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A comparison of the Fagerström Test for Nicotine Dependence and smoking prevalence across countries

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Abstract

Aims—To examine the correlation between the Fagerström Test for Nicotine Dependence (FTND) score and smoking prevalence across countries.

Design—Cross-sectional study.

Setting—Fifteen studies from 13 countries with FTND score data.

Participants—Samples of smokers were identified through systematic literature searches, web queries and colleagues. Smokers were considered representative of their country's smoking population if they were drawn from population-based sources, were not seeking smoking cessation treatment and did not have significant comorbidities. Smoking prevalence data were derived from the study itself or the country's population rate of daily smoking for the study year.

Measurements—A Pearson correlation coefficient was used to examine the direction and magnitude of the correlation between FTND score and smoking prevalence across countries.

Findings—FTND scores ranged from 2.8 to 4.6. Smokers in Germany and Norway had the lowest FTND scores, while smokers in Sweden and the United States had the highest FTND scores. The prevalence of daily smoking in these countries was very different: 37% and 30% in Germany and Norway, 19% and 16% in the United States and Sweden, respectively. An inverse correlation towards higher FTND scores in countries with lower smoking prevalence was found (r = -0.73, P = 0.001). Current smokers had higher FTND scores than former smokers.

Conclusions—The significant inverse correlation between FTND score and smoking prevalence across countries and higher FTND score among current smokers supports the idea that remaining smokers may be hardening. Less dependent smokers may quit more easily and remaining dependent smokers may need more intensive treatment.

Keywords

Correlation; country; FTND score; hardening; nicotine dependence; smoking prevalence

INTRODUCTION

For some time, smokers have been pressured to stop smoking and it has been suggested that current smokers might be more dependent than former smokers, as less dependent smokers can quit more easily [1]. Termed the ‘hardening hypothesis’ it is currently being debated,

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particularly in the United States, where the smoking prevalence dropped significantly over the last decades but has plateaued in recent years [2,3]. Empirical and observational evidence support that today's smoking population contain groups of smokers for whom it is harder to quit, potentially because they have a higher degree of nicotine dependence. Irvin & Brandon demonstrated that smoking quit rates have declined over time in the United States, suggesting that today's smokers are more difficult to help [4]. Differences in personal characteristics between current and former smokers have been reported where socio-economic status and educational attainment are lower and psychiatric comorbidities are higher among current smokers [2,5,6]. Consistent with this evidence, the first author (K. F.) has observed a change in the smoking cessation patient population in Sweden since 1975. With the continuous decline in cigarette smoking over time among Swedish men [7], he has noticed that the remaining smokers are more likely to be single, less educated, of lower income and report more alcohol consumption, chronic pain conditions, depression, unemployment and sick leave. Finally, Hughes & Brandon [3] proposed that future smokers might be more dependent and thereby contribute to a hardening of the smoking population because the same social pressures that urge the less-dependent smokers to quit would prevent those who find nicotine less reinforcing from starting smoking [8].

Contrary to the ‘hardening hypothesis’, O'Connor reported recently that the number of cigarettes and nicotine intake had decreased in parallel when they compared two American smoking populations in 1988–94 and 1999–2002 [9]. These data are inconsistent with the hypothesis that the remaining population of smokers is becoming more dependent on nicotine over time, as they are smoking fewer cigarettes and nicotine intake also decreased. If there is such a thing as a ‘hardening target’ of smokers it should be examined by country, as countries differ dramatically in their antismoking climates. In some countries, the prevalence of cigarette smoking has just started to decline while it has more than halved in countries such as the United States and Sweden. Antismoking climates around the world have been assessed and countries in Europe with strong antismoking climates include Ireland, the United Kingdom and Sweden, while the Mediterranean and German-speaking countries generally have less developed antismoking climates [10,11].

In this report we present the available data on degree of dependence as assessed by the Fagerström Test for Nicotine Dependence (FTND) [12] among samples of smokers from around the world. The objectives of this report were: (i) to compile existing data on FTND score and smoking prevalence by country; (ii) to calculate a correlation between FTND scores and smoking prevalence across countries; and (iii) to examine whether patterns observed in our data are consistent with the idea of a ‘hardening target’. We hypothesized that in countries with low smoking prevalence, smokers would have higher FTND scores, and that current smokers would have higher FTND scores than former smokers.

