



Critical Appraisal of Various Indices in Tobacco Cessation: A Review

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Abstract

The measure of dependence is based on theoretical conceptual models of which are the commonly used methods in tobacco cessation. The assumption is that individual variability of nicotine dependence, which is construed as a continuously scaled variable. Many physiological and psychological indices have been used either singly or in combination to study nicotine dependence considering it as unidimensional or multidimensional scale and tool in tobacco cessation. With this background, we aim to critically appraise the various indices used in tobacco cessation so as to derive maximize benefit in tailor made clinical tobacco cessation therapy. The interpretation of indices produces different interpretation considering it to be unidimensional or multidimensional tool. Further caution is essential for researchers in interpretation, considering the variability produced by these scales. Implicit assumption of unidimensionality is considered in the counts of continuously scaled variable approach. The multidimensional scales are not substitute but are certainly complementary in understanding the conceptually driven measure of multidimensional construct of addiction. This understanding is essentially important for researchers and using these indices aligned to their research questions of physiological and psychological nicotine dependence and their correlation with different attributes. The assessment of both physiological and psychological dependence helps to restructure our tobacco cessation by overcoming various perceived barriers of quitting.

Keywords: Nicotine dependence, Indices, Tobacco Cessation

Introduction

The measure of dependence is based on theoretical conceptual models of which are the commonly used methods in tobacco cessation. The assumption is that individual variability of nicotine dependence, which is construed as a continuously scaled variable. These index provides a thorough insight into probable reason of dependence in more sensitive manner providing a tailor made behavioral counseling in tobacco cessation.^[1] These scales provide a continuum of dependence with distinct magnitude apart from the conventional coding of DSM-IV(Diagnostic and Statistical Manual of Mental Disorders) based on Edwards and Gross 1976 criteria, which just identifies the presence or absence of dependence. DSM and International statistical

classification of diseases and related health problems (ICD-10) are clinimetric measure done through interview by expert which is time consuming and costly.^[2-4]

Tobacco dependence is due to nicotine which is considered gateway addictive substance. This nicotine dependence leads to the compulsive and repetitive behavior of tobacco use. Further, the nicotine dependence is both at physiological and psychological level. The physiological dependence in clinical practice has been assessed by most commonly used FTND scale and the psychological dependence measuring the cognitive factors is done through various psychological dependence scales. Social cognitive theory (SCT) given by Bandura in 1986 is based on outcome expectations and perceived

self-efficacy, which is used to understand behavioral aspect of dependence. Outcome expectations which can be physical, social, and self-evaluative. Self-efficacy is related to refraining from smoking in social and emotional situations.^[5] These cognitive factors are related to attributes of individuals in expecting more lost functions of smoking in the case of quitting, reduced confidence to maintain abstinence, expecting fewer positive outcomes of quitting, strong adherence to excuses to smoke and finally expecting more withdrawal symptoms if they quit.^[6]

Many physiological and psychological indices have been used either singly or in combination to study nicotine dependence considering it as unidimensional or multidimensional scale and tool in tobacco cessation. With this background, we aim to critically appraise the various indices used in tobacco cessation so as to derive maximize benefit in tailor made clinical tobacco cessation therapy.

Indices for Physiological nicotine dependence:

Fagerstrom Tolerance Questionnaire (FTQ) was introduced by Fagerstrom in 1978 and was later modified to Fagerstrom Test for Nicotine Dependence (FTND) by Heatherton, Kozlowski, Frecker and Fagerstrom in 1991.^[7,8] This was based on the physiological dependence of signs and symptoms of dependence and tolerance leading to reinforced behavior. It is reported that FTND is able to assess some part of psychological dependence like self efficacy and expected withdrawal symptoms but fails to measure the motivational and other attributes of psychological dependence.^[6] Lichtenstein et al^[9] reported that the low internal consistency and poor structured question of FTQ as yes and no, as the main limitations. This dichotomization also fails to provide information on incremental increase of nicotine dependence in chronic dependence apart from reduced variance.^[10] The FTQ was modified by Heatherton et al^[8] in 1991 but the internal consistency was marginally improved from 0.55 to 0.61. This low internal consistency is also attributed for considering it to be multidimensional scale which produces variability in its interpretation.^[11-13] Kozlowski et al^[14] reported that prediction of smoking cessation in moderate and heavy dependence is weak. In spite of its psychometric limitation, it is still the most commonly used as it is

brief, measuring smoking heaviness, helps in the efficacy prediction of different dose of nicotine replacements and is well associated with biological indices of carbon monoxide and cotinine levels.^[1,8] Further, it fails to measure the severity of withdrawal making unidimensional scale for tolerance per se in measuring the smoking heaviness considering the fact that nicotine dependence is a multidimensional based on other core latent constructs of craving, automaticity or saliency and withdrawal.^[15] The FTQ and FTND have relied on two constructs of heaviness of tobacco use and withdrawal. The heaviness of use have contributed to the total score producing in consistent scores to the item response.^[16]

Heaviness of Smoking Index (HSI) consists of two items of the FTND. This index has adequate reliability (0.72), good test-retest validity and is best predictor for smoking cessation.^[17-19] Tobacco Dependence Screener (TDS) is a screening questionnaire which assesses DSM-IV and ICD10 criteria of nicotine dependence. The psychometric properties measure nicotine dependence based on psychiatric diagnostic criteria. It consists of 10 items with dichotomous (yes/no) response and a score of more than five yes is identified as nicotine dependence.^[20] It has better reliability than FTQ but provides less variability due to dichotomized response.

