.	Company	17	16.66
19.	After-dinner time	16	15.68
20.	Drugs	16	15.68
21.	Alcohol	14	13.72
22.	Habit	14	13.72
23.	Satisfaction	10	9.80

Table 2: Words with emotional content related to smoking, found in the "Good-bye" letters.

1.	Stress	10.	Security
2.	Anger	11.	Energy
3.	Acceptance	12.	Problems
4.	Comfort	13.	Personality
5.	Just enjoying	14.	Attraction
6.	Concentration	15.	Company
7.	Anxiety	16.	Think
8.	Sadness	17.	Rest
9.	Tranquility		

Table 3: Demographic characteristics of the participants, by age group.

Characteristic	Youngsters	Adults
n	100	100
Women	50	50
Men	50	50
Mean Age (years) Range	21.53 ± 2.53 (18-29)	45.45 ± 12.34 (30-81)
Marital Status (n)		
Married	3	44
Single	97	36
Free Union	-	5
Widow	-	7
Divorced	-	6
Separated	-	2
Number of cigarettes per day Range	5.94 ± 5.23 (1-30)	14.78 ± 11.32 (3-50)
Mean age when smoking started Range	16.25 ± 2.30 (6-23)	17.57 ± 6.00 (8-47)
Mean years smoking Range	5.19 ± 3.02 (1-17)	27.69 ± 12.50 (1-67)
Mean attempts to stop smoking Range	1.09 ± 1.74 (0-10)	1.93 ± 2.11 (0-12)
Mean FTND score Range	1.63 ± 1.91 (0-9)	3.67 ± 3.02 (0-10)
Mean TAPDS score Range	45.68 ± 7.61 (27-66)	48.06 ± 9.30 (31-69)

Abbreviations: FTND: Fagerström Test for Nicotine Dependence; TAPDS: Test to Assess the Psychological Dependence on Smoking.

Table 4: Main Clusters included in the Test to Assess Psychological Dependence on Smoking (TAPDS).

Name of the Cluster	Questions included
Emotional modulator Smoking is done under the belief of controlling, intensifying, or diminishing emotions	2. Smoking comforts me 14. Smoking helps me feel better when I am sad or depressed 15. By smoking I can manage my stress 16. Smoking helps me control my anger 17. Smoking gives me great pleasure 18. By smoking I can control my anxiety 19. Smoking helps me settle down 20. Smoking gives me satisfaction
Image/Self rewarding Smoking is done under the belief that this conduct creates in the smoker a different image, or through smoking you can achieve positive issues	3. I have a good time only when smoking 4. Smoking helps me to concentrate 5. When I smoke I feel confident 6. Smoking gives me the energy I need 7. The cigarette is my best company 8. Smoking lets me project the personality I want 9. Smoking makes me look attractive 10. If I smoke I can think more clearly
Indifference Smoking is chosen without being concerned by affecting the persons who are near and oneself, although one has the information of the harm caused by tobacco.	21. Smoking is an addiction associated with disease, cancer and death; however I have considered will continue smoking 22. Smoking tobacco is a vice and nicotine is a drug; however, I have considered I will continue smoking 23. When buying cigarettes I spend money that I could use for other things, but I think it is worthwhile 24. Smoking near my family affects its health, still I will keep on smoking 25. Smoking in my work affects and bothers my coworkers, still I will keep on smoking
Social Acceptance Social issues are associated to smoking, which generate social pleasure and acceptance, associated also to other substances, as alcohol.	1. I think when I smoke I am accepted by others 11. I think smoking is a crave 12. Smoking at parties and reunions make them nicer 13. I enjoy more a cigarette when I drink alcohol

Table 5: Test for the Assess Psychological Dependence on Smoking (TAPDS) - Long Version.

	Very Frequently (3)	Occasionally (2)	Never (1)
1. I believe when I smoke I am accepted by others.			

