Assessment of Behavioral Dependence With the Glover-Nilsson Test in Smoking Cessation Treatment

I. Nerín,[a] A. Crucelaegui,[b] P. Novella,[b] A. Beamonte,[c] N. Sobradiel,[b] V. Bernal,[b] and P. Gargallo[c]

[a]Departamento de Medicina y Psiquiatría. Unidad de Tabaquismo FMZ, Facultad de Medicina, Universidad de Zaragoza, Zaragoza, Spain.
[b]Unidad de Tabaquismo FMZ, Facultad de Medicina, Universidad de Zaragoza, Zaragoza, Spain.
[c]Departamento de Métodos Estadísticos, Escuela Universitaria de Estudios Empresariales, Universidad de Zaragoza, Zaragoza, Spain.

OBJECTIVE: To assess behavioral dependence using the Glover-Nilsson test and determine its association with successful smoking cessation.

MATERIAL AND METHODS: An analytical longitudinal study was carried out, the target population of which consisted of smokers who enrolled in a smoking cessation clinic for treatment. The following variables were examined: age, sex, nicotine dependence (Fagerström test), psychoactive drug use, prior attempts at quitting, and behavioral dependence measured with the Glover-Nilsson test. The most recent version of this test is an 11-item questionnaire which classifies behavioral dependence according to the scores obtained: mild (<12), moderate (12-22), severe (23-33), and very severe (>33). Successful cessation was defined as self-reported abstinence confirmed by measurement of expired CO level (≤10 ppm). Results were expressed as means (SD) for quantitative variables and percentages and absolute frequencies for qualitative variables.

RESULTS: The study population consisted of 167 smokers —89 men (53.3%) and 78 women (46.7%)—with a mean age of 43.5 (9.9) years, a nicotine dependence score (Fagerström test) of 6.5 (2.2) points, and a Glover-Nilsson score of 23.3 (6.6). Of the study population, 65.9% (n=110) had made previous attempts at quitting. Abstinence at 3 months was 55.1% (n=92). Differences between the sexes were found for age and previous attempts at quitting. Younger patients had higher scores on the Glover-Nilsson test and the Fagerström test and lower abstinence rates.

CONCLUSIONS: Severe behavioral dependence can result in less successful cessation outcome. All aspects related to dependence must be assessed to help select the most adequate pharmacological and psychological treatment for results to be optimized.

Key words: *Smoking. Nicotine addiction. Smoking cessation. Glover-Nilsson test.*

Evaluación de la dependencia psicológica mediante el test de Glover-Nilsson en el tratamiento del tabaquismo

OBJETIVO: Evaluar la dependencia psicológica mediante el test de Glover-Nilsson y establecer su relación con el éxito al finalizar el tratamiento.

MATERIAL Y MÉTODOS: Se ha realizado un estudio analítico longitudinal, cuya población objetivo han sido los fumadores que accedieron a una unidad de tabaquismo para deshabituación tabáquica. Se estudiaron las siguientes variables: edad, sexo, dependencia a la nicotina (test de Fagerström), consumo de psicofármacos, intentos previos de cesación y dependencia psicológica mediante el test de Glover-Nilsson. Este cuestionario, en su versión más reciente, consta de 11 ítems y clasifica la dependencia psicológica, según la puntuación obtenida, en leve (< 12), moderada (12-22), fuerte (23-33) y muy fuerte (> 33). Se consideró éxito la abstinencia autodeclarada confirmada con cooximetría (monóxido de carbono ≤ 10 ppm). Los resultados se expresan como medias ± desviación estándar (variables cuantitativas) y como proporciones y frecuencias absolutas (variables cualitativas).

RESULTADOS: La población de estudio estaba compuesta por 167 fumadores —89 varones (53,3%) y 78 mujeres (46,7%)—, con una edad media de 43,5 ± 9,9 años, dependencia a la nicotina (test de Fagerström) de 6,5 ± 2,2 puntos y media en el test de Glover-Nilsson de 23,3 ± 6,6 puntos. El 65,9% (n = 110) había hecho intentos previos para dejar de fumar. El éxito a los 3 meses fue del 55,1% (n = 92). Según el sexo, se observaron diferencias en la edad y en la existencia de intentos previos. Los individuos más jóvenes obtuvieron mayor puntuación en el test de Glover-Nilsson y en el test de Fagerström y presentaron una menor tasa de éxito.

