RESEARCH COMMUNICATION

Heaviness of Smoking Index, Number of Cigarettes Smoked and the Fagerstrom Test for Nicotine Dependence Among Adult Male Malaysians

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Abstract

Two methods of identifying smokers with high nicotine dependence, the heaviness of smoking index (HSI) and number of cigarettes per day (CPD) were compared with the Fagerstrom test for nicotine dependence (FTND). The HSI, CPD and the FTND were administered to 316 adult Malaysian male, daily smokers aged between 25-64 years old in the Malaysian NCD Surveillance-1 Survey using a two-stage stratified random sampling of enumeration blocks and living quarters, via an interview based on a validated questionnaire. The cut-off point for classification of high nicotine dependence on the HSI was a score of four or higher, and for the heavy smoking category, smoking more than 20 cigarettes per day. Classification using each method was compared with classification by the FTND (score of six or more) as the reference standard. Sensitivity, specificity and kappa statistics for concordance between both measures and the FTND were evaluated. The HSI gave a similar prevalence rate of high nicotine dependence as the FTND. There was substantial agreement between the HSI and the FTND (kappa=0.63.), with moderate sensitivity (69.8%) and high specificity (92.5%). However, prevalence of high nicotine dependence using the CPD was 7% lower than the FTND. The heavy smoking category also showed fair agreement with the FTND (kappa=0.45) and moderate sensitivity (67.0%), but specificity was high (86.9%). The findings indicate that the HSI can be used as an alternative to the FTND in screening for high nicotine dependence among daily smokers in large population-based studies, while CPD may not be a suitable alternative to the FTND.

Keywords: Fagerström test for nicotine dependence - heaviness of smoking index - heavy smoking - Malaysians

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Introduction

The level of nicotine dependence is important in assessing the effectiveness of smoking prevention and control programmes (Breslau et al., 2001) There are several scales available for measuring addiction level such as the Fagerström Tolerance of Nicotine Dependence (FTND) (Heatherton et al., 1991) , the Cigarette Dependence Scale (CDS) (Etter, 2005) and the Nicotine Dependence Syndrome Scale (Shiffman et al., 2004). Among these, the FTND is the most widely used as it consists of only six items, can be easily administered, noninvasive, provides a quantitative measure and is able to conceptualize addiction level through behavioural and physiological symptoms. However, the amount of time required to complete the six items may be too long for studies that also involve the assessment of numerous other risk factors and dimensions of health such as diabetes, alcohol consumption, obesity, hypertension etc which makes the questionnaire very lengthy (Institute for Public Health, 2008) This calls for a simpler instrument for measuring level of nicotine dependence.

The Heaviness of Smoking Index (HSI), a subset of the FTND, has been suggested as an alternative to the FTND. It comprises of only two items which are "time to first cigarette upon waking" and the "quantity of cigarettes smoked in a day". The HSI has shown high consistency (kappa agreement 0.72-0.78) with the FTND in several population-based studies (de Leon et al., 2003; Chabrol et al., 2005; Diaz et al., 2005; Perez-Rios et al., 2009). However, its use in Malaysia has not been examined. Another method that has been used is based exclusively on the number of cigarettes smoked in a day (Cigarettes per day, CPD), a type of qualitative measure that has been used in many population-based studies (de Leon et al., 2003; Institute Public Health, 2008).

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This study aimed to evaluate the consistency between the two methods (HSI and CPD) with the FTND for measuring high nicotine dependence among a representative sample of adult male daily cigarette smokers in Malaysia.

Materials and Methods

Sampling

The data for this study was obtained from the Malaysian NCD Surveillance-1 survey that assessed risk factors for non-communicable diseases among Malaysians aged 25-64 years old. This cross-sectional, population-based study was conducted from September 2005 until March 2006. The total sample size, based on design effect of 2 and 20% non response, was 3040. The sample was selected using two-stage stratified sampling. First stage stratification was by state, and the second stage, by urban/rural classification. The primary sampling units were enumeration blocks (EB), while the secondary sampling units were living quarters (LQ). Between 3 to 5 LQs were selected from each selected EB using systematic random sampling. A total of 398 EBs which consisted of 1683 (LQs) were selected. The number of EBs and LQs selected per state was based on the desired sample size, proportionate to the 2005 Malaysian adult (25-64 years) population size. A detailed description of the methodology of the study has been reported elsewhere (Disease Control Division, 2006)