2. Smoking gives me comfort.			
3. I can only have a good time if I smoke.			
4. I can concentrate better when I smoke.			
5. When I smoke I feel confident.			
6. Smoking gives me the energy I need.			
7. The cigarette is my best companion.			
8. Smoking allows me project the personality I wish.			
9. Smoking makes me look attractive			
10. I can think better when I smoke.			
11. I think smoking is a crave.			
12. Smoking in parties and reunions make them more enjoyable.			
13. I enjoy more the cigarette when I consume alcohol.			
14. Smoking makes me feel better when I am sad or depressed.			
15. Smoking helps me control my stress.			
16. Smoking helps me control my anger.			
17. Smoking gives me great pleasure.			
18. Smoking helps me control my anxiety.			
19. Smoking helps me to calm down.			
20. Smoking gives me satisfaction.			
21. Smoking is an addiction associated with disease, cancer, and death. However, I have decided I will keep on smoking.			
22. Smoking is a vice and nicotine is a drug. However, I have decided to keep on smoking.			
23. When I buy cigarettes I spend money I could use for other things, yet I think it is worthwhile.			
24. Smoking near my family affects its health, yet I will go on smoking.			
25. Smoking at work affects and bothers my coworkers, yet I will keep on smoking.			
Score: 25-41: mild dependence; 42-58: moderate dependence; 59-75: severe dependence			

Table 6: Test for the Assess Psychological Dependence on Smoking (TAPDS) - Short Version.

	Very Frequently (3)	Occasionally (2)	Never (0)
1. Smoking helps me control my stress, anxiety and anger.			
2. Smoking gives me great pleasure.			
3. Smoking allows me project the image and personality I wish.			
4. Smoking makes me look attractive			
5. Smoking is an addiction associated with disease, cancer, and death. However, I have decided I will keep on smoking.			
6. Smoking near my family affects its health, yet I will go on smoking.			
7. I believe when I smoke I am accepted by others.			
8. I enjoy more the cigarette when I consume alcohol.			
Score: 8-13: mild dependence; 14-19: moderate; 20-24: severe dependence			

questionnaires in the smoker population are the FTND and occasionally the Russell`s Classification of Smoking by Motives. The present work pretends to contribute with the elaboration of a test to assess the psychological dependence on tobacco, consisting in a long questionnaire (25 items) and a shorter version (8 items) that will allow measuring in a quantitative way this type of dependence in Mexican smokers.

MATERIALS AND METHODS

Participants

Participants whose data contributed to the development of the technique of semantic nets were 100 current smokers (50 women, 50 men) with an average age of 46.74 ±11.69 years (range 23 to 73) who were in treatment to stop smoking at the Tobacco Cessation Clinic (TCC) located at the school of Medicine, National Autonomous University of Mexico. For the validation analysis of the questionnaire we recruited 200 current smokers from the local community, who were divided by age in two groups: 18-29 years (n=100) and more than 30 years (n=100).

Informed Consent

The protocol of this study was evaluated by the ethical and research commissions of the School of Medicine, National Autonomous University of Mexico and all participants of the TCC signed an informed consent. Smokers interviewed outside the University were asked to accept through an oral informed consent, they were informed that their answers were going to be stored on a computer file for statistical analyses, and they were given the option of declining.

METHODS

The first step was applying the technique of semantic nets to 100 smokers who were under treatment to stop smoking in the TCC. Smokers attending this facility were asked to write in descendent order of importance five words closely related to the word stimulus: tobacco smoking, using the procedure described by Valdez [33]. For the elaboration of the instrument, the words with emotional content most commonly mentioned by the smokers were taken in consideration; we found 23 words which are shown in Table 1.

Table 7: Differences found in the participants of the study by sex and age.

Characteristic	Young women	Adult Women	P	Young Men	Adult Men	p
Number of cigarettes smoked per day	5±2.7	13.04±11.7	0.0001*	6.98±6.7	16.52±10.7	0.000*
Age (years)	21.08±2.7	43.52±10.8	0.0001*	21.62±2.6	47.38±13.5	0.000*
Initiation of smoking (age)	16.32±3.22	18.48±7.7	0.06	15.94±2.5	16.66±3.26	0.232
Years of smoking	5.14±4	24.86±10.3	0.0001*	5.70±3.5	30.52±13.8	0.000*
Previous attempts to quit	1.54±3.5	2.14±2.4	0.34	1.1±1.7	1.72±1.7	0.043*
TAPDS score	45.64±8.9	48.78±9.7	0.130	44.98±8.7	47.34±8.8	0.172
FTND score	1.30±1.2	3.2±3	0.0001*	1.98±2.3	4.14±2.9	0.000*

Values are expressed as the mean ± standard deviation (SD). * p< 0.05 statistical significance with T-test comparing the same sex by age.
Abbreviations: FTND: Fagerström Test for Nicotine Dependence; TAPDS: Test to Assess the Psychological Dependence on Smoking.

