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A Self-Administered Questionnaire to Measure Dependence on Cigarettes: The Cigarette Dependence Scale

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A valid measure of dependence on cigarettes is a useful tool for clinicians and researchers. The aim of this study was to develop a new, self-administered measure of cigarette dependence, and to assess its validity. The content of the instrument was generated in qualitative surveys. A long version (114 items) was tested on the internet in 3009 smokers. Subsamples provided retest data after 18 days ($n = 578$), follow-up data after 45 days ($n = 990$) and saliva cotinine ($n = 105$). The study resulted in a 12-item scale labelled the Cigarette Dependence Scale (CDS-12), and in a 5-item version of this scale (CDS-5). Except for tolerance, CDS-12 covers the main components of DSM-IV and ICD-10 definitions of dependence: compulsion, withdrawal symptoms, loss of control, time allocation, neglect of other activities, and persistence despite harm. CDS-5 has similar measurement properties but less comprehensive content. Both scales had a high test–retest reliability ($r \geqslant 0.83$), and a high internal consistency (Cronbach's $\alpha \geqslant 0.84$). CDS-12 scores were higher in daily smokers than in occasional smokers (+1.3SD units), and were associated with the strength of the urge to smoke during the last quit attempt ($R^2 \geqslant 0.25$), and with saliva cotinine ($R^2 \geqslant 0.17$). CDS-12 and CDS-5 scores decreased in daily smokers who switched to occasional smoking at 18-day retest. Dependence scores did not predict smoking abstinence at follow-up. In conclusion, CDS-12 and CDS-5 are reliable measures of cigarette dependence which fulfill several criteria of content validity and construct validity and are sensitive to change over time.
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Keywords: tobacco use disorder; nicotine dependence; smoking; validation studies; epidemiologic measurements; internet

INTRODUCTION

A valid measure of dependence on cigarettes is needed both for effective preventive care and for research purposes. There are two traditions of measurement in clinical sciences: the clinimetric tradition and the psychometric tradition (Wright and Feinstein, 1992). The clinimetric approach relies on doctors' expertise and patients' experience to define a set of signs and symptoms that are deemed relevant for a given disease. The logic of a clinimetric instrument is grounded in medical opinion, and the items forming the instrument can be quite disparate, as long as they are clinically connected. In contrast, the psychometric approach seeks to identify a correlated set of items that reflect, as much as possible, an unobserved latent variable. The logic of a psychometric instrument relies heavily on statistical properties, such as reliability and validity.

Thus far, addiction to cigarettes has been assessed by clinimetric scales only. The most frequently used instruments are the Fagerström Tolerance Questionnaire (FTQ),

published 25 years ago (Fagerström, 1978), a shorter version of this test, the Fagerström Test for Nicotine Dependence (FTND) (Heatherton *et al*, 1991), and a modified version of this test for adolescents (Prokhorov *et al*, 2000). These tests have several limitations. First, they fail to include important aspects of dependence, as defined in DSM-IV and ICD-10 (Etter *et al*, 1999; Moolchan *et al*, 2002). Several items of FTND are difficult to apply to moderate smokers, and the internal consistency of FTQ and FTND is low (Etter *et al*, 1999; Heatherton *et al*, 1991; Lichtenstein and Mermelstein, 1986; Pomerleau *et al*, 1990). Another published scale is based on the DSM definition of dependence (Kawakami *et al*, 1999), and two other scales also based on DSM were not published in peer-reviewed journals (Covey and Elmer, 1999; Saul Shiffman, personal communication). One scale is intended for adolescents only (DiFranza *et al*, 2002).

Other clinimetric measures are DSM-IV and ICD-10 diagnoses of tobacco dependence, which can be established through clinical interviews such as the Composite International Diagnostic Interview (CIDI) (Ustun *et al*, 1997), the Diagnostic Interview Schedule (DIS) (Johnson *et al*, 1996) or the MINI interview (Nezelof *et al*, 2001). These interviews must be administered by trained personnel, which is costly, and they identify only the presence but not the intensity of dependence.

In this study, we used a psychometric approach to develop a short, valid, self-administered, continuous measure of addiction to cigarettes, developed according to standard psychometric methods, and covering DSM-IV and ICD-10 criteria of dependence (Colby *et al*, 2000).

METHODS

Scale Development

We used a systematic approach to the development of the scale (Jackson, 1970; Streiner and Norman, 1995). First, we conducted two surveys, one by mail and the other on the internet, to collect qualitative data on dependence on cigarettes. We sent a questionnaire by mail in 1999 to a random sample of 2000 people (age range 18–70 years), drawn from the official registry of residents of Geneva, Switzerland. Only current and former smokers were invited to take part in the survey. The main purpose of this survey was to assess attitudes towards nicotine replacement therapy (Etter and Perneger, 2001a), but participants were also asked to give written answers to the following question: 'In your opinion, what signs indicate that smokers are dependent on cigarettes?' The same question was posted on the Stop-tabac.ch website between October 1999 and April 2000. We classified answers to both surveys according to their content and counted the number of citations in each category (Table 1).

Then, we used these qualitative data and the scientific literature to write 153 items (in French), following recommended rules for item writing (Nunnally and Bernstein, 1994; Streiner and Norman, 1995). We wrote items covering each dimension of DSM-IV and ICD–10 definitions of tobacco dependence and the main categories in qualitative data (American Psychiatric Association, 1994; World Health Organization, 1992). This 153-item questionnaire was split into two parts and tested in 506 and 606 smokers recruited on the internet, on www.stop-tabac.ch. At this stage, we deleted 39 items that had a high proportion of missing or 'Don't know' answers, important floor or ceiling effects, or weak associations with other indicators of dependence (cigarettes per day, minutes to first cigarette

Table I Answers to the Question: 'In your opinion, what signs indicate that smokers are dependent on cigarettes?', given by 384 Smokers and Ex-smokers Recruited by Mail, and 145 Smokers and Ex-smokers Recruited on the Internet in 1999–2000