CONCLUSIONES: La elevada dependencia psicológica puede condicionar peores resultados en el éxito de la deshabituación. Es necesario valorar todos los aspectos relacionados con la dependencia, ya que puede ayudar a seleccionar el tratamiento farmacológico y psicológico más adecuado para optimizar los resultados.

Palabras clave: *Tabaquismo. Adicción a la nicotina. Deshabituación tabáquica. Test de Glover-Nilsson.*

Introduction

Nicotine is considered a highly addictive substance.[1] Nicotine dependence and abstinence syndrome are considered smoking derived disorders as stated in the

Correspondence: Dra. I. Nerín.
Departamento de Medicina y Psiquiatría. Facultad de Medicina, edificio B. Domingo Miral, s/n. 50009 Zaragoza. España.
E-mail: isabelne@unizar.es

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fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* of the American Psychiatric Association.[2] Nicotine acts on the central nervous system by binding to nicotine receptors in the presynaptic region. This triggers the release of transmitters such as acetylcholine, dopamine, noradrenaline, serotonin, and beta-endorphin, among others. Nicotine, which acts on the transmission of dopamine and noradrenaline, mediates their gratifying effects; signs and symptoms of withdrawal develop in relation to adaptive responses in these neurological systems after repeated nicotine doses.[3-5]

In addition to the physical dependence derived from the continuous administration of nicotine, smokers develop behavioral dependence—also called psychosocial or psychological dependence—when they use cigarette smoking to cope with situations of varying degrees of stress and when they associate smoking with certain social situations.[6] All components of dependence are interrelated so smoking behavior continues due to both the physical effects of nicotine use and the psychological effects of smoking.[7]

The Fagerström test is currently widely used to measure physical dependence.[8] Several studies have associated the degree of dependence measured by this test with successful smoking cessation and with the selection of appropriate pharmacological treatment.[9-12] The assessment of behavioral dependence, however, is not as well established, and although some authors have studied behavioral dependence on smoking,[13,14] its association with smoking cessation treatment outcomes and its influence on treatment selection have not yet been determined. Several manuals include the Glover-Nilsson test to measure behavioral dependence in the assessment of smoking[6,15] but no studies have examined its clinical usefulness in Spain.

The objective of this study was to assess the behavioral dependence of smokers undergoing treatment at a smoking cessation clinic using the Glover-Nilsson test and to determine the relation between scores on the test and successful cessation.

Material and Methods

A longitudinal analysis was performed on a population of smokers starting treatment at a smoking cessation clinic. Each patient was interviewed to determine his or her smoking history, pharmacological treatment was subsequently agreed on, and structured psychological treatment was started. Psychological treatment consisted of 9 group sessions of cognitive behavioral therapy over 3 months.

Enrollment criteria consisted of being a smoker, personally seeking smoking cessation treatment, and giving written consent to the treatment program. Exclusion criteria were serious psychiatric disorders, other active drug addictions, and/or pregnancy. Characteristics of the population seeking treatment have been described in earlier studies.[16]

Study variables were age, sex, nicotine dependence measured by the Fagerström test,[8] psychoactive drug use, previous attempts at quitting, and behavioral dependence measured by the Glover-Nilsson test. Successful cessation on treatment completion was defined as self-reported abstinence confirmed by measurement of expired CO level (≤10 ppm); CO was measured with a Mini Smokerlyzer CO-oximeter (Bedford Scientific Ltd, Rochester, UK).[17]

During the first group session, held the day before quitting smoking, patients answered the Glover-Nilsson Smoking Behavioral Questionnaire.[18] Given doubts arising because of variation in the application of the questionnaire reported in several smoking addiction manuals and the scarce literature on its use,[6,15,16] we made contact with an author of the test[19] (E.D. Glover, professor at West Virginia University). He recommended using the latest version, shown in its translated form in the Appendix. The recommended version consists of 11 items rather than 18 items as in the previous version and classifies behavioral dependence according to the score obtained into mild (<12), moderate (12-22), strong (23-33), and very strong (>33).

