Community Based Screening of Smoking Related Pulmonary Disorders

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Abstract

Background:

Smoking is one of the most prevalent risky behaviors around the world. It is a major risk factor for many morbid and deadly diseases. Chronic obstructive pulmonary disease (COPD) is a disorder that is underdiagnosed in many populations, since its diagnosis requires spirometry, which is costly and not readily available in primary care sittings. Therefore, a cheaper and simpler test may contribute as a screening tool for early referral and diagnosis of COPD.

Methods:

This is a community based cross-sectional study which was conducted in Saudi Arabia. We included men who were 35-year-old or older. We excluded subjects with history of previous respiratory or neuromuscular disease. Each subject underwent an interview based questionnaire and performed peak expiratory flow (PEF) test. Subjected with lower than expected PEF values underwent spirometery test.

Results:

619 subjects were interviewed, of which 588 were included. The average age of the population was 46 years. The percentage of current smokers, regardless of the type, among males in our population was 63% (95% CI = 59 – 67). When compared to non-smokers, subjects with a history of smoking were three times more likely to complain from wheeze (OR= 2.55; P-value<0.001). Heavy cigarette smokers ($\geq$30 pack-year), on the other hand, were more likely to complain from both cough and wheeze (OR= 1.84; P-value=0.04 and OR= 2.63; P-Value= 0.001, respectively). Although reduced FEV1 and obstructive defects were three times more likely among heavy smokers than non-smokers, this did not reach to a statistical significance.

Conclusion:

Two-third of our male population smoked during their lifetime. The most frequently used type of smoking is cigarette. One-third of smokers suffer from respiratory symptoms and small proportion were detected to have undiagnosed obstructive pulmonary defect. When compared to non-smokers, respiratory symptoms (mainly cough and wheeze) were significantly higher among heavy smokers.

Keywords: Smoking; Respiratory; Pulmonary; Dysfunction; Screening

Introduction

Smoking is one of the most prevalent risky behaviors around the world. There are around 1.1 billion smokers globally, 900 million of them are men [1]. It is a major risk factor for many morbid and deadly diseases, like cancers, cardiovascular disorders, and chronic obstructive pulmonary disease (COPD) [1,2]. It has been estimated by European experts that 24% of all male deaths in the developed countries are due to tobacco [1,3]. Cardiovascular disease, COPD, and cancer are the main consequences of smoking among both active and passive smokers [1,2,4]. Active smoking increase the risk of lung cancer by 11 folds, while passive smoking increases this risk by 1.4 folds [2]. According to a report made by the Saudi Ministry of Health in 2009, the prevalence of smoking in Saudi Arabia is between 35-45%, with an estimated economic burden of 1.3 billion U.S dollars [5]. In Saudi

, most smokers use three main products, cigarettes, shisha, and muassil. Shisha and muassil are two types of flavored smoke inhalation, also called waterpipe or hookah.

COPD is a disorder that is underdiagnosed in many populations, since its diagnosis requires spirometry, which is costly and not readily available in primary care sittings [6,7]. Therefore, a cheaper and simpler test may contribute as a screening tool for early referral and diagnosis of COPD. Peak expiratory flow (PEF) meter is a simple, cheap, and widely available test that has been found to have 90% sensitivity to diagnose obstructive lung disease [8].

Although many studies explore the prevalence of smoking, few assessed the relationship between smoking behavior and the manifestation of respiratory symptoms. In addition, most of these studies are not community based and usually target a very specific population. Our study aims to explore smoking behavior patterns among residents of the city of Jeddah and its relationship with respiratory health, including the manifestation of respiratory symptoms and physiological measurement of lung function.

Method

In this study, the targeted population was men above the age of 35 years. The estimated sample size required to determine an increase in the prevalence of respiratory symptoms from 20% among non-smokers to 30% among smokers, with a power of 80% and alpha of 0.05, was around 600 subjects. The inclusion criteria were males and age of 35 years or older. We excluded subjects known with any chronic lung disease or any neuromuscular disease. We used a standardized self-administered questionnaire that contained questions about age, gender, nationality, chronic illnesses, smoking status, second hand smoking, and presence of respiratory symptoms of COPD (wheezes, shortness of breath, or chronic cough). For weight and heightmeasurements, we used a (Taitan®) scale with stadiometer. For assessing participants' lung function, a PEF meter (Pocket Peak, by Teleflex®) and portable spirometer (Spirodoc®: touch screen spirometer and 3D oxymeter) were used. The data was collected from four different locations in Jeddah city, two local markets and two shopping malls. A stand was prepared with a sign related to our study, and participants approached the stand voluntarily. All measurements were done by trained medical students. The measurement process was as the following: the data collectors took the height and weight of each participant, then they directly interviewed the participants and accordingly completed the questionnaire. After that, the participant underwent the PEF test three times and the best result was reported. The normal predicted value of the PEF was based on data from Leiner GC, et al [9]. Participants who scored less than 80% of their predicted value, were asked to perform spirometry test. Four spirometry values were reported: FVC, FEV1, FVC/FEV1, FEF 25-75. The collected data were entered to Microsoft excel 2016 software. This study was approved by King Abdullah International Medical Research Center, western region office (KAIMRC). The IRB approval was issued on 21st of February 2016. The study participant signed an informed consent form and agreed to participate after their anonymity was ensured.

Statistical analysis

All analyses were performed using STATA (StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP) software. The proportion and mean for dichotomous and continuous variables, respectively, were measured to describe subjects' characteristics. Categorical outcomes were compared between subjects with different smoking behaviors using chi-square test and logistic regression analysis. Multivariate regression analysis was performed to control for potential