	No. of comments	
	Mail survey	**Internet survey**
Feeling nervous, irritable, anxious, stressed, impatient, aggressive, in a bad mood when lacking cigarettes	119	12
Compulsive need to smoke, always needs to smoke, inability to resist cigarettes, urge to smoke, physical need to smoke, fear of experiencing the urge to smoke, impossible not to smoke	118	49
Smoke at precise times of the day, in precise situations, stereotypic use, automatic smoking, habit, ritual, smokes at regular intervals	109	23
Making stocks of cigarettes, always taking care of having enough cigarettes, borrowing cigarettes, always carrying cigarettes with him/her	46	19
Smoking after the meal	20	0
Smoking when stressed or when feeling nervous	20	3
Frequency of smoking, number of cigarettes per day, chain smoking, smoking more and more, smoking too much, more than × cigarettes	19	18
Smoking as soon as waking up, urge to smoke in the morning	19	14
Smoking with other smokers, when someone lights a cigarette	18	0
Feeling pleasure when smokes, cigarettes are relaxing	13	10
Going out at night or making kilometers just to buy cigarettes, needing cigarettes at any price, at any time	12	12
Smoking when drinking alcohol	11	0
Smoking to avoid boredom, or when waiting for someone	8	5
Smoking when drinking a coffee	8	0
Avoiding activities and places because smoking is prohibited, interrupting one's activity to smoke	7	12
Difficulty concentrating when deprived	6	2
Smoking in all circumstances and situations	5	3
Smoking even where it is prohibited, in any situation, or even in the presence of nonsmokers, or smoking when ill, denying the risks	4	18
Difficult to quit smoking	4	0
Tremor	4	0
Smoking in spite of the danger, costs and drawbacks of cigarettes	3	6
Cough	3	0
Being aggressive and intolerant against nonsmokers	0	4
Other	0	23
Total	576	233

of the day, 0–100 scale of self-perceived dependence, occasional *vs* daily smoking, self-perceived difficulty to quit, and the strength of the urge to smoke during the last quit attempt). We retained 114 items for the next phase. These items are available at http://www.stop-tabac.ch/fr/q-addic-round2-23.html.

Main Survey

We conducted a survey on the internet to test the psychometric properties of these 114 items, to construct shorter composite scales, and to assess the validity of these scales. Data were collected between September 2000 and June 2001. An invitation to fill the survey was sent by e-mail to 5000 smokers who participated in the 'Stop-tabac.ch' smoking cessation program (Etter and Perneger, 2001b). A link to the questionnaire was also posted on several pages of this site. The site was visited by 95 000 people during the data collection period. Only current cigarette smokers were invited to answer the questionnaire.

Questionnaire Content

Participants answered 108 of the 114 questions on 5-point Likert scales ranging from 'totally disagree' to 'fully agree' (Table 2). A sixth response option labelled 'I don't know/ Not applicable' was coded as a missing value. Other items intended to measure dependence included a 0–100 rating of one's level of dependence (Table 2); a 0–100 rating of the strength of the urge to smoke during the last quit attempt, with two anchors (Absolutely no need to smoke = 0 and 'A constant, urgent and uncontrollable need to smoke = 100'); the number of cigarettes smoked per day; the number of minutes between waking up and smoking the first cigarette of the day; whether quitting smoking would be difficult (five response options, from 'very easy' to 'impossible'); and the Fagerström test for nicotine dependence (Heatherton *et al*, 1991).

Additional questions probed whether participants had ever smoked 100 cigarettes in their lifetime (which is the criterion recommended by WHO to identify ever smokers) (World Health Organization, 1996); whether they smoked every day, occasionally (not daily) or never; whether it was likely that they would have quit smoking in 1 year from now (six response options, from 'Yes, it is very likely' to 'No, it is highly unlikely'); and the level of motivation to quit smoking (three response options: not in the next six months, in the next six months and in the next 30 days) (Prochaska *et al*, 1992). The questionnaire also covered age and sex. We recorded the date when the questionnaire was answered and the computer number of each participant to identify duplicate records. Participants who agreed to take part in a follow-up survey indicated their first name and e-mail address.

Retest

Participants who agreed were invited by e-mail to answer the same questionnaire a second time, 2 weeks after the baseline survey. To assess reliability, we computed intra-class correlation coefficients for each item and scale (Streiner and Norman, 1995) among participants who were

smokers on both occasions and who answered the retest questionnaire within 15–31 days after the baseline survey.

Follow-up

To assess whether intended measures of dependence predicted smoking cessation, participants who agreed were invited by e-mail 40 days after baseline to answer the following question by 'yes' or 'no': 'Did you smoke tobacco during the past 7 days (even one puff of cigarette, cigar, pipe, etc)?' The criterion of 1 week of abstinence was recommended by a recent guideline to assess the outcome of smoking cessation treatments (Fiore *et al*, 2000).

Saliva Cotinine

Volunteers who provided a postal address received a plastic vial for analysis of saliva cotinine (Salivette, Sarstedt, Nümbrecht, Germany). Cotinine, a major metabolite of nicotine, has a half-life of 20 h in smokers (Perez-Stable *et al*, 1995), and is stable in saliva when mailed or stored at room temperature during several days (Etter *et al*, 2000; Foulds *et al*, 1994; Greeley *et al*, 1992). The saliva samples were frozen at −20°C upon receipt and sent for cotinine analysis to ABS Laboratories (Dr Feyerabend, London). Saliva cotinine level was determined by gas–liquid chromatography (Feyerabend and Russell, 1990). Because of budget limitations, we sent vials to 300 participants only.

Factor Structure

We applied factor analysis to assess the factorial structure of the data. To assess whether the data were uni- or multifactorial, we applied Velicer's MAP test, Horn's parallel analysis, the criterion of eigenvalue > 1, and criteria of interpretability and content validity (Horn, 1965; O'Connor, 2000; Velicer, 1976).

Content Validity and Internal Consistency

To assess content validity, we compared the content of the final scale to the categories in qualitative data, and to DSM-IV and ICD-10 definitions of dependence (Table 3). We assessed whether internal consistency coefficients (Cronbach's α) of the scales exceeded 0.7, as recommended (Nunnally and Bernstein, 1994).

Construct Validity

We tested the following hypotheses to assess construct validity:

1. Dependence would be stronger in daily smokers than in occasional smokers.
   Dependence measures would be associated with:
2. the number of cigarettes smoked per day;
3. the Fagerström test for nicotine dependence (Heatherton *et al*, 1991);
4. a 0–100 rating of the urge to smoke during the last quit attempt;
5. the level of saliva cotinine.