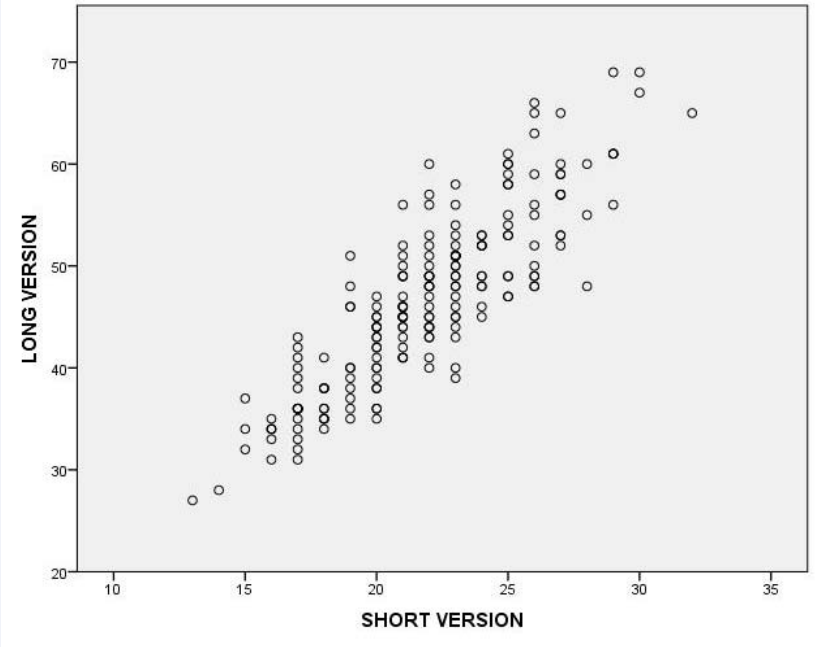

Figure 1 (A) Correlation between the values found with the TAPDS long version (25 items) and the TEPDS short version (8 items), r=0.94 (p<0.001).

Table 8: Comparison of TAPDS and FTND scores by age and sex.

Test	Young women	Adult women	Young men	Adult men	Women	Men	P
TAPDS	45.64±8.9	48.78±9.7	44.98±8.7	47.34±8.8	47.21±9.4	46.16±8.8	ND
FTND	1.30±1.2	3.20±3	1.98±2.3	4.14±2.9	2.25±2.5	3.06±2.8	p<0.05*

Values are expressed as the mean ± standard deviation (SD). No differences (ND)* p < 0.05 statistical significance with T-test comparing FNDT scores: young women vs adult women; young men vs adult men; women vs men.
Abbreviations: FTND: Fagerström Test for Nicotine Dependence; TAPDS: Test to Assess the Psychological Dependence on Smoking.

We also analyzed 100 "good-bye" letters written by smokers as a part of the treatment to stop smoking [34]; four psychologists involved in the treatment were asked to pick up the main words with emotional content found in each letter. In Table 2 there is a list of these words.

The 40 words obtained were used to form questions, to design the questionnaire that will measure psychological dependence on tobacco. The initial questionnaire had 23 items with a Likert scale, plus 12 words related to smoking health effects and 4 questions related to self-efficacy to control and stop smoking, it was validated several times with smokers attending the TCC, until all the questions were clear for all the participants, obtaining a second questionnaire. This later was validated again and according to the result, it was decided to eliminate the words

and add its content in form of 7 questions, the final Test to Assess the Psychological Dependence on smoking (TAPDS) had 30 items.