Statistical Analysis

The statistical program SPSS 11.5 for Windows was used for the analysis and an initial descriptive study was made of all the variables. Results were expressed as means (SD) for quantitative variables and percentages and absolute frequencies for qualitative variables. The relationships between the variables and the Glover-Nilsson test scores were analyzed using the Student *t* test and scatterplots. Finally, the relation between the Fagerström test and age on the one hand and scores for the 4 categories of the Glover-Nilsson test was studied using analysis of variance (ANOVA). Tamhane T2 and least significant difference tests were applied for post hoc multiple comparisons. A *P* value less than or equal to .05 was considered significant.

Results

The population consisted of 167 smokers—89 men (53.3%) and 78 women (46.7%)—with a mean (SD) age of 43.5 (9.9); nicotine dependence according to the Fagerström test was 6.5 (2.2) points, and the mean score on the Glover-Nilsson test was 23.3 (6.6). Of the population studied, 65.9% (n=110) had made previous attempts at quitting and 34.1% (n=57) had not. Successful cessation, defined as self-reported abstinence confirmed by measurement of expired CO level (≤10 ppm) after completing the 3-month treatment, was 55.1% (n=92).

There were significant sex-related differences for age (women being younger) and previous attempts at quitting (73% of men making attempts compared with 57.7% of women) (*P*=.04 in both cases). There were no differences between men and women for the Fagerström test scores or the Glover-Nilsson test scores (Table 1), nor in success rates at 3 months (Table 2).

The relation between behavioral dependence, measured with the Glover-Nilsson test, and the other variables was examined post hoc. Table 3 shows that there were no significant differences for sex, prior attempts at quitting, psychoactive drug use, and success after 3 months' treatment. Figure 1 shows a scatterplot of age against Glover-Nilsson scores, which tended to

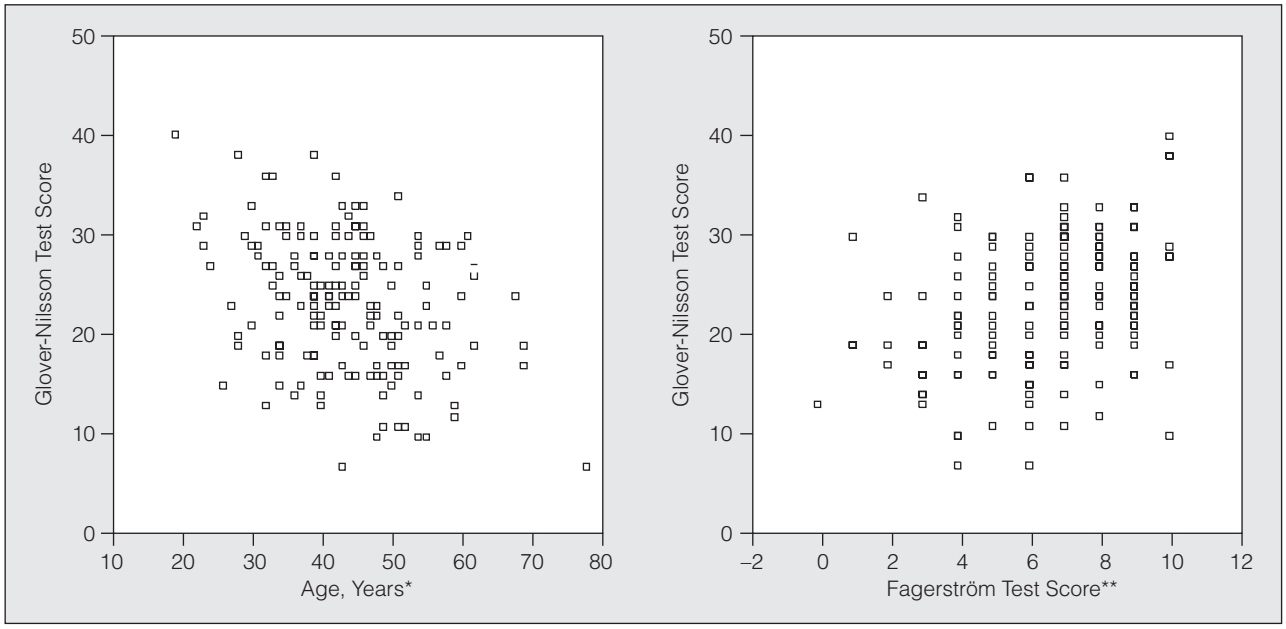

Figure 1. Scatterplots showing age plotted against Glover-Nilsson test scores and Fagerström test scores. *Correlation coefficient, –0.328. **Correlation coefficient, 0.342.