Table 2 Characteristics of Items and Scales, and Tests of Construct Validity

	Missing+Don't know/Not applicable (%)	Percent at lowest possible value (%)	Percent at highest possible value (%)	Mean	SD	Item–scale correlation for CDS-12	Test–retest correlation	Daily vs occasional smokers a	Cotinine (ng/ml) b	Cigarettes day c	Craving 0–100 c	FTND c	Switched from daily to occasional vs daily smokers d
Self-rated dependence, 0–100 score recoded to five categories	7	2	33	3.9	1.0	0.70	0.71***	1.1***	41**	4.8***	16.0***	1.2***	−1.0***
Cigarettes per day, recoded to five categories	6	4	17	3.3	1.1	0.62	0.84***	1.3***	49***	—	8.1***	1.6***	−0.9***
Minutes to first cigarette, five categories	8	18	16	2.9	1.4	0.54	0.90***	−1.1***	41***	3.8***	5.8***	1.4***	−0.4***
smoke too much	7	1	70	4.6	0.8	0.47	0.60***	0.8***	35*	4.3***	7.2***	1.0***	−0.9***
Always cigarettes with me	7	4	51	4.2	1.1	0.55	0.67***	1.4***	26*	3.5***	7.6***	0.9***	−1.0***
Prisoner cigarettes	5	5	40	3.9	1.2	0.66	0.62***	1.1***	34**	3.5***	9.6***	0.9***	−0.8***
Quitting would be difficult	7	0	1	3.5	0.6	0.55	0.60***	0.5***	65**	5.5***	19.4***	1.6***	−0.4***
Urge to smoke after a few hours	6	4	45	4.1	1.1	0.68	0.66***	1.4***	38***	3.8***	9.5***	1.1***	−1.2***
Idea of no cigarette causes stress	4	4	45	4.1	1.1	0.65	0.66***	1.3***	31**	3.5***	9.5***	1.0***	−0.7***
Smoke all the time	6	20	18	2.9	1.4	0.67	0.73***	1.1***	23**	4.1***	6.3***	1.0***	−0.9***
Drop everything	6	16	25	3.2	1.4	0.61	0.63***	0.9***	39***	2.7***	6.0***	0.8***	−1.2***
Smoke despite risks	7	1	61	4.6	0.7	0.36	0.60***	0.3***	41*	2.7***	6.7***	0.8***	−0.7***
CDS-12	3	0	0	43.8	10.1	—	0.84***	13.0***	6***	0.7***	1.2***	0.2***	−11.2***
CDS-5	4	0	0	17.3	4.3	—	0.83***	5.7***	15***	1.7***	3.1***	0.5***	−4.8***
Fagerström test (FTND)	5	5	1	4.3	2.4	—	0.75***	2.4***	25***	2.9***	4.2***	—	−1.0***

(a) Difference between daily and occasional smokers; (b) change in saliva cotinine levels (ng/ml) per point in measures of tobacco dependence, from linear regression models; (c) change in cigarette/day, craving scores or FTND scores, per point in measures of tobacco dependence, from linear regression models; (d) difference in change over time between those who switched from daily to occasional smoking between baseline and cigarettes/day retest and those who remained daily smokers. *$p \leqslant 0.05$; **$p \leqslant 0.01$; ***$p \leqslant 0.001$.

Table 3 Items Classified According to DSM-IV and ICD-10 Categories of Dependence

DSM-IV criteria for substance dependence	ICD-10 Tobacco dependence syndrome	Main categories in qualitative data	Abbreviated items in CDS-12 and CDS-5
	1. A strong desire or sense of compulsion to take tobacco	Compulsive use	Prisoner of cigarettes
			Smokes too much
		Always carries cigarettes, makes stocks of cigarettes	Smokes all the time
			Before going out Minutes to first cigarette
1. Tolerance	4. Tolerance		No item, tolerance is assessed by repeated measures of CDS-12 or CDS-5
2. Withdrawal	3. Withdrawal when tobacco use has ceased or been reduced. Use of the substance with the intention of relieving or avoiding withdrawal symptoms	Feels nervous, irritable when lacks a cigarette	Urge to smoke
a. Characteristic withdrawal syndrome b. The substance is taken to relieve withdrawal		Smokes when stressed or feeling nervous	Idea of no cigarette Stress Minutes to first cigarette
3. The substance is often taken in larger amounts or over a longer period than was intended	2. Difficulties in controlling tobacco-taking in terms of its onset, termination, or levels of use		Smokes too much
			Prisoner of cigarettes Cigarettes per day
4. Persistent desire or unsuccessful efforts to cut down or control substance use			Smokes too much
			Quitting difficult
5. A great deal of time is spent in activities necessary to obtain the substance (eg driving long distances), or use the substance (eg chain-smoking)			Smokes all the time
6. Important social, occupational, or recreational activities are given up or reduced because of substance use	5. Neglect of alternative pleasures or interests because of substance use, increased amount of time necessary to obtain or take the substance		Drops everything
			Smokes all the time
7. Substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem caused or exacerbated by substance	6. Persisting with substance use despite clear evidence of overtly harmful consequences		Smokes despite risks
	(Narrowing of the personal repertoire of patterns of tobacco use)	Stereotypic use, automatic smoking, rituals	Before going out
		Always carries cigarettes	Smokes all the time

Sensitivity to Change

To assess whether intended measures of dependence were sensitive to change over time, we computed differences between baseline and retest for each indicator of dependence and for each participant. Then, we compared baseline–retest change scores in people who switched from daily to occasional smoking between baseline and retest ($n = 31$) and in those who remained daily smokers ($n = 664$).

Development of Multi-item Scales

To reduce the initial set of 114 items, we first determined the number of factors to retain. Then, we eliminated items that had the highest proportions of missing and 'Don't know' answers, important floor or ceiling effects, low test–retest correlations, a low loading on the main factor and weak performances on tests of construct validity. Next, we compared items that were variations of the same idea and retained only the items that performed best on tests of validity.

When the set of items was finalized, we constructed a 12-item composite scale by averaging the remaining items. We retained at least one item from each dimension of DSM–IV and ICD-10 definitions of tobacco dependence and for each of the main categories in qualitative data. We also developed a 5-item version of the scale, for use when a short scale is preferred. We verified that the final scales were unidimensional in factor analysis.

Age

Tobacco dependence may differ in teenage and adult smokers (DiFranza *et al*, 2002; McNeill *et al*, 1989; Shadel *et al*, 2000). Thus, we assessed whether the characteristics of the scales were maintained in smokers aged 12–19 ($n = 298$), comparing them with smokers aged 20–74 ($n = 2594$).