This modified version was applied initially to 100 current smokers from the University community: 50 men and 50 women, ranging in age between 18 to 29 years, with a mean age 21.5 ± 2.5 years, mostly students. Other 100 questionnaires were applied to adult current smokers from the local community, 30 years or more, with a mean age of 45.4 ± 12.3, 50 men and 50 women. At the same time participants answered the TAPDS, FTND was applied in order to include a measure of physical dependence. Inclusion criteria for both groups were smoking at least one cigarette every day, have smoked continuously during the last 5 years, and accepting voluntarily to participate in the study after have listened the voluntary consent. Incomplete surveys were culling during data cleaning. Characteristics of both groups of smokers included in this study are shown in Table 3.

We performed a statistical analysis using SPSS 22 (SPSS, Inc., Chicago, IL), an Exploratory Factor Analysis (EFA) and a Principal Component Analysis (PCA) with the Bartlett´s sphericity Test and the Kaiser-Mayer-Olkin Test (KMO) were applied. Data reduction was accomplished by means of principal-components factor analysis with a varimax with Kaiser Rotation on the full 30 items scale. The value obtained with the KMO was 0.8 (p=0.000), therefore the data were adequate for EFA. Factorial values lower than 0.35 in the analysis (items 11,12,15,29 and 30) were extracted obtaining a 25 items final questionnaire divided in four clusters: 1) emotional modulator, 2) personality-image, 3) indifference, and 4) social acceptance.

The Internal reliability of the resultant 25 items questionnaire was assessed with Cronbach's alpha, obtaining a value of α=0.847.

Since the long version of the questionnaire would be difficult to answer when time is limited (we obtained an average answering time of 3 minutes), we decided to perform a shorter version of 8 items, using the two main questions of each factor, in order to keep the main components of the longer version. This shorter version was applied to 100 current smokers from the university community who voluntarily accepted to participate. When comparing both versions we found a Spearman correlation of r=0.94 (p<0.001), therefore any of them can be applied to assess the psychological dependence of smokers. The average time to answer this version was about 1 minute.

RESULTS AND DISCUSSION

The final instrument to evaluate psychological dependence on smoking, is a 25-items questionnaire, with option-type Likert answers (very frequently, occasionally, and never) (Table 4) and with 4 clusters: 1) emotional modulator, 2) personality-image, 3) indifference, and 4) social acceptance cluster (Table 5).We also obtained a shorter 8-items version (Table 6), suitable to apply when time is limited and with a good correlation with the longer version (r=0.94, p<0.001), as it is shown Figure 1.

Statistical analysis was performed to evaluate differences between groups (Table 7), we compared the same sex by age (young vs adult). In women, statistical differences were found in the number of cigarettes smoked, years of smoking and FTND score, in men it was the same plus previous attempts to quit. It is generally assumed that physical dependence increases with smoking time; in our population we found that FTND scores were higher in adults of both sexes. When comparing women vs men by age, the only statistical difference found was the number of cigarettes (p<0.05) which was higher in young men.

Analysis of the scores of TAPDS and FTND were performed comparing by sex and age in different combinations as it is shown in Table 8. No differences were found when analyzing TAPDS scores, with FTND we found statistical significance comparing women and men by sex and women vs men. Scores were higher in men and in the adult smokers.

Grouping the participants by age (between 18-29 years and 30 and more years), we found significant differences in the number of cigarettes smoked, years of smoking, age at initiating smoking, and TAPDS and FTND scores, demonstrating that age is an important factor when analyzing smokers (Table 9).

When performing a statistical analysis to find out if there is a correlation between TAPDS and FTND, we found r = 0.5 (p<0.0001) in adults and r = 0.4 (p<001) in youngsters.

Discussion

A valid measure of dependence on cigarettes is essential both for tailoring effective treatment of dependence and for research purposes. Behavioral aspects of smoking addiction include the rituals associated with smoking, the feelings or perceptions of security that smoking provides, and the relationship between the smoker and cigarette. Ideally, administering a physical and a behavioral questionnaire, clinicians could match treatment to the behavioral as well as physical needs of the patient.

In this study we applied both, the FTND and the new TAPDS in order to have indicators of physical and psychological dependence on smoking, one initial hypothesis was that the scores were going to correlate, assuming a direct relationship between both types of dependence. Nevertheless, the correlation found was low, it can be explained analyzing the components of both tests, and TAPDS is more oriented to emotional perceptions and lacks a withdrawal indicator while FTND is primarily indicative of a difficulty maintaining abstinence because of withdrawal symptoms [35].