TABLE 1
Differences by Sex for Quantitative Variables*

	Men	Women	*P*
Age, years	45 (10.1)	41.7 (9.5)	.028
Fagerström test	6.5 (2.3)	6.5 (2.1)	NS
Glover-Nilsson test	22.5 (6.3)	24.2 (6.9)	NS

*Data are expressed as means (SD).

TABLE 2
Differences by Sex for Success at 3 Months*

	Success at e Months
Total	55.1% (n=92)
Men	51.7% (n=46)
Women	59.0% (n=46)

*Differences were not significant.

TABLE 3
Mean Scores of the Glover-Nilsson Test, by Qualitative Variables*

	Mean Score
Sex	
Men	22.5 (6.3)
Women	24.2 (6.4)
Psychoactive drug use	
No	23.5 (6.7)
Yes	22.4 (6.2)
Prior attempts	
No	23.2 (6.3)
Yes	23.3 (6.8)
Success at 3 months	
No	23.5 (7.2)
Yes	23.1 (6.1)

*Differences were not significant.

decrease with age, and a plot of age against Fagerström test scores, which tended to increase with age (correlation coefficients –0.328 and 0.342 respectively). As the same mathematical function could not be fit to the data distribution, the Glover-Nilsson test scores were broken down for analysis by categories (mild, moderate, strong, very strong), the distribution of the study population into the 4 levels being shown in Figure 2. Table 4 shows that distribution along with the mean ages and Fagerström scores for each category. Highly significant differences were observed in the ANOVA ($P<.001$). The comparison of means showed differences between all Glover-Nilsson test categories in relation to the age variable. In relation to the Fagerström score variable, mean Glover-Nilsson test scores were different only between the central behavioral dependence categories (moderate and strong) (Figure 3). The results in Table 4 suggested that there was a tendency for

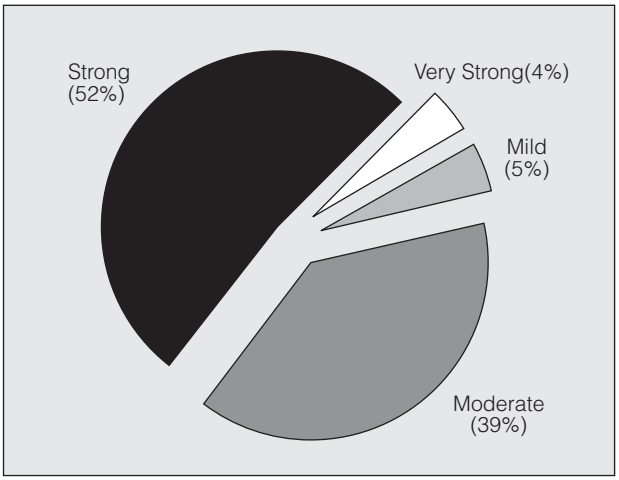

Figure 2. Percentage distribution of score categories of the Glover-Nilsson test.