Statistical Analyses

We used univariate linear regression models to assess associations between addiction items and scales (indepen-dent variables) and continuous dependent variables, and *t*-tests to assess associations between addiction items and scales and dichotomous dependent variables.

We used interaction terms from ANOVA models to compare the strength of associations between CDS-12 and external variables in teenage smokers and adult smokers.

To assess whether the differences between test–retest correlation coefficients (r) of CDS-12, CDS-5 and FTND were statistically significant, we used Fisher's z transformation, where $z(r) = (1/2)\ln((1+r)/(1-r))$. When comparing correlation coefficients $r1$ and $r2$, a test statistic z with a normal distribution is $z = (z(r1) - z(r2))/\sqrt{1/(n1 - 3) + 1/(n2 - 3)}$. Differences are statistically significant if $z > 1.96$ (Dawson-Saunders and Trapp, 1994).

Translation into English

We conducted a rigorous translation of the instrument into English to provide researchers and clinicians with a valid translation of the scales (English version, Table 4; French version, Table 5). First, four independent translations were

Table 4 The Cigarette Dependence Scale, English-Language Version

Questions	Response options	Recoding
* 1. Please rate your addiction to cigarettes on a scale of 0–100 I am NOT addicted to cigarettes at all = 0 I am extremely addicted to cigarettes = 100	Addiction	0–20 = 1 21–40 = 2 41–60 = 3 61–80 = 4 81–100 = 5
* 2. On average, how many cigarettes do you smoke per day?	Cigarette/day	0–5 = 1 6–10 = 2 11–20 = 3 21–29 = 4 30+ = 5
* 3. Usually, how soon after waking up do you smoke your first cigarette?	Minutes	0–5 = 5 6–15 = 4 16–30 = 3 31–60 = 2 61+ = 1
* 4. For you, quitting smoking for good would be:	Impossible = 5 Very difficult = 4 Fairly difficult = 3 Fairly easy = 2 Very easy = 1	No recoding
Please indicate whether you agree with each of the following statements:		
* 5. After a few hours without smoking, I feel an irresistible urge to smoke	Totally disagree = 1 Somewhat disagree = 2 Neither agree nor disagree = 3 Somewhat agree = 4 Fully agree = 5	
6. The idea of not having any cigarettes causes me stress	As item no. 5	
7. Before going out, I always make sure that I have cigarettes with me	As item no. 5	
8. I am a prisoner of cigarettes	As item no. 5	
9. I smoke too much	As item no. 5	
10. Sometimes I drop everything to go out and buy cigarettes	As item no. 5	
11. I smoke all the time	As item no. 5	
12. I smoke despite the risks to my health	As item no. 5	
CDS-12		Sum of items 1–12
CDS-5 (items marked *)		Sum of items 1–5

Table 5 The Cigarette Dependence Scale, French Language Version

Questions	Options de réponse	Recodage
* 1. Indiquez par un chiffre entre 0 et 100 quel est votre degré de dépendance des cigarettes: Je NE suis absolument PAS dépendant des cigarettes = 0 Je suis extrêmement dépendant des cigarettes = 100	Dépendance	0–20 = 1 21–40 = 2 41–60 = 3 61–80 = 4 81–100 = 5
* 2. Combien de cigarettes fumez-vous par jour, en moyenne?	Cigarettes/jour	0–5 = 1 6–10 = 2 11–20 = 3 21–29 = 4 30+ = 5
* 3. D'habitude, combien de temps apres votre réveil fumez-vous votre première cigarette?	Minutes	0–5 = 5 6–15 = 4 16–30 = 3 31–60 = 2 61+ = 1
* 4. Pour vous, arrêter définitivement de fumer serait:	Impossible = 5 Très difficile = 4 Plutôt difficile = 3 Plutôt facile = 2 Très facile = 1	Pas de recodage
Veuillez indiquer si vous êtes d'accord avec chacune des affirmations suivantes:		
* 5. Après quelques heures passées sans fumer, je ressens le besoin irrésistible de fumer	Pas du tout d'accord = 1 Plutôt pas d'accord = 2 Plus ou moins d'accord = 3 Plutôt d'accord = 4 Tout à fait d'accord = 5	Pas de recodage
6. Je suis stressé à l'idée de manquer de cigarettes	comme item no. 5	
7. Avant de sortir, je m'assure toujours que j'ai des cigarettes sur moi	comme item no. 5	
8. Je suis prisonnier des cigarettes	comme item no. 5	
9. Je fume trop	comme item no. 5	
10. Il m'arrive de tout laisser tomber pour aller acheter des cigarettes	comme item no. 5	
11. Je fume tout le temps	comme item no. 5	
12. Je fume malgré les risques que cela entraîne pour ma santé	comme item no. 5	
CDS-12		Somme items 1–12
CDS-5 (questions marquées *)		Somme items 1–5

made by a professional translator whose first language was English and by each author. On the basis of these translations, we produced a consensus version, which was tested by people whose mother tongue was English, recruited through the internet. First, 166 people chose their preferred formulation among alternative translations of problematic items and suggested alternative formulations. Next, 73 current smokers answered the final version of the translated questionnaire.

RESULTS

Preliminary Surveys

In the mail survey, we collected 494 questionnaires from smokers and ex-smokers (25% of 2000), and 384 people (78% of 494) contributed 576 statements on cigarette dependence. In the internet survey, 145 smokers and ex-smokers contributed 233 statements on cigarette dependence (Table 1).

Participation in the Main Survey

The raw baseline database included 3653 records. We deleted 38 empty records, 179 duplicate records, 103 records of people who had smoked fewer than 100 cigarettes in their lifetime, 63 records of people who gave obviously incorrect answers ($\geqslant 150$ cigarettes/day, >1000 min before the first cigarette of the day, age <5 years), and 261 records of ex-smokers. The analyses were based on the remaining 3009 participants, and included 2876 daily smokers (96%), and 124 occasional smokers (4%). Participants who indicated a postal address ($n = 807$, 27%) came from France (56%), Switzerland (28%), Belgium (7%), Canada (3%), and other countries (6%). Participants were on average 32 years old (range 12–74) and 47% were men. Of these, 13% had no

intention to quit smoking in the next 6 months, 46% seriously considered quitting in the next 6 months, and 41% had decided to quit in the next 30 days. A total of 49% had made a 24-h quit attempt in the previous year.