METHODS

We identified 15 samples of smokers with FTND score data from 13 countries through colleagues, the US National Library of Medicine, the SRNT Listserve and Psych Info. To be included in the analysis, samples of smokers had to contribute FTND score data and be representative of their country's general smoking population; studies among specific subgroups of smokers including psychiatric patients, smoking cessation trial participants or smokers with significant comorbidities were excluded. Most of the studies we included have been published formally as independent research papers, while other studies have been described previously and used in a similar analysis [1].We chose to include data from three twin registries as they are population-based, and twins exhibit similar means, frequencies and prevalences to singletons for many traits and adult diseases [13].

Characteristics were described for each study, including country, sample size, data collection method, group surveyed, year of survey, age group, definition of smoker and response rate. FTND scores could range from 0 to 10, with higher scores reflecting greater dependence. Smoking prevalence was based on the actual prevalence of daily smoking in the sample for most studies. For two studies, the prevalence estimates for the survey year were obtained from the US Centers for Disease Control website, which contains smoking prevalence estimates in the United States between 1965 and 2006 for current smokers (http://www.cdc.gov/tobacco/data_statistics/tables/adult/table_2.htm). On a limited set of studies, FTND score by sex and by smoking status were available, and FTND scores for ex-smokers were based on smoking behaviour before they quit.

A Pearson correlation coefficient (r) measured the strength and direction of the linear relationship between FTND scores and smoking prevalence for each country, while a t-test was utilized to determine whether the correlation was statistically significant.

RESULTS

Table 1 describes the studies included in this report; 15 studies from 13 countries are represented. Table 2 presents FTND score, smoking prevalence and survey year for each country, and is sorted from lower to higher FTND scores. The observed FTND scores ranged from 2.8 to 4.6 with a mean of 3.6. The lowest FTND scores (< 3) were observed in Germany, Norway, Spain and the Netherlands, while the highest scores (> 4) were found in Sweden and the United States. The prevalence of daily smoking at the time of the surveys in the two extremes was also very different, with 37% and 30% in Germany and Norway and only 19% and 16% in the United States and Sweden, respectively. The Pearson correlation coefficient between smoking prevalence and FTND score across countries was r =-0.73, P = 0.001. The inverse correlation suggests that, as smoking prevalence decreased, FTND score increased. Sex-specific FTND data were available only in a subset of studies; therefore correlations were not calculated separately for males and females. However, in all instances males had higher FTND scores than females (data not shown). Similarly, while only a few studies reported FTND score by smoking status, in all studies current smokers had higher FTND scores than former smokers (data not shown).

DISCUSSION

FTND scores ranged from 2.8 to 4.6 and smoking prevalence from 16 to 37%. The observed significant inverse correlation between FTND score and smoking prevalence suggests that countries with lower smoking prevalence had higher FTND scores.

A possible mechanism to explain the observed association is that stronger antismoking climates (such as the United States and Sweden) may have lowered smoking prevalence by encouraging the less dependent smokers to quit. The limited data from former smokers support this idea, as in all studies former smokers reported lower FTND scores at the time of smoking compared with current smokers [26]. Clearly, recall accuracy is a concern and conclusions should be drawn carefully. However, preliminary evidence suggests that retrospective recall of the FTND is acceptably reliable [27]. If our observed correlation is true, remaining smokers in the future might be more dependent and require more intensive smoking cessation treatment.

It was interesting to note that in the studies with sexspecific FTND scores, males had higher scores than females. It is unclear whether this is a true reflection of underlying dependence or differences in other factors. The lower FTND scores among females may be due to their lower daily cigarette consumption, which in turn might reflect lower buying power or

greater concerns about health [28,29]. However, females have at least the same difficulties quitting smoking as males [30,31], and markers of smoke intake such as carbon monoxide in exhaled air usually show the same concentration [32]. Future studies should investigate this association further.

Differences in FTND scores alone may not explain why today's smokers may be more difficult to help quit smoking. Differences in personal characteristics between current and former smokers have been reported where socio-economic status and educational attainment are lower and psychiatric comorbidities are higher among current smokers [2,5,6]. These factors are probably relatively independent of the degree of tobacco dependence as measured by FTND. Although genetic factors may play a role in dependence and in quitting smoking [33], it is unlikely that our observed inverse correlation was due entirely to differences in allele frequencies between countries because a high proportion of people in Germany, Norway, Sweden and the United States may have similar northern European ancestry [34].

Findings from our report are not reconciled easily with those of O'Connor *et al*. [9], who found that the number of cigarettes and nicotine intake has decreased in parallel among American smokers participating in two cross-sectional comparisons. If ‘hardening’ of smokers is occurring, one would have expected that serum nicotine would remain stable as remaining smokers could ingest more nicotine through compensatory smoking even if their number of cigarettes smoked per day decreased. However, O'Connor *et al*. did not assess nicotine dependence directly using a multi-dimensional scale that would capture other important aspects of dependence. The FTND scale is one of many instruments that is used to assess degree of dependence, each with its own strengths and limitations.