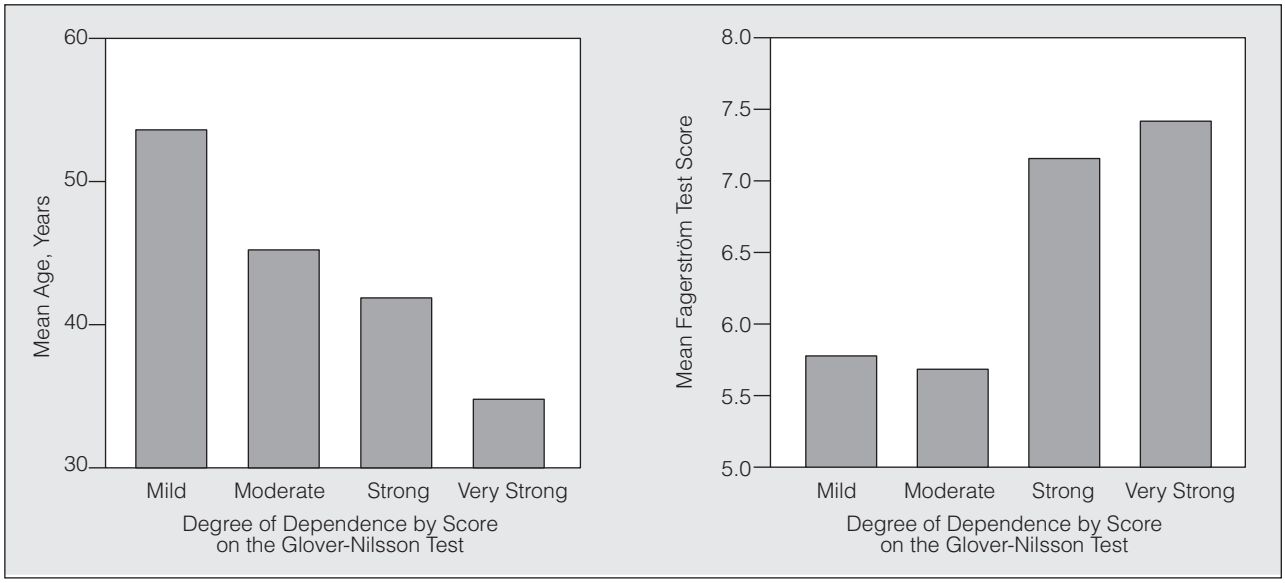

Figure 3. Bar graphs showing mean age and Fagerström test scores, each in relation to levels of behavioral dependence indicated by Glover-Nilsson test score categories.

younger patients to score higher on both the Glover-Nilsson and Fagerström tests. Scores on both tests decreased with age although the decline was not as sharp on the Fagerström test.

Given that age was the variable that showed the strongest relation with the Glover-Nilsson test, the relation between age and success at 3 months was analyzed. The age variable was symmetric (mean: 43, median: 43), so analysis of success after 3 months' treatment, in function of Glover-Nilsson test scores, was performed for 2 groups: patients 43 years old or older and patients younger than 43 years. Younger patients were shown to have higher Glover-Nilsson test scores (*P*=.008) and a lower success rate (*P*=.02) (Table 5).

TABLE 4
Distribution by the 4 Glover-Nilsson Dependency Categories on Which ANOVA Was Based: Frequencies, Mean Scores on the Fagerström Test, and Mean Age

Glover-Nilsson Test	Patients, No. (%)	Mean Score in Fagerström Test*	Mean Age, Years*
Mild	8 (5)	5.8 (2.1)	53.8 (10.5)
Moderate	65 (39)	5.7 (2.3)	45.2 (9.7)
Strong	87 (52)	7.1 (1.8)	41.9 (9.1)
Very strong	7 (4)	7.4 (2.7)	34.7 (10.3)

*SD shown between parentheses.

TABLE 5
Glover-Nilsson Test Scores in Relation to Success at 3 Months With Age Grouping

	Glover-Nilsson Test	Success at 3 Months
Age ≤43 years	24.6 (6.7)	46.6%
Age >43 years	21.9 (6.7)	64.6%
P	.008	.02

Discussion

Our results show a relation between age and the Glover-Nilsson test scores that is apparent in several kinds of analysis. When the population was studied according to age groups (using age 43 years as the cut point), younger patients were seen to have higher behavioral dependence scores and lower rates of success on treatment completion (Table 5). When patients were classified into the 4 categories of the Glover-Nilsson test (mild, moderate, strong, very strong) for analysis, the same relation with age was observed (Table 4). In this case we found a direct relation between the Fagerström and the Glover-Nilsson tests, higher scores in the first corresponding with higher scores in the second. These results suggest that physical and behavioral dependence are not independent conditions but rather different facets of the same condition: nicotine dependence. The study population, however, presented moderate nicotine dependence according to the Fagerström test (6.5) and strong dependence according to the Glover-Nilsson test (23.3). We do not think that these results are in disagreement as the 2 tests have different scales of measurement and in fact they support the affirmation that they measure different facets of dependence. Furthermore, a moderate to strong degree of nicotine dependence has been described as characteristic of the population of smokers who seek treatment.[20]

Nicotine dependence is a complex condition involving pharmacological and nonpharmacological factors. The determinant among the former is the addictive capacity of nicotine, a psychoactive substance which produces positive reinforcement (improving concentration and the feeling of wellbeing) and negative reinforcement (removing withdrawal syndrome

symptoms).[21-23] Among the nonpharmacological factors are patient characteristics and behavioral learning through a process of conditioning which establishes the relation between multiple cues and smoking cigarettes. Dependence is normally measured with the Fagerström test alone, although assessing such a complex condition should probably involve use of additional instruments of measurement.