Item Selection

We eliminated items with high proportions of missing and 'Don't know/Not applicable' answers and items that performed poorly on validity tests. Then, we compared items that were variations of the same idea and retained only items that performed best on validity tests. Finally, we retained 12 items because models with more items did not add to the performance of the scale, and because 12 items were sufficient to cover DSM-IV and ICD-10 definitions of dependence. Factor analysis indicated that only one factor was present in the final versions of CDS-12 and CDS-5; this factor explained 45% of total variance in CDS-12 and 55% in CDS-5.

Content Validity

Except for tolerance, all other components of DSM-IV and ICD-10 definitions of dependence, and the most frequent categories in qualitative data were covered by at least one item in CDS-12. Items that measured tolerance (eg 'I have to smoke more and more cigarettes to obtain the same effect', 'Smoking a cigarette has fewer and fewer effects on me', 'I smoke more and more cigarettes') performed poorly and were not retained. Similarly, items on feeling nervous, irritable, anxious, or in a bad mood when lacking cigarettes performed poorly on validation tests and were not retained.

Items retained in CDS-5 did not cover all DSM-IV and ICD-10 criteria of dependence, but otherwise CDS-5 performed as well on validity tests as CDS-12.

Characteristics of Items and Scales

Retained items and scales had few missing and 'Don't know/Not applicable' answers. Three items had proportions of 'Fully agree' above 50%. CDS-12 and CDS-5 were slightly skewed towards higher values (skewness = −0.98 and −0.74, respectively). For CDS-12, the observed range was 3–60 (quartiles: 38, 46, and 51). For CDS-5, the observed range was 1–25 (quartiles: 15, 18, and 20).

Internal consistency was higher for both CDS-12 ($\alpha = 0.90$) and CDS-5 ($\alpha = 0.84$) than for FTND ($\alpha = 0.66$). Item–scale correlations were all >0.5, except for the items 'I smoke in spite of the risks for my health' and 'I smoke too much', but these items were nevertheless retained in CDS-12 to preserve content validity and because of their good performance on other validity tests (Table 2).

Retest

The retest survey was answered by 772 people, but test–retest analyses were restricted to 578 participants (19% of 3009) who were still current smokers at retest and who answered 15–31 days after the baseline survey (median interval between baseline and retest = 18 days). Test–retest correlations were $\geqslant 0.60$ for all items, and $\geqslant 0.83$ for both CDS-12 and CDS-5 (Table 2). Test–retest correlation

coefficients were significantly higher for CDS-12 than for FTND ($z = 24.9$, $p < 0.001$), and they were also significantly higher for CDS-5 than for FTND ($z = 3.73$, $p < 0.001$).

Tests of Construct Validity

Daily smokers had higher scores than occasional smokers for all dependence items and scales. Expressed in terms of standard deviation (SD) units, the differences between daily and occasional smokers were of 1.3SD for CDS-12 and CDS-5, and 1.0SD for FTND. All items and scales were associated with a 0–100 rating of the strength of the urge to smoke during the last quit attempt. This association was stronger for CDS-12 ($R^2 = 0.25$) and CDS-5 ($R^2 = 0.29$) than for FTND ($R^2 = 0.18$). Finally, all items were associated with the number of cigarettes smoked per day.

Cotinine

Saliva samples were returned by 116 people (39% of 300 to whom salivettes were sent). Four vials contained an insufficient quantity of saliva for analysis, six vials were returned by ex-smokers, and one participant did not give valid answers to the questionnaire. The analysis was performed on the remaining 105 samples.

Compared to the rest of the sample, participants included in the cotinine analysis were 5 years older (37 years in the cotinine group *vs* 32 years in the no-cotinine group, $p < 0.001$) and were more likely to be men (59 *vs* 47%, $p = 0.02$), but they were as likely to have made a 24-h quit attempt in the previous year (52 *vs* 48%, $p = 0.4$) and they had similar levels of dependence (mean FTND = 4.3 in both groups, $p = 0.9$; mean CDS-12 = 46 in the cotinine group *vs* 44 in the no-cotinine group, $p = 0.08$).

All items and scales were associated with the level of saliva cotinine. CDS-5 and FTND were more strongly associated with cotinine ($R^2 = 0.21$ for both scores) than CDS-12 ($R^2 = 0.17$).

Sensitivity to Change

For all items and scales, there was a statistically significant difference in change over time in dependence scores between those who switched from daily to occasional smoking between baseline and retest and those who remained daily smokers. Expressed in terms of SD units of these scales, the between-group difference was 1.1SD for CDS-12 and CDS-5, and 0.4SD for FTND.

Cessation at Follow-Up

The follow-up e-mail on smoking abstinence was answered by 990 people (33% of 3009). The median interval between baseline and follow-up was 45 days, and 13% of participants in this analysis (129 of 990) had not smoked in the 7 days before the follow-up survey. None of the intended measures of dependence was a statistically significant predictor of smoking cessation.

The best predictors of smoking cessation were the self-perceived likelihood of being abstinent 1 year later (26% of those who answered 'Very likely' had quit smoking, *vs* 0% of those who answered 'Not at all likely', $p < 0.001$), the self-

perceived chances of success of quit attempts (20% of those who answered 'Every chance' had quit, vs 0% of those who answered 'No chance', $p < 0.001$), and the level of motivation to quit (3% quitters among smokers who had no intention to quit in the next 6 months, 7% among those who seriously considered quitting in the next 6 months, and 25% among those who had decided to quit in the next 30 days). One-third (33%) of those who had decided to quit in the next 30 days and said that they would have 'every chance' to succeed if they tried to quit had quit smoking at 45-day follow-up.

Age

Smokers aged 12–19 had lower scores than older smokers on CDS-12 (-7.7 points or 0.76SD units, $p < 0.001$), CDS-5 (-3.3 points or 0.77SD units, $p = 0.004$) and FTND (-1.2 points or 0.50SD units, $p < 0.001$). Otherwise, the characteristics of CDS-5 and CDS-12 were maintained in teenage smokers (Table 6). In particular, in smokers aged 12–19, both scales produced few missing and 'Don't know' values, had test–retest correlations ≥ 0.77, were significantly lower in occasional smokers than in daily smokers, were associated with cigarette/day, FTND and craving, and both scores decreased in smokers who switched from daily to occasional smoking between baseline and follow-up. However, the strength of most of these associations was significantly smaller in smokers aged 12–19 than in adult smokers (Table 6).