The Cigarette Dependence Scale (CDS) is available in 5 item (CDS-5) and 12-item format (CDS-12). It is reliable with internal consistency of greater than 0.85 for both the versions.^[17,21,22] It is reported as important indicator of nicotine dependence in young smokers.^[17] Etter et al^[17] and McNeill et al^[23] reported that CDS scores were lower in younger smokers than old smokers. This clearly indicates that the early initiation of tobacco use at young age have lower dependence scores and likely to have higher dependence scores as they tend to be chronic smokers. Both versions of CDS are associated with saliva cotinine levels and urge to smoke during a quit attempt, but could not sufficiently predict smoking abstinence.^[17,21]

The Nicotine Dependence Syndrome Scale (NDSS) is a 19-item scale with five constructs consisting of drive (craving, withdrawal and compulsion to smoke), priority (preference for smoking over other reinforcers), tolerance (reduced sensitivity to the

effects of smoking), continuity (regularity of smoking rate), and stereotypy (invariance of behavior).^[24-26] Both NDDS and CDS lacks predictive validity on relapse and withdrawal.^[1,21] All these scales are confounded by the motivation and ability of the individual to quit smoking.^[1] Further psychometric scales measuring the unobserved variables are dependent on validity and reliability.^[21]

The Hooked On Nicotine Checklist (HONC) consist of 10 item was developed specifically to assess the development of dependence in young people.^[27] Wellman et al^[28] reported that it is less sensitive at the high end of the spectrum as many adult smokers reach the ceiling score. They also pointed that it was reliable scale for adult and adolescent with a ability to measure the loss of autonomy both new users and previous users.^[29] Further, loss of autonomy is valuable in whom dependence is developing before they reach a diagnosable level.

Indices for Psychological nicotine dependence:

The multidimensionality of nicotine was addressed by Piper et al^[1] considering Wisconsin Inventory of Smoking Dependence Motives (WISDM-68) with 68 items. WISDM scale considers other constructs of withdrawal and relapse. Motives are an important drive in reinforcement of dependence and 13 domains were considered which included affiliative attachment (5 items), automaticity (5 items), behavioral choice–melioration (7 items), cognitive enhancement (5 items), craving (4 items), cue exposure–associative processes (7 items), loss of control (4 items), negative reinforcement (6 items), positive reinforcement (5 items), social–environmental goods (4 items), taste and sensory properties (6 items), tolerance (5 items), weight control(5 items). Automaticity, loss of control, tolerance, and craving construct constitute the Primary Dependence Motives and rest nine constructs constitute the Secondary Dependence Motives (SDM). WISDM-68 have demonstrated excellent internal consistency for the overall scale ($\alpha = 0.96$) although subscales had internal consistency ranging from 0.74 to 0.94.^[16] The high internal consistency also underscores the redundancy in the scales that could also be attributed to the repetitive overlapping items. The shorter form of WISDM-35, included 11 constructs with 35 items by consolidating Negative and Positive Reinforcement and eliminating

Behavioral Choice-Melioration with comparable reliability and validity.^[30] This comprehensive scale though too long may limit its use but the individual construct could be adapted and combined with other scales. The combinations of scales fulfill the missing construct reported as limitations in these scales and enhance its convergent and predictive validity.

Oklahoma Scale for Smokeless Tobacco Dependence (OSSTD) is a modified form of WISDM 68 consisting of 23 items with 7 constructs and an internal consistency of $\alpha = 0.92$ was reported which clearly indicates the reduction of repetitive item. The addition and elimination of construct is also based on the type of tobacco dependence. Mushtaq et al^[16] reported that social & environmental goods and taste & sensory processes did not contribute to smokeless tobacco dependence unlike the smoking dependence. Therefore the choice of construct inclusion and elimination also depends upon the type of tobacco addiction and thorough literature review in psychological dependence based on type of tobacco dependence is essential in considering the relevance of item in the construct. Loss of control and craving construct were considered as to be a single factor similarly, automaticity and tolerance construct as separate in OSSTD.^[16]

Social dependence is synonymous with psychological and psychosocial dependence. The physiological dependence is based on symptoms of withdrawal and tolerance. Similarly the psychological dependence is based on strong desire, constant neglect and motives.^[2] This has also been related to cognitive distortion like denial of ill effects, over estimation of favorable effects and overrating the difficulty of the smoking cessation.^[31-33] Such misperception is a potential threat to tobacco cessation. This lead to the introduction of Kano test for social nicotine dependence (KTSND) used to quantify social nicotine dependence which consists of 10-item questionnaire with Likert scale and a total maximum score of 30. Yoshi et al^[34] reported that the potential for quitting smoking is more accurately estimated if combined with the FTND. In quitters, it is predictive of recurrence of smoking and in non-smokers it is also used to show attitudes toward acceptance of smoking. Lastly, it may diagnose the severity of psychological nicotine dependence. Relapse in ex-smokers is associated with the high residual outcome expectation (ROE).^[35] Kano et al^[36] reported that