The high degree of dependence among the youngest patients, who had the highest scores on both tests, could explain the lower success rate in this group. This result could also reflect the changes described as occurring in smoking populations whereby a reduction in prevalence produces an increase in the degree of dependence of the people who continue to smoke.[20]

We found a difference between the sexes regarding age and number of prior attempts and a direct relation between age and prior attempts: the older the person the more attempts at quitting smoking. Quitting smoking is not a dichotomous process but rather one of changes the smoker goes through over several years before finally managing to quit.[24,25] This means that a smoker who decides to quit and then relapses will try to quit again in the future. Several authors have observed that female smokers seeking treatment are younger than males,[26,27] as we found in our study. This indicates that women decide to quit smoking younger than men and start the process of change earlier, although this aspect must be confirmed by further studies examining gender.

Other gender differences indicated by some authors suggest that women have greater behavioral dependence as they have lower scores in the Fagerström test and higher scores in the Glover-Nilsson test.[27] Lower rates of success at quitting have also been described for women,[27] a result which could be related to differences described between men and women regarding nicotine dependence. In our study, however, we did not find sex differences on either test measuring dependence.

If we consider the relation we found between dependence and age, and that the group of women were younger than the men, we might perhaps assume that the difference is more influenced by age than by sex; in other words, the conditioning factor is not whether you are a man or a woman but whether you are older or younger. Several studies have found age to be a prognostic factor for quitting smoking[28,29] reinforcing the idea that age conditions smoking cessation more than gender does.

Our results indicate that more studies on assessment of smokers and in particular with the Glover-Nilsson test need to be undertaken; we recommend the latest version, as the authors themselves did to us. Like other addictive behavior, smoking must be assessed before, during, and after treatment, as well as after follow-up.[30] Likewise, all aspects related to dependence must be assessed when starting smoking cessation treatment in order to select the most appropriate pharmacological and psychological treatment for results to be optimized.

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APPENDIX

Spanish Version of the 11-Item Glover-Nilsson Test*

¿Cuánto valora lo siguiente? (peguntas 1 a 2)					
Por favor, seleccione la respuesta haciendo un círculo en el lugar indicado 0 = nada en absoluto; 1 = algo; 2 = moderadamente; 3 = mucho; 4 = muchísimo					
1. Mi hábito de fumar es muy importante para mí	0	1	2	3	4
2. Juego y manipulo el cigarrillo como parte del ritual del hábito de fumar	0	1	2	3	4
¿Cuánto valora lo siguiente? (Preguntas 3 a 11)					
Por favor, seleccione la respuesta haciendo un círculo en el lugar indicado 0 = nunca; 1 = raramente; 2 = a veces; 3 = a menudo; 4 = siempre					
3. ¿Suele ponerse algo en la boca para evitar fumar?	0	1	2	3	4
4. ¿Se recompensa a sí mismo con un cigarrillo tras cumplir una tarea?	0	1	2	3	4
5. Cuando no tiene tabaco, ¿le resulta difícil concentrarse y realizar cualquier tarea?	0	1	2	3	4
6. Cuando se halla en un lugar en el que está prohibido fumar, ¿juega con su cigarrillo o paquete de tabaco?	0	1	2	3	4
7. ¿Algunos lugares o circunstancias le incitan a fumar: su sillón favorito, el sofá, la habitación, el coche o la bebida (alcohol, café, etc.)?	0	1	2	3	4
8. ¿Se encuentra a menudo encendiendo un cigarrillo por rutina, sin desearlo realmente?	0	1	2	3	4
9. ¿A menudo se coloca cigarrillos sin encender u otros objetos en la boca (bolígrafos, palillos, chicles, etc.) y los chupa para relajarse del estrés, la tensión, la frustración, etc.?	0	1	2	3	4
10. ¿Parte de su placer de fumar procede del ritual que supone encender un cigarrillo?	0	1	2	3	4
11. Cuando está solo en un restaurante, parada de autobús, fiesta, etc., ¿se siente más seguro, a salvo o más confiado con un cigarrillo en las manos?	0	1	2	3	4

*The questionnaire shown a Spanish manual version.[6]

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