Data collection

Validated questionnaires in Malay or English language (depending on the preference of the respondents) were used for data collection. The section assessed smoking status (daily smoker, occasional smoker or non-smoker), age started smoking, cigarettes smoked per day, type of cigarette, level of addiction based on the FTND and socio demographic profile. The FTND (and thus the HSI) was administered to daily smokers only. Daily smokers were those who smoked a tobacco product at least once a day. These included persons who smoked every day with rare exception such as not on days of religious fasting or during acute illness. Individuals who used other types of tobacco product were excluded from the analysis. The FTND consisted of 6 items with an overall score ranging between 0-10, while the HSI consisted of two items with an overall score ranging between 0-6. The cutoff points for high nicotine dependence were 6 with the FTND, and 4 with the HSI, these were selected based on previous studies. Smokers were also categorised as heavy or non-heavy smokers based on the number of cigarettes smoked daily (Cigarettes per day). Those who smoked more than 20 cigarettes daily were classified as heavy smokers while those who smoked 20 or less cigarettes daily as non heavy smokers (Institute of Public Health, 2008)

Data was collected through face-to-face interview at the respondents' homes and its confidentiality was assured. Written and verbal consents were obtained from the respondents before they were interviewed. Interviewers comprised of staff from the state health departments who had been trained and equipped with fieldwork guidance modules. This study was approved by the Medical Research and Ethics Committee of the Ministry of Health, Malaysia.

Table 1. Socio Demographic Characteristics

Variable	n	Population estimate	%
Area of residence			
Urban	166	1342865	61.4
Rural	197	845957	38.6
Income (RM)			
0-999	170	951525	44.2
1000-1999	113	704176	32.7
2000-2999	42	235732	11.0
>= 3000	35	259292	12.1
Marital status			
Single	32	189468	8.7
Married	323	1900741	86.8
Divorce/widow/widower	8	98612	4.5
Age group(years)			
25-34	89	771147	35.2
35-44	108	777573	35.5
45-54	97	410617	18.8
55-64	69	229484	10.5
Occupation			
Government	48	254045	11.6
Private sector	123	797692	36.4
Self employed	152	865529	39.5
Others	42	271554	12.4
Education attainment			
No schooling and did not complete primary school	59	344927	15.8
Primary school	73	322864	14.8
Secondary school	209	1317291	60.2
Tertiary education	22	203733	9.3

Data analysis

The sample was weighted to account for the possible differences in the probability of EBs and LQ selected non response, population locality, gender and age group stratification in 2005 based on information provided by the Malaysian Statistic Department. Descriptive statistics was used to illustrate the characteristic of respondents. The sensitivity and specificity of the HSI and heavy smoker category as compared to the FTND as the standard reference were assessed. Concordance between each measure and the FTND were evaluated using Cohen's Kappa. The data was analysed using SPSS Version 16.0. (SPSS Inc, 2007). All analyses were carried out at 95% confidence level.

Results

There were 363 daily smokers, with 166 (61.4%) from urban and 197 (61.4%) from rural areas. The mean age of the respondents was 39.9 years (standard error (SE) 0.62). About 88% were employed or self employed, 86.8% were married. 44.2% earned monthly income of less than RM1000. Nine point three percent of respondents completed their tertiary education. The mean tobacco consumption was 14.2 (SE=0.54) cigarettes per day. The mean age of onset of daily smoking was 19.5 (SE=0.23) years. Approximately half (49.5%) of the smokers became daily smokers before or at the age of 18 years (Table 1). The FTND and HSI identified 64 (20.5%) and 64

Table 2. Level of Nicotine Dependence Using HSI and Heavy Smoking Category Compared with the FTND

Dependence measure		FTND[a] Low dependence	High Dependence	Kappa	p value
HSI (n=330)[b]	Low dependence	248(1442562[d]) (92.5%)	18(116938[d]) (7.5%)	0.63	<0.001
	High Dependence	18(124346[d]) (30.2%)	46(287404[d]) (69.8%)		
Cigarettes per[c] day (n=330)	Non Heavy smoker	247(1477088[d]) (86.9%)	78(222130[d]) (13.1%)	0.45	<0.001
	Heavy Smoker	19(89820[d])(33.0%)	26(182212[d]) (67.0%)		