FTND scores showed a statistical significant increase with age in both genders, while TAPDS only showed a difference when comparing between young and adults, the later showed higher values in both. Tobacco addiction is a complex process involving the interplay of pharmacology, learned or conditioned factors, personality, and social settings, interactions smoker-cigarette are increased with the number of years smoked and therefore with age. This is confirmed since we found a positive correlation between FTND scores and age at initiation of smoking (r=0.98, p>0.05), with TAPDS this correlation was r=0.73 and r=0.7 (p<0.05) with the number of years smoked. All drug-taking behavior is learned, a result of conditioning. Drug-taking behavior is made more probable (reinforced) by the consequences of the pharmacologic actions of the drug. At the same time, the drug abuser begins to associate specific moods, situations, or environmental factors with the rewarding effects of the drug. The association between such cues, anticipated drug effects and

Table 9: Analysis of the differences when comparing participants by age.

Characteristic	Young (18-29 years)	Adults (+ 30 years)	p
Number of cigarettes smoked per day	5.99±5.21	14.78±11.32	0.000*
Initiation of smoking (age)	16.13±2.92	17.57±6	0.032*
Years of smoking	5.42±3.79	27.69±12.5	0.000*
Previous attempts to quit	1.32±2.79	1.93±2.11	0.08
TAPDS score	45.31±8.79	48.06±9.3	0.033*
FTND score	1.64±1.91	3.67±3.02	0.000*

Values are expressed as the mean ± standard deviation (SD).)* $p < 0.05$ statistical significance with T-test comparing number of cigarettes per day, age at initiation of smoking, years smoking, TAPDS and FTND scores between young and adult groups.
Abbreviations: FTND: Fagerström Test for Nicotine Dependence; TAPDS: Test to Assess the Psychological Dependence on Smoking

Table 10: Some Scales for the evaluation of nicotine dependence- Aims, advantages and disadvantages.

Tool	Aim/Composition	Advantages	Disadvantages
Fagerström Tolerance Questionnaire (FTQ) and The Fagerström Test for Nicotine Dependence (FTND)	Diagnose the degree of physical dependence among smokers	• It is a good indicator of the intensity of physical dependence on nicotine • The test can be filled out either by the therapist/researcher or the smoker • It is a short test that does not need a long time to answer • It correlates with biomarkers of smoking like cotinine and exhaled CO • Estimated time to complete: 1 minute	• It is no clear if it evaluates dependence or/ and heaviness of smoking • It does not discriminate well among very low dependent smokers such as adolescent non-daily smokers • Several FTND items are difficult to apply to moderate smokers • FTND is not a good predictor of withdrawal symptoms in smokers who subsequently quit smoking
The Heaviness of Smoking Index (HSI)	It consists of FTND items 1 and 4, using the same response scale and calculating the total score using the sum of the scores on those two items	• It is so brief • This index have been used as a short version of the full FTND • HSI is the best predictor of smoking cessation among the physical dependence scales • Estimated time to complete: <1 minute	• For Mexican population neither FTQ, FTND nor HSI have been validated using a Spanish version this may affect the reliability and validity of the data obtained
The Cigarette Dependence Scale (CDS)	It was developed according to standard psychometric methods and covers DSM-IV and ICD-10 criteria of dependence	• It is adapted for individuals with high and low levels of dependence • It covers DSM-IV and ICD-10 criteria of dependence • There are two versions (12 and 5 items) which have similar psychometric properties • Estimated time to complete: 1-2 minutes	• It does not contain an item to evaluate tolerance (as defined in DSM-IV and ICD-10) • CDS-12 includes only a concise evaluation of withdrawal. Although, tobacco withdrawal is better assessed using specific scales
The Nicotine Dependence Syndrome Scale (NDSS)	It was developed as a multidimensional scale to assess nicotine dependence using Edwards' theory of the dependence syndrome	• It evaluates: • -Drive (captures craving, withdrawal and the subjective sense of compulsion to smoke) • -Priority (the behavioral preference of smoking over other reinforces • -Tolerance (reduced sensitivity to smoking´s effects • -Continuity (the regularity of smoking) • -Stereotypy (the rigidity of smoking patterns and tendency to smoke in the same way regardless of circumstances) • It provides robust discrimination between occasional smokers and regular smokers • It can be used as an outcome measure to assess changes in level of dependence across time and smoking status • Estimated time to complete: 2-3 minutes	• It has not reliably predicted smoking cessation • It does not predict outcomes well across all major dependence criteria: abstinence, self-administration heaviness, and withdrawal severity. • Emotional aspects of tobacco use disorder and Nicotine Dependence are not indicated by a specific factor
The Wisconsin Inventory of Smoking Dependence Motives (WISDM-68) & the brief WISDM	It was developed based on theoretically grounded motives for drug use.	• It includes four primary dependence motives (automatically, craving, loss of control and tolerance) and nine secondary dependence motives (affiliative attachment, behavioral choice/melioration, cognitive enhancement, cue exposure/associated processes, negative reinforcement, positive reinforcement, social/environmental goads, taste/sensory processes and weight control) • It can be useful for treatment planning and provides predictive utility regarding quitting	• It does not predict outcomes well across all major dependence criteria: abstinence, self-administration heaviness, and withdrawal severity. • The long version has 68 items and the short version has 37 items • Estimated time to complete: 10-15 minutes • In its brief version, needs further refinement of the subscales and model specification may be necessary

