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Do adolescents under-report their smoking status? – Findings from secondary school students in Kota Tinggi, Johor

Lim H.L[1], Teh C.H[2], Kee C.C$_2$, Normala.I[3], Lim K.H[2].

[1] Melaka Manipal Medical College, Jalan Pengkalan Hulu, 75150, Bukit Baru, Melaka.
[2] Institute for Medical Research, Jalan Pahang, 50588, Kuala Lumpur
[3] Faculty of Medicine, University Putra Malaysia, 43300, Serdang, Selangor.

**Corresponding author: Lim Kuang Hock, Institute for Medical Research, Jalan Pahang, 50588, Kuala Lumpur. Email address: keelimkota@yahoo.com*

ABSTRACT

Background: The denormalisation of smoking behavior and anti-smoking measures taken to curb smoking prevalence have created an environment which might contribute to the under-reporting of smoking status among adolescents. The detection of under-reporting is crucial in ascertaining the accuracy of smoking data, therefore this study was undertaken to determine the prevalence of under-reporting of smoking status among school-going adolescents.

Materials and Methods: A total of 405 of 2700 adolescents who participated in a longitudinal study in Kota Tinggi were randomly selected and their exhaled carbon monoxide concentration was measured using a pre-calibrated carbon monoxide (CO) analyzer. The cut-off point of exhaled CO of 5 parts per million (ppm) was used to determine smoking status. A total of 343 adolescents responded (84.69%) in the study, of which 85 smokers and 8 non-smokers with recent respiratory illness were excluded from the analysis.

Results: Of these 250 non-smoking adolescents, 44.6% (115) were male, and 76.4% (197) were in lower secondary school. Analysis showed that the concentration of exhaled CO among 257 adolescents (99.6%) were between 0 - 5.00ppm. In addition, the CO level of all non-smoking females and lower secondary school students were in the range of 0 - 5.00ppm. This study revealed that the under-reporting of smoking status was negligible.

Conclusion: Self-reported smoking status among adolescents can be accepted as valid answers for their smoking status. However, more studies in different localities on a larger scale are warranted to determine that self-reported smoking status is a valid measurement of actual smoking status among adolescents in the country.

Keywords: self-reported smoking, carbon monoxide, under-reporting, school-going adolescents.

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1.0 Introduction

Smoking initiation during adolescence plays an important role in determining smoking status in later life. Therefore, surveillance and research in adolescent smoking has become an integral part of anti-smoking policies. Self-reporting of smoking status has been widely used to determine smoking status in both developed and developing countries (Wong et al., 2012 , Jeganathan et al., 2013, Lim et al., 2014). However, recently-implemented anti-smoking measures such as prohibition of smoking in designated public areas, prohibition of the sale of tobacco products to individuals aged below 18 years, health education to address the harmful effects of smoking in schools, mass media campaigns to denormalise smoking as well as penalties on school-going adolescents who smoked (WHO, 2010) have all collectively created an environment that is not conducive for smokers. Therefore adolescents who smoke might have a tendency to under-report their smoking behavior so as to not appear to defy the social norm (social desirability bias) as reported in several studies (Gorber et al., 2009; Jin et al., 2013)

In view of this situation, the detection/ determination of the extent of under-reporting is extremely important as anti-smoking policies and measures in the country are based on self-reported smoking prevalence. Several methods have been used to validate self-reported smoking among adolescents, for instance the measurement of cotinine or thiocyanate levels in biological samples such as serum and saliva and measurement of exhaled carbon monoxide (Wong et al., 2013; Low et al., 2000, Antuni et al., 2000; Jarvis et al 1987). Among these methods, the measurement of carbon monoxide in exhaled breath has been most widely used in view of its non-invasiveness, rapidity, affordability, portability, and does not require special technical background.(Jarvis et al., 1986, Pearce et al., 2014).. It has been shown to be reliable and correlates with the concentration of blood carboxylhaemoglobin which varies by smoking status.(Jarvis et al., 1986, Pearce et al., 2014). Although studies have been done elsewhere, in Malaysia, where the prevalence of adolescent smoking is reportedly high (Jeganathan et al., 2013, Lim et al., 2014), there is a lack of data on the reliability and validity of self-reported smoking status among adolescents. In this write-up, we examined the prevalence of under-reporting of self-reported smoking status among school-going adolescents in Kota Tinggi District, Johor, Malaysia.

2.0 Materials and Methods

Data for this study was obtained from a longitudinal study among secondary school students in Kota Tinggi District which was conducted during the years 2008 - 2010 to evaluate the factors which lead to smoking initiation among non-smoking adolescents, namely the psychosocial, susceptibility and stages of smoking aspects. Two-stage proportionate-to-size sampling was employed to obtain a representative sample of secondary school-going adolescents. The first stage involved division of schools by locality (FELDA re-settlement area (FELDA), urban and rural). This was followed by the selection of schools proportionate to each locality. Six schools were selected from the FELDA area, three schools from urban and one school from rural. The administrators of the selected schools provided complete lists of their Forms 1, 2 and 4 (13-, 14- and 16-year old) students and simple random sampling was used to select a sample based on random numbers generated by EpiInfo Version 6. A more detailed description of the study was reported previously (Lim et al 2011).