[a]Cut-off point: >= 6 classified as high dependence, 0-5 classified as low dependence, [b]Cut-off point: >= 4 classified as high dependence, 0-3 classified as low dependence, [c]Heavy smoker defined as smokes > 20 cigarettes per day, [d]Estimated population, [*]Calculation of Kappa, sensitivity and specificity were based on weighted sample

Table 3. Previous Studies Comparing FTND and HSI as Measures of Nicotine Dependence

Study	Population studied	Mode of data collection	Cohen's Kappa	Sensitivity	Specificity
Diaz et al. 2005	:749 smokers: Age range 18-64 351 males	Face to face interview	0.72	78.1	96.1
De Leon et al., 2003	1462 smokers (5 samples from USA and Spain)	Face to face interview	0.78	94.4	88.1
Chabrol et al. 2005	819 smokers Age range: 15 and above	Face to face interview	0.71	85.0	91.3
Perez-Rios et al. 2009	1674 smokers 941 male Age range: 16-74 Standardize as the above smoker, age, males	Telephone and computer interview	0.75	83.1	95.7

(20.1%) respondents as high nicotine dependent smokers respectively. Using the CPD, 46 (13.2%) respondents were categorised as high nicotine dependent smokers. Concordance between FTND and HSI was good (kappa=0.63, p<0.001). However, concordance between FTND and CPD was moderate (kappa=0.45, p<0.001). Sensitivity and specificity of the HSI as compared to FTND were 69.8% and 92.5% respectively. The sensitivity and specificity of the heavy smoker category compared to FTND was 67.0% and 86.9% respectively (Table 2).

Discussion

The study found that both the HSI and the FTND produced almost similar prevalence of high nicotine dependence, 20.1% by the HSI and 20.5% by the FTND. These findings were consistent with Chabrol's et al in 2005, who reported prevalence of 13% and 14% using the same cut-off points. De Leon et al. in 2003 reported a difference of 1-3% in a study consisting of 1462 smokers in Spain and the USA. However, the heavy smoker category which was used as an indirect measure of high nicotine dependence underestimated by approximately 7%.

The level of agreement between the HSI and the FTND was substantial (Kappa=0.63) (Landis and Koch, 1977) with sensitivity of 69.8% and specificity of 92.5%. With the exception of a population-based study by John et al. in 2003 who reported an agreement level of 0.55-0.6 (John et al., 2004) other studies which evaluated the agreement level between FTND and HSI have reported agreement of more than 0.70. (de Leon et al., 2003; Chabrol et al., 2005; Diaz et al., 2005; Perez-Rios et al., 2009). However, the specificity of the HSI in this study is comparable to those studies (de Leon et al.,2003; Chabrol et al., 2005; Diaz et al., 2005; Perez-Rios et al., 2009) (Table 3).

The differences in level of Kappa agreement and sensitivity compared to other studies may be due to differences in the population composition, prevalence of tobacco consumption, and age of smoking initiation and different method of analysis. For example, the current study applied the weight to the sample for generalization to the population, while this was not available in those studies. The heavy smoking category showed fair agreement with FTND, moderate level of sensitivity but the level of specificity was comparable to those studies (de Leon et al.,2003; Chabrol et al., 2005; Diaz et al., 2005; Perez-Rios et al., 2009).

These findings indicate that the HSI is a valuable test for the assessment of nicotine dependence and can be used in large, population-based studies. It provides a better measure compared to the heavy smoking category. The HSI and the heavy smoking category differed by only one question (time to first cigarette upon waking). The addition of this item to current population-based studies such as the National Health and Morbidity Survey will enable the collection of more accurate data on the level of nicotine dependence.

This study has several limitations. Firstly, smoking status was obtained through self-report without biochemical verification. However, findings from population-based studies have shown that there is a high consistency between self-report and biochemical measures (Benowitz et al., 2002). Secondly, smokers may tend to report the number of cigarettes smoked daily in multiples of 10 cigarettes (Klesges et al., 1995) which may introduce bias due to misclassification of the nicotine dependence level. However, the sample in this study was obtained from a general population framework which is representative of Malaysian male adult population and a high response rate ensures the accuracy of inference from study to target population.

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