DISCUSSION

This paper reports on the development and assessment of the validity of a scale measuring addiction to cigarettes in daily and occasional cigarette smokers. We developed two versions of this scale: a 12–item version, CDS-12, which covers all the main elements of DSM-IV and ICD-10 definitions of dependence, except tolerance, and a 5-item version, CDS–5, for use in situations where a shorter questionnaire is preferable. Both scales performed well on tests of construct validity, were reliable in test–retest procedures, had a high internal consistency, and were sensitive to change over time.

Dimensions in CDS-12

Factor analyses indicated that only one dimension was present in the data. At first sight, this result may seem incompatible with DSM-IV and ICD-10, which identify a list of symptoms of tobacco dependence. However, the syndrome approach used in DSM-IV and ICD-10 does not require that symptoms of dependence should be statistically independent. On the contrary, according to these definitions, any three symptoms must be present to identify a dependent individual, which implies that these symptoms are expected to be associated. Thus, our finding of a single dimension in the dependence scale is compatible with DSM-IV and ICD-10.

CDS-12 contains at least one item for each dimension of dependence, as defined in DSM-IV and ICD-10, except for tolerance. Tolerance is the need for increased amounts of tobacco to achieve desired effects, or diminished effect with continued use of the same amount of tobacco (American Psychiatric Association, 1994). Items reflecting tolerance performed poorly on validity tests. Tolerance is a dynamic concept that can probably not be detected in a cross-sectional sample of regular adult smokers. Tolerance may be easier to detect in young smokers who are in the process of acquiring tobacco dependence.

An important category in qualitative data included feeling nervous, irritable, anxious, or in a bad mood when lacking cigarettes. This category reflects typical tobacco withdrawal symptoms (Hughes and Hatsukami, 1986). However, items measuring withdrawal performed poorly on validity tests and were not retained in the final scales. Possibly, these items lacked validity in this sample because most withdrawal symptoms are not present in current smokers, who smoke precisely to avoid these symptoms. Withdrawal symptoms are best assessed in smokers who attempt to quit, using other available scales (Hughes and Hatsukami, 1986; Patten and Martin, 1996; Shiffman and Jarvik, 1976; Welsch et al, 1999). In CDS-12, withdrawal is nevertheless assessed by at least two items (urge to smoke when abstaining and feeling stressed by the perspective of lacking cigarettes). Arguably, the item on time to the first cigarette of the day is also a measure of withdrawal, since blood levels of nicotine are lowest upon waking up. The most specific symptom of tobacco withdrawal is the urge to smoke. It is included among withdrawal symptoms in ICD-10 and DSM-III, but not in DSM–IV. Whether craving and urge to smoke are symptoms of tobacco withdrawal has been the subject of debate (Sayette et al, 2000), because craving levels are often high in current smokers (Hughes and Hatsukami, 1992). Even though craving is not included in the list of DSM-IV symptoms of nicotine withdrawal, DSM-IV nevertheless states that 'craving is an important element in nicotine withdrawal' (American Psychiatric Association, 1994, p 245).

The self-reported 0–100 rating of dependence performed well on tests of validity. Similar questions were identified as useful indicators of dependence on tobacco (DiFranza et al, 2002; Kawakami et al, 1999), alcohol (Spak and Hallstrom, 1996), and illicit drug use in adolescents (Latimer et al, 1997).

Comparison with the FTND

Both CDS-12 and CDS-5 were better than FTND at differentiating between daily and occasional smokers. They were more strongly associated with the strength of craving during the last quit attempt and with age, they had a higher test–retest reliability and a higher internal consistency, and CDS-5 was as strongly associated with saliva cotinine. Both scales were more sensitive than FTND to change over time, probably because the 'Yes–No' response options in FTND capture less variance in change over time than response options in CDS-12 and CDS-5. More importantly, FTND does not cover important aspects of dependence, as defined in DSM-IV and ICD-10, such as desire or efforts to quit smoking, withdrawal symptoms, time spent using tobacco, taking more tobacco than intended, and reduction of activities because of tobacco use (Etter et al, 1999). In addition, there is little agreement between FTND- and DSM-based measures of dependence (Moolchan et al, 2002).

Table 6 Comparison of CDS-12 and CDS-5 in Adult and Teenage Smokers

	Missing+ Don't know/Not applicable (%)	Percent at lowest possible value (%)	Percent at highest possible value (%)	Mean	SD	Test–retest correlation	Daily–occasional smokers b	Cotinine (ng/ml) b	Cigarettes/day c	Craving 0–100 c	FTND c	Switched from daily to occasional vs daily smokers d
CDS-12 in smokers aged 12–19	1.3	0.3	0.3	36.9	11.1	0.79***	10.3***	6***	0.4***	1.0***	0.1***	−7.1***
CDS-12 in smokers aged 20–74	0.4	0	0.3	44.6	9.7	0.83***	12.2***	6***	0.7***	1.3***	0.2***	−12.4***
CDS-5 in smokers aged 12–19	3.0	0.3	0.3	14.3	4.5	0.77***	4.2***	8 ns	1.1***	2.8***	0.4***	−3.5***
CDS-5 in smokers aged 20–74	1.3	0	0.3	17.6	4.1	0.83***	5.6***	15***	1.8***	3.2***	0.5***	−5.2***
p-value on diff. between age groups in characteristics of CDS-12	—	—	—	<0.001e	—	f	<0.001 g	0.75 g	<0.001 g	<0.001 g	<0.001 g	<0.001 g
p-value on diff. between age groups in characteristics of CDS-5	—	—	—	0.004e	—	f	<0.001 g	0.84 g	<0.001 g	<0.001 g	<0.001 g	<0.001 g

(a) Difference between daily and occasional smokers; (b) change in saliva cotinine levels (ng/ml) per point in measures of tobacco dependence; (c) change in cigarettes/day, craving scores or FTND scores, per point in measures of tobacco dependence, from linear regression models; (d) difference in change over time between those who switched from daily to occasional smoking between baseline and retest and those who remained daily smokers; (e) p-value from t-test; (f) z statistics based on Fisher's z transformation: $z = 0.78$ for CDS-12 and $z = 1.13$ for CDS-5 (Both $z < 1.96$, thus the difference between age groups in test–retest correlations is not statistically significant); (g) p-value based on interaction terms from Anova models. $*p \leqslant 0.05$; $**p \leqslant 0.01$; $***p \leqslant 0.001$.