Approximately 15% of the calculated sample size was randomly selected from each selected school using simple random sampling to participate in the measurement of exhaled carbon monoxide. Measurement of exhaled CO was carried out after respondents completed the questionnaire. The study protocol was reviewed and approved by the Ministry of Education and the Johor State Education Department. The Malaysian Research Ethics committee, Ministry of Health Malaysia granted the ethical clearance for the study to be carried out.

2.1 Study protocol

The method of passive consent was applied in this study. Letters with accompanying consent forms were sent to parents or guardians of the selected respondents through the school management to inform them that their child had been selected to participate in the study. In this letter, the study protocol and objectives (to answer the questionnaire and participate in the measurement of exhaled CO) were explained and the parents or guardians were asked to return the letter if they did not consent to their child participating in the study. Only respondents who did not return the signed consent form were allowed to participate in the study. To reduce bias, teacher/s and school managements staffs were requested not to attend the interview and measurement of exhaled CO session.

2.2 Measurement of exhaled carbon monoxide

Exhaled carbon monoxide (CO) was measured using The EC-50 CO analyser (Bedfont Instruments, Kent, UK) which was shown as a reliable tool for CO measurement (Middleton and Morice 2000; Jarvis et al., 1987). The instrument was calibrated prior to use. Respondents were instructed to inhale fully and hold their breath for 15 seconds. If they were unable to, they were requested to hold their breaths for as long as they could. This was to allow the CO concentration in the alveolar sacs to be equivalent with the CO concentration in the blood due to displacement of oxygen by CO from cigarette smoke which can then be measured by the CO analyzer. Respondents were subsequently asked to blow slowly into the CO analyser via the mouth-piece. The process was repeated another time and the higher concentration of CO was recorded. Besides this CO measurement, respondents were also asked whether they had recently been infected by respiratory diseases or if they have had an acute exacerbation of asthma. Any reading above the selected cut-off point of ≥5 parts per million (Low et al., 2004) indicated the subject had recently smoked.

2.3 Data analysis

Data was analyzed using SPSS for Windows version 16.0 (SPSS Inc, Chicago, Illinois, USA). Descriptive statistics were used to illustrate the characteristics of respondents, while descriptive analysis was used to determine the consistency between self-reported smoking and level of exhaled CO.

3.0 Result

Out of the 405 respondents who were selected to participate in the exhaled CO testing, 343 (84.7%) responded, the remainder of which refused or were absent. A total of 85 respondents who reported themselves as daily smokers and 8 respondents who reported having had

respiratory diseases/ asthma lately were excluded from further analysis. Of the 250 respondents who self-reported as non-daily smokers, 115 (44.6%) were males, 107 (42.8%) were Form Two students (aged 15 years old) and a majority (227, 88.3%) were of Malay descent.

In 99.6% (249/250) of respondents, the exhaled CO concentration was within the range of 0 - 5 ppm. 100% of female respondents, Form One and Two school-going adolescents who were non-smokers (self-reported) also had exhaled CO concentration between 0 - 5 ppm (Table 1).

Table 1: Exhaled Carbon Monoxide level among non smoking (self reported) school-going adolescents in Kota Tinggi District, Johor, Malaysia.

Variable	Exhaled Carbon Monoxide Level	
	0.0 -4.9 parts per million (ppm)	5.00 part per million (ppm) and above
	n(%)	n(%)
Gender		
Male	114(99.1)	1(0.9)
Female	143 (100)	0
Form		
Form 1	90(100)	0
Form 2	107 (100)	0
Form 4	60(98.4)	1(1.6)
Ethnicity		
Malay	226(99.6)	1(0.4)
Chinese	24(100)	0
Indian	5(100)	0
Others	1(100)	0
Schooling Area		
FELDA	181(100)	
Urban	49(98)	1(2)
Rural	27(100)	

4.0 Discussion

To the best of our knowledge, this study to determine the prevalence of under-reporting of smoking status among school-going adolescents is the first in the country. This study found almost perfect consistency between self-reported smoking status and concentration of exhaled CO. Our finding was similar with the finding by Che et al. (2009) in which 1.3% of under-reporting of smoking status among public university students in Malaysia, 1.5% among adolescents aged 12-17 (Caraballo, Giovino & Pechacek, 2004) and sensitivity and specificity of 90.9% and 91.8% respectively among vocational high school students (Park and Kim 2009). However, the current finding contradicts findings by Malcon et al. (2008) who reported low correlation between self reported smoking status and blood cotinine level among Brazilian adolescents, which might be due to the lack of provision of anonymity in their study.

There were several limitations in the study. Firstly, exhaled CO has a short half life and cannot be detected in respondents who abstained from smoking 24 hours prior to the study. Secondly, other factors such as exposure to environmental pollutants, environmental tobacco smoke and level of physical activity which influence exhaled CO concentration were not investigated in detail. In addition, these findings were generalizable to school-going adolescents in Kota Tinggi district only. Future verification studies on a larger scale, using more sensitive biochemical measurements (cotinine in blood or urine) among adolescents are strongly recommended.

5.0 Conclusion and recommendation

The study showed that under-reporting of smoking status is negligible and self-reported smoking status among adolescents can be accepted as reliable and valid, provided that the respondents' anonymity had been adequately guaranteed during the survey.

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Declaration

The authors declared that they have no competing interest.

Authors contribution

LHL wrote the manuscript, and carried out statistical analysis with assistance from LKH and KCC., TCH and NI responsible for data collection, design and coordination of the study. and involved in interpretation and implications of the analysis. All authors contributed to developing the manuscript, and read and approved the final version.

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