We acknowledge the limitations of this report and do not interpret the findings as causal. Smoking data were based on self-report and, for some studies, national smoking prevalence estimates, rather than study smoking estimates, were used. West *et al*. tested whether national smoking prevalence figures were accurate and found that underestimates of smoking were minimal in the United States but significant for England and Poland [35]. If this pattern occurred in these countries in this report, our correlation would have increased slightly. The age intervals of smokers differed slightly between studies, and surveys were conducted in different years. Also, the wording of the questionnaire in different languages may have directed respondents to different cognitive representations. The response mode appeared to differ between face-to-face interviews, telephone interview and mailed questionnaires. If these differences resulted in non-differential misclassification our results would be biased towards the null value, and our ability to detect a correlation would be blurred [36]. Finally, all samples were cross-sectional, so it was not possible to examine changes in dependence and smoking prevalence over time.

Despite these limitations, our analysis of FTND score and smoking prevalence across 13 countries supports the hypothesis that remaining smokers may be hardening. Less dependent smokers may quit more easily and remaining highly dependent smokers may need more intensive treatment.

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Table 1

Characteristics of the studies included in the report.

Author (reference number)	Country	Survey year	Number of smokers	Data collection method	Source population	Age-group of smokers	Definition of smokers	Response rate
Danish Office [14]	Denmark	1994	2398	Telephone interview	National Population Registry	>13 years	Ever used tobacco	>70%
deLeon [15]	Spain	1997	646	Telephone interview	Representative sample from 21 cities	>16 years	Daily smoker	
Furberg [16]	USA	1992–98	3025	Interview	Population-based Twin Registry	22–59 years	Regular smoker	>70%
Furberg [17]	Sweden	1998–2002	8066	Web or telephone interview	Population-based Twin Registry	20–64 years	Regular smoker	>70%
Gallus [18]	Italy	2002	1837	Interview	National Population Registry	>15 years	Daily smoker	
Hollebush [19]	USA	1993	753	Telephone interview	National Sample	>18 years	Regular smokers	
Jahn [20]	Germany	1997	2502	Interview	Representative sample from Northern Germany	18–64 years	Daily smoker	70%
Kraft [21]	Norway	1995	421	Interview	National Population Registry	16–79 years	Daily smoker	71%
Kunze [22]	Austria	1994	667	Interview	National Population Registry	>14 years	Daily smoker	
LaGrue [23]	France	1987	307	Interview	National Population Registry	>15 years		
Peiska [24]	Finland	1994	1115	Mailed questionnaire	National Population Registry	15–64	Regular smoking	70%
Shiftman [25]	USA	1999	2120	Telephone interview	National Representative Sample	>18 years	Daily smoker	
Vink [26]	Netherlands	2000	1378	Mailed questionnaire	Dutch Twin Registry	>16 years	Daily smoker	
West *	England	2007	529	Household survey	National Representative Sample	>16 years	Ever smoker	
Zatonski †	Poland	1993	386	Mailed questionnaire	National Population Registry	>16 years	Daily smoker	72%

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Table 2

Fagerström Test for Nicotine Dependence (FTND) scores and smoking prevalence by country.

Author (reference number)	Country	Survey year	FTND score	Smoking prevalence
John [20]	Germany	1997	2.8	37%
Kraft [21]	Norway	1995	2.8	30%
deLeon [15]	Spain	1997	2.9	38%
Vink [26]	Netherlands	2000	2.9	26%
Danish Office [14]	Denmark	1994	3.0	39%
Gallus [18]	Italy	2002	3.1	27%
LaGrue [23]	France	1987	3.4	37%
Puska [24]	Finland	1994	3.5	23%
Zatonski[†]	Poland	1993	3.6	36%
West[*]	England	2007	3.0	25%
Kunze [22]	Austria	1994	3.6	33%
Hellebush [19]	USA	1993	4.3	26%
Furberg [16]	USA	1992–98	4.4	20%[‡]
Shiffman [25]	USA	1999	4.6	19%[‡]
Furberg [17]	Sweden	1998–2002	4.6	16%

[*] R. West, personal communication 2007, robert.west@ucl.ac.uk.

[†] W. Zatonski, personal communication 1994, zatonskiw@coi.waw.pl.

[‡] Smoking prevalence estimate obtained from the Centers for Disease Control tobacco statistics website for year of study.