Hooked on Nicotine Checklist (HONC)	It is a reliable and valid measure of diminished autonomy over tobacco	• It is validated in adolescents and adults, and for smoked and oral tobacco products • It is a useful tool over the entire spectrum of smoking behavior, from novice youths to chain-smoking adults • The HONC is probably the most sensitive measure of early or low level dependence • Estimated time to complete: 1-2 min	• Its items only indicate a loss of autonomy (only as a marker of dependence) • It has some difficulties to be a screening tool for adolescent nicotine dependence
The Autonomy Over Smoking Scale (AUTOS)	It is a 12-item theory-based (Autonomy Theory) instrument used to measure tobacco dependence in smokers	• It measures both the presence and the intensity of current, presumably transitory symptoms • it assesses three symptom domains (withdrawal, psychological dependence, and cue-induced urges to use tobacco) • Can be used with adolescents and adults, for oral and smoked tobacco products	• The utility of the AUTOS as a predictor of cessation outcomes is not established • It is not known how long recovering smokers remain psychologically dependent on smoking after their quit date
The Michigan Nicotine Reinforcement Questionnaire (M-NRQ)	It looked at the positive reinforcements such as reward dependence and negative reinforcements of smoking such as self-treatment of depression	• It has potential as a diagnostic tool for individualizing behavioral intervention and pharmacotherapy and also may be useful in identifying new phenotypes for genetic research on smoking	• Testing is needed in a variety of subjects, ranging from occasional smokers to heavy smokers to establish the generalizability of the original investigation results • Self-rated reinforcement patterns must be validated using direct observation of smoking behavior in smokers exhibiting different M-NRQ profiles
The Social Smoking Situations (S^3)	It is an enhanced psychometric instrument measuring the situational contexts in which social exposure to smoking occurs.	• It is a stronger predictor of smoking behavior and smoking expectancies • S^3 Scale is a brief, psychometrically sound instrument that could be used as an alternative to existing measures when assessing contextual exposure to smoking and statistically modeling adolescent smoking behavior	• It is only focused in the evaluation of the social exposure, not in physical or psychological dependence • Only validated in adolescents
The Glover-Nilsson Smoking Behavioral Questionnaire (GN-SBQ)	The scale was developed with the aim of providing an option for clinicians to assess both physiologic and behavioral dependence when used in combination with FTND and/or other scales that are already widely used to measure physical dependence	• It is a self-administered, concise, unidimensional scale that captures the phenomenon of behavioral nicotine dependence • The GN-SBQ is the only variable predictive of craving level in the stepwise regression • It offers an additional means of defining the type of symptoms that the smoker is experiencing • It incorporates the cognitive, social, and behavioral effects associated with tobacco dependence	• It is not a totally reliable instrument due to variations in the population to which it applies. The different categories could be take in a different way by the respondent
Tobacco Dependence Screener (TDS)	It is a dimensional measure that allows a brief assessment of nicotine dependence	• The items have been created according to ICD-10 and DSM • It requires about 1-2 minutes to administer • TDS scores are correlated with other indices of tobacco use, including biochemical measures • It can successfully predict the likelihood of success with smoking cessation	• Some aspects of the DSM derived interviews and similar instruments may cause problems in any sample, or when using the instrument with culturally diverse populations. • Another important caveat to observe, in regards to the DSM measure of dependence, is that the scoring algorithm used in establishing formal DSM diagnoses does not appear to yield decision rules that agree with empirical methods
The Minnesota Withdrawal Scale (MWS)	It is the most widely used measure of nicotine withdrawal	• It takes about 1-2 minutes to administer • Includes 15 symptoms associated with the presence and severity of nicotine withdrawal	• To track changes accurately over time, patients should be instructed to complete the measure for several days prior to their quit attempt and then daily thereafter