Age

One in 10 participants was 19 years old or younger. Cigarette dependence scores were lower in these participants than in older smokers, which is compatible with previous research (McNeill et al, 1989). CDS-12 and CDS-5 performed adequately in teenage smokers, which suggests that these scales are useful indicators of dependence in young smokers. However, the strength of most associations between these scales and external variables was smaller in smokers aged 12–19 than in adult smokers, probably because younger smokers had lower dependence scores at baseline. A formal comparison with other dependence scales specifically intended for adolescents (DiFranza et al, 2002; Prokhorov et al, 2000) should be conducted before CDS-12 and CDS-5 can be recommended for use in adolescents.

Study Limitations

This study was conducted in a self-selected sample of internet users. Compared to a representative sample of smokers in Geneva, participants in this study were more motivated to quit smoking, more likely to have made a quit attempt in the previous year, and more dependent on tobacco (Etter et al, 1997). In a previous study, we compared smokers self-recruited on the same website to smokers recruited in a mail survey (Etter and Perneger, 2001c). The latter study showed that even though the distribution of smoking-related variables was different in the two samples, the strength of associations between smoking-related variables was similar in smokers recruited on the internet or by mail. Thus the present study, which focused on associations between indicators of dependence, should be generalizable. However, tests of CDS-12 and CDS-5 in representative samples of smokers are warranted.

None of the measures of dependence predicted smoking cessation, but motivation to quit smoking, the self-perceived likelihood of quitting smoking, and the self-perceived chances of success of quit attempts did. Similar results were also observed by other researchers (Sciamanna et al, 2000). It is possible that the follow-up interval (45 days) was too short in this study to detect an effect of dependence on abstinence, or that too few people tried to quit between baseline and follow-up. Even though other indicators of dependence predicted smoking cessation in previous reports, this association was weak (Farkas et al, 1996; Kozlowski et al, 1994). This suggests that smoking cessation relies on psychological and social processes that are fairly independent of the level of addiction (Prochaska et al, 1992).

CDS-12 has demonstrable content validity, but it does not include a measure of tolerance. However, the utility of tolerance as a criterion for defining dependence has been questioned (Perkins et al, 2001).

Saliva samples were obtained from a subsample of participants only, and this subsample included more men and slightly older people. However, the dependence level was the same in participants who provided a saliva sample and in those who did not. While selection bias may have affected our analysis, the comparability of the samples is reassuring in this regard.

In this study, we conducted a limited number of validation tests. More tests of validity should be conducted in various samples before the validity of CDS–12 and CDS–5 is fully established. Such tests could include the long-term prediction of smoking cessation and relapse, the prediction of the strength of tobacco withdrawal symptoms, and tests of whether these scales are associated with increasing tolerance in longitudinal studies of young smokers. In addition, CDS-12 and CDS-5 should be compared with available measures of dependence along several criteria, including agreement with DSM-based diagnostic interviews, as in the study by Moolchan et al (2002).

We conclude that CDS-12 and CDS-5 are reliable measures of cigarette dependence that fulfill criteria of content validity and construct validity and are sensitive to change over time. These scales should be useful both for research on addiction to cigarettes and for clinical interventions among smokers.

COMPETING INTERESTS

JFE was reimbursed by Pharmacia Inc., a producer of nicotine replacement products, for attending international conferences, and was paid by Novartis to give lectures on smoking cessation. The Institute of Social and Preventive Medicine at the University of Geneva received financial support from Novartis to develop an education program for users of nicotine replacement products. JLH works with Pharmacia In.

REFERENCES

American Psychiatric Association (1994). *Diagnostic and Statistical Manual of Mental Disorders —Fourth Edition (DSM-IV)*. American Psychiatric Association: Washington DC.

Colby SM, Tiffany ST, Shiffman S, Niaura RS (2000). Measuring nicotine dependence among youth: a review of available approaches and instruments. *Drug Alcohol Depend* **59**(Suppl 1): S23–S39.

Covey LS, Elmer L (1999). The structure and validity of the DSM-IV criteria for nicotine dependence (Abstract). *Nicotine Tobacco Res* **1**: 190.

Dawson-Saunders B, Trapp RG (1994). *Basic and Clinical Biostatistics*. Appleton & Lange: Norwalk, CT, p 165.

DiFranza JR, Savageau JA, Fletcher K, Ockene JK, Rigotti NA, McNeill AD et al (2002). Measuring the loss of autonomy over nicotine use in adolescents: the DANDY (Development and Assessment of Nicotine Dependence in Youths) study. *Arch Pediatr Adolesc Med* **56**: 397–403.

Etter JF, Duc TV, Perneger TV (1999). Validity of the Fagerstrom test for nicotine dependence and of the Heaviness of Smoking Index among relatively light smokers. *Addiction* **94**: 269–281.

Etter JF, Perneger TV (2001a). Attitudes toward nicotine replacement therapy in smokers and ex-smokers in the general public. *Clin Pharmacol Ther* **69**: 175–183.

Etter JF, Perneger TV (2001b). Effectiveness of a computer-tailored smoking cessation program: a randomized trial. *Arch Intern Med* **161**: 2596–2601.

Etter JF, Perneger TV (2001c). A comparison of cigarette smokers recruited through the Internet or by mail. *Int J Epidemiol* **30**: 521–525.

Etter JF, Perneger TV, Ronchi A (1997). Distributions of smokers by stage: international comparison and association with smoking prevalence. *Prev Med* **26**: 580–585.

Etter JF, Vu Duc T, Perneger TV (2000). Saliva cotinine levels in smokers and nonsmokers. *Am J Epidemiol* **151**: 251–258.

Fagerström KO (1978). Measuring degree of physical dependence to tobacco smoking with reference to individualization of treatment. *Addict Behav* **3**: 235–241.

Farkas AJ, Pierce JP, Zhu SH, Rosbrook B, Gilpin EA, Berry C (1996). Addiction versus stages of change models in predicting smoking cessation. *Addiction* **91**: 1271–1280.

Feyerabend C, Russell MA (1990). A rapid gas–liquid chromatographic method for the determination of cotinine and nicotine in biological fluids. *J Pharm Pharmacol* **42**: 450–452.

Fiore MC, Bailey WC, Cohen JJ (2000). *Treating Tobacco Use and Dependence. Clinical Practice Guideline*. US Department of Health and Human Services: Rockville, MD, USA.

Foulds J, Bryant A, Stapleton J, Jarvis MJ, Russell MA (1994). The stability of cotinine in unfrozen saliva mailed to the laboratory (letter). *Am J Public Health* **84**: 1182–1183.