KTSND is used as adjunct to support smoking cessation and Kurioko *et al*^[37] reported that it also predict the success or failure of smoking cessation treatments. This prediction of relapse into smoking is based on the ability of assessment in abstinent misperceptions.^[38] Otani *et al*^[38] reported that it was well correlated to the stages of quitting and were able to differentiate the physiological and psychological dependence based on the fact that the past smokers initiating smoking after long abstinence were not confounded by the physiological dependence. Modified KTSND have been used in children and adolescent. Studies have correlated higher KTSND scores with children vulnerable to second hand smoke and those who have tried smoking earlier. Such vulnerability is well associated with the early initiation of tobacco use, due to the unrestricted smoking exposure at home or workplace.^[39-41] Dijkstra *et al*^[6] reported that when FTND and other psychological indices are used, psychological indices measures predicted quitting activity better and the overlap between the two types of dependence is also small.

Penn State (PS) Cigarette Dependence Index consists of 10 items. Two of these were adapted from the FTND/HSI, five are from the HONC (covering difficulty quitting, experience of craving and withdrawal symptoms), two adapted from Bover *et al*^[42], and one adapted from Fiddler *et al*^[43]. Foulds *et al*^[44] reported current e-cigarette users reported being less dependent on e-cigarettes and vary by product characteristics and liquid nicotine concentration, but the dependence may increase over time. This clearly indicates that the usage of e cigarette as a substitute is no way solution to nicotine addiction and such substitution is a potential threat to tobacco endgame. So research considering this index needs recommendation based on their strong interpretation as tobacco industries may try to misinterpret such conclusion in the promotion of their brands based on considering only a part of the research.

Reasons for Smoking Scale was introduced Ikard & Tomkins in 1973 and Smoking Motives Questionnaire (SMQ) was introduced in Russell, Peto and Patel in 1974, but were overshadowed by the wide acceptance of FTQ developed during 1970's.^[45,46] SMQ consist of 34 questions and categorized smokers as stimulation, indulgent, psychosocial, sensorimotor, addictive, and automatic.

Severson Smokeless Tobacco Dependency Scale (SSTDS) is based on item response theory consisting of 7-items from the FTND, Cigarette Dependence Scale (CDS-5), and items representing behavioral aspects of smokeless tobacco (ST) dependence. The various construct included are craving (item 1), withdrawal (item 2), affective enhancement (item 3), behavioral choice (item 4), sedation (item 5), cognitive enhancement (item 6), and stimulation (item 7). The first item is dichotomized to yes and no, item 2 adapted from FTQ, item 3-5 in the time 5 point Likert scale and item 6-7 in the quantity 4 point Likert scale. A score of 9 or more is an optimal diagnostic threshold for screening ST dependence.^[47,48] It has better reliability than FTND-ST and TDS.

Glover-Nilsson Smoking Behavioral Questionnaire (GN-SBQ) is a unidimensional scale that measures the unique behavioral phenomenon of nicotine dependence. The behavior dimension is well rooted to the classical conditioning and operant conditioning theories. It predicts craving level which is one of the most problematic symptoms of nicotine withdrawal that can prevent quit attempts.^[49] Item is scored on five point Likert scale with total scores ranging from 0 to 44. Higher scores indicate greater behavioral dependence. The scores between (0-16) are low behavioral dependence, score (17-22) as intermediate dependence and score greater than 23 are high behavioral dependence. Rath *et al*^[50] failed to consider the intermediate scores in one of their study as such elimination could affect the interpretation of the study in qualitative research.

Smoking craving is measured by the Questionnaire of Smoking Urges (QSU) scale consist of 32 items consisting of 4 constructs of craving which includes anticipation of withdrawal relief, anticipation of positive outcomes of smoking, desire and intention to smoke. QSU-Brief consists of 10 items scored in 7 point Likert scale.^[51,52]

Conclusion:

The interpretation of indices produces different interpretation considering it to be unidimensional or multidimensional tool. Further caution is essential for researchers in interpretation, considering the variability produced by these scales. Implicit assumption of unidimensionality is considered in the counts of continuously scaled variable approach. The

multidimensional scales are not substitute but are certainly complementary in understanding the conceptually driven measure of multidimensional construct of addiction. This understanding is essentially important for researchers and using these indices aligned to their research questions of physiological and psychological nicotine dependence and their correlation with different attributes. The assessment of both physiological and psychological dependence helps to restructure our tobacco cessation by overcoming various perceived barriers of quitting. This also underlines the fact about multidimensionality nature of nicotine dependence and using a combination of dependence scales will enhance and improve cessation. This customized approach is based on more specific assessed needs of the patient in tobacco cessation.

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