Abbreviations: AUTOS: Autonomy over Tobacco Scale; CDS: Cigarette Dependence Scale; FTND: Fagerström Test for Nicotine Dependence; FTQ: Fagerström Tolerance Questionnaire; GN-SBQ: Glover-Nilsson Smoking Behavioral Questionnaire; HONC: Hooked on Nicotine Checklist; HSI: Heaviness of Smoking Index; NDSS: Nicotine Dependence Syndrome Scale; TDS: Tobacco Dependence Screener; WISDM: Wisconsin Inventory of Smoking Dependence; DSM: Diagnostic and Statistical Manual of Mental Disorders; ICD: International Classification of Diseases; M-NRQ: The Michigan Nicotine Reinforcement Questionnaire; S^3: The Social Smoking Situations; MWS: The Minnesota Withdrawal Scale

the resulting urge to use the drug is another type of conditioning. Cigarette smoking is maintained in part by such conditioning. People often smoke cigarettes in specific situations, such as after a meal, with a cup of coffee or an alcoholic beverage, or with friends who smoke. The association between smoking and these other events repeated many times link them in a very strong way, that may vary in each smoker, suggesting that the older a person the higher the dependence on nicotine, both psychological and physical. In contrast in the youngsters' population the scores obtained were lower, probably because they had been smoking

during shorter periods. Interestingly, Nerín [36] in a study of Spanish population found that younger smokers had higher scores of the Glover-Nilsson and FTND tests.

The models of physical dependence assert that the amount of drug exposure reflects susceptibility to the drug withdrawal syndrome and that both the amount of drug self-administration and severity of withdrawal index drug determine dependence [13]. TAPDS lacks a withdrawal indicator, which can be a weakness. However in or view tobacco psychological dependence is more related to emotions and auto-perceptions of the smoker and this is the reason TAPDS contains the four factors we wanted to evaluate: 1) emotional modulator, 2) image/self-rewarding, 3) indifference and 4) social acceptance.

TAPDS is an exploratory approach to the "emotional environment" of smokers, thoughts never said like "*smoking near my family affects its health, yet I will go on smoking…*" or "*smoking is a vice and nicotine is a drug, however I have decided to keep smoking…*" are present in the mind of the smoker and play a role over the decision of continue smoking. There are many tools to measure smoking dependence, as it is show in Table 10, many of them overlaps the items, and all represent the need of clinical researchers to get a better knowledge about nicotine dependence.

The more comparable tools with TAPDS are the GN-SBQ which evaluates the cognitive, social and behavioral effects associated with tobacco dependence, but as we mentioned before TAPDS is more involved in internal emotions and perceptions of the smoker. Both were internally consistent (Cronbach α= 0.82), compared with TAPDS (Cronbach α= 0.84). About AUTOS, it comprises items that show that smokers perceived themselves as relying on smoking as a crutch to help them cope (e.g., to handle stress) or had developed convictions that they could not function without smoking, as in TAPDS the self-perception is very important. AUTOS had a higher internal consistency than TAPDS and GN-SBQ (α=0.96). The WISDM-68 and the brief WISDM as TAPDS evaluates multidimensionality of smoking motives: positive and negative reinforcements, cognitive enhancement and social and environmental goads plus loss of control as a measure of withdrawal, the main disadvantage of WISDM-68 is the number of items (estimated time to complete= 15 minutes). In future studies it will be very important to compare those three scales in adult and adolescent populations.