Greeley DA, Valois RF, Bernstein DA (1992). Stability of salivary cotinine sent through the U.S. mail for verification of smoking status. *Addict Behav* **17**: 291–296.

Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO (1991). The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *Br J Addict* **86**: 1119–1127.

Horn JL (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika* **30**: 179–185.

Hughes JR, Hatsukami DK (1986). Signs and symptoms of tobacco withdrawal. *Archi Gen Psychiatry* **43**: 289–294.

Hughes JR, Hatsukami DK (1992). The nicotine withdrawal syndrome: a brief review and update. *Int J Smoking Cessation* **1**: 21–26.

Jackson DN (1970). A sequential system for personality scale development. In: Spielberger CD (ed). *Current Topics in Clinical and Community Psychology*. Vol. 2. Academy Press: New York, pp 61–96.

Johnson EO, Breslau N, Anthony JC (1996). The latent dimensionality of DIS/DSM-III-R nicotine dependence: exploratory analyses. *Addiction* **91**: 583–588.

Kawakami N, Takatsuka N, Inaba S, Shimizu H (1999). Development of a screening questionnaire for tobacco/nicotine dependence according to ICD-10, DSM-III-R, and DSM-IV. *Addict Behav* **24**: 155–166.

Kozlowski LT, Porter CQ, Orleans CT, Pope MA, Heatherton T (1994). Predicting smoking cessation with self-reported measures of nicotine dependence: FTQ, FTND, and HSI. *Drug Alcohol Depend* **34**: 211–216.

Latimer WW, Winters KC, Stinchfield RD (1997). Screening for drug abuse among adolescents in clinical and correctional settings using the problem-oriented screening instrument for teenagers. *Am J Drug Alcohol Abuse* **23**: 79–98.

Lichtenstein E, Mermelstein RJ (1986). Some methodological cautions in the use of the Tolerance questionnaire. *Addict Behav* **11**: 439–442.

McNeill AD, Jarvis MJ, Stapleton JA, West RJ, Bryant A (1989). Nicotine intake in young smokers: longitudinal study of saliva cotinine concentrations. *Am J Public Health* **79**: 172–175.

Moolchan ET, Radzius A, Epstein DH, Uhl G, Gorelick DA, Cadet JL et al (2002). The Fagerstrom Test for Nicotine Dependence and the Diagnostic Interview Schedule: do they diagnose the same smokers? *Addict Behav* **27**: 101–113.

Nezelof S, Taccoen Y, Corcos M, Girardon N, Perez-Diaz F, Bizouard P et al (2001). Drug use in a declared non-addicted sample and comorbidity. A survey in 860 French-speaking subjects. *Ann Med Intern* **152**: 18–25.

Nunnally JC, Bernstein IH (1994). *Psychometric Theory*. 3rd ed. McGraw-Hill: New York.

O'Connor BP (2000). SPSS and SAS programs for determining the number of components using parallel analysis and velicer's MAP test. *Behav Res Methods Instrum Comput* **32**: 396–402.

Patten CA, Martin JE (1996). Measuring tobacco withdrawal: a review of self-report questionnaires. *J Subst Abuse* **8**: 93–113.

Perez-Stable EJ, Benowitz NL, Marin G (1995). Is serum cotinine a better measure of cigarette smoking than self-report? *Prev Med* **24**: 171–179.

Perkins KA, Gerlach D, Broge M, Grobe JE, Sanders M, Fonte C et al (2001). Dissociation of nicotine tolerance from tobacco dependence in humans. *J Pharmacol Exp Ther* **296**: 849–856.

Pomerleau CS, Pomerleau OF, Majchrzak MJ, Kloska DD, Malakuti R (1990). Relationship between nicotine tolerance questionnaire scores and plasma cotinine. *Addict Behav* **15**: 73–80.

Prochaska JO, DiClemente CC, Norcross JC (1992). In search of how people change. Applications to addictive behaviors. *Am Psychol* **47**: 1102–1114.

Prokhorov AV, De Moor C, Pallonen UE, Hudmon KS, Koehly L, Hu S (2000). Validation of the modified Fagerstrom tolerance questionnaire with salivary cotinine among adolescents. *Addict Behav* **25**: 429–433.

Sayette MA, Shiffman S, Tiffany ST, Niaura RS, Martin CS, Shadel WG (2000). The measurement of drug craving. *Addiction* **95**(Suppl 2): S189–S210.

Sciamanna CN, Hoch JS, Duke GC, Fogle MN, Ford DE (2000). Comparison of five measures of motivation to quit smoking among a sample of hospitalized smokers. *J Gen Intern Med* **15**: 16–23.

Shadel WG, Shiffman S, Niaura R, Nichter M, Abrams DB (2000). Current models of nicotine dependence: what is known and what is needed to advance understanding of tobacco etiology among youth. *Drug Alcohol Depend* **59**(Suppl 1): S9–S22.

Shiffman SM, Jarvik ME (1976). Smoking withdrawal symptoms in two weeks of abstinence. *Psychopharmacology (Berl)* **50**: 35–39.

Spak F, Hallstrom T (1996). Screening for alcohol dependence and abuse in women: description, validation, and psychometric properties of a new screening instrument, SWAG, in a population study. *Alcohol Clin Exp Res* **20**: 723–731.

Streiner DL, Norman GR (1995). *Health Measurement Scales A Practical Guide to their Development and Use*. 2nd ed. Oxford University Press: Oxford.

Ustun B, Compton W, Mager D, Babor T, Baiyewu O, Chatterji S et al (1997). WHO Study on the reliability and validity of the alcohol and drug use disorder instruments: overview of methods and results. *Drug Alcohol Depend* **47**: 161–169.

Velicer WF (1976). Determining the number of components from the matrix of partial correlations. *Psychometrika* **41**: 321–337.

Welsch SK, Smith SS, Wetter DW, Jorenby DE, Fiore MC, Baker TB (1999). Development and validation of the Wisconsin Smoking Withdrawal Scale. *Exp Clin Psychopharmacol* **7**: 354–361.

World Health Organization (1992). *The ICD-10: Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines*. World Health Organization: Geneva.

World Health Organization (1996). *Guidelines for Controlling and Monitoring the Tobacco Epidemic*. World Health Organization: Geneva.

Wright JG, Feinstein AR (1992). A comparative contrast of clinimetric and psychometric methods for constructing indexes and rating scales. *J Clin Epidemiol* **45**: 1201–1218.