This study is subject of some limitations. First, the opinion of smokers who wanted to quit smoking was taken into consideration to build the initial questionnaire, therefore their motivation to stop was very high and probably there was a modification of thoughts about smoking; second, levels of cigarette consumption were self-reported and third, we did not use biochemical measures to grade the level of psychological dependence like nicotine or CO exhaled. Also as we mentioned before, TAPDS lacks of a withdrawal indicator. On the other hand, the strengths of the study includes the number of Mexican smokers studied, a total of 400 in the whole study, also to validate the questionnaire, we invited a group of smokers from open population not motivated to stop smoking.

Mexican smokers in particular and in general Latin smokers who smoke an average of 6 cigarettes per day have not been previously studied in this context. Most of the scales are based on the results of studies from European or North American populations who smoke more than 15 cigarettes per day. FTND as an example is the most widely applied questionnaire in Mexico to evaluate physical dependence on nicotine and surprisingly it has not been validated in its Spanish translation, also it has been described that FTND is difficult to apply to moderate smokers and does not discriminate well among low dependent smokers [16].

In Mexico with more than 17 million smokers according to the last published national survey, cessation is a forgotten issue. Only about 2% of smokers have received pharmacological treatment [32]. One of the challenges is time, the average face-to-face for physician office visits at the public health services is about 10-15 minutes, therefore it is important to offer a tool suitable to be applied or self-rate very fast and therefore widely accepted, the shorter version of TAPDS takes only about 1 minute to be completed.

TAPDS did not show a statistical correlation with FTND(r=0.5).Other authors [35] also found a low correlation (r=0.34) comparing the Glover-Nilsson test and the FTND.

The sensation of pleasure is one of the factors that surges from both, psychological and physical dependence; thus, it is important to elucidate the meaning that smoking tobacco represents to them. It is interesting to mention that the most common word mentioned by the smokers included in this study was "pleasure", which indicates that despite many participants know about the harmful effects of tobacco, these are minimized by the pleasure generated by smoking, leaving aside the risks that this conduct leads to, and which is related with the level of dependence of the participants towards smoking tobacco. The second word obtained was "sickness", showing a controversial thinking of smokers where pleasant sensations can be more important than risk perception.

At the moment, vital questions remain about the psychological motivation of smoking classical and operant conditioning [19]. It is then important to emphasize the use scales of both psychological and physiological dependence in order to have a better understanding of its relationship and contribution to the global smoking dependence. The TAPDS can be a good compliment to the FTND and a new tool to better understand the complexity of addictive behaviors like smoking.

CONCLUSION

The main objective of this work was achieved: to design and validate a tool capable of evaluating in a quantitative way the psychological dependence of smokers. This tool may be used as a diagnostic aid in treating tobacco smoking. We found that TAPDS is direct, concise, simple, short, and easy to understand, besides being easily self-applied. The internal reliability assessed with Cronbach's alpha was 0.84 which is a good result for a psychological instrument.

Data obtained allows us to suggest the use of TAPDS in the psychological diagnosis of smokers. Clearly our results provide limited but promising evidence and need to be replicated with larger samples of smokers; also it is important to evaluate its

association with biochemical parameters associated to smoking (cotinine, carbon monoxide, etc.) as well as with the severity of withdrawal symptoms. In this way we could successfully relate the two components of dependence, the physical and the psychological issues. Future research is needed to determine if smokers who have been classified into different typologies of psychological dependence with TAPDS respond differently to behavioral versus pharmacologic interventions. There is still a long way to come, but we are getting closer to a better understand of smoking.

ACKNOWLEDGEMENTS

Special thanks to America Morales for helping with the patients at the TCC. To the National Autonomous

University of Mexico for the support in the development of the study.

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Cite this article

Ponciano-Rodríguez G, Valerio-Gutiérrez R, Pliego-Rosas CA, Córdova-Alcaráz A (2015) Development and Evaluation of a New Self-Rating Test to Assess the Psychological Dependence on Smoking (TAPDS). J Addict Med Ther 3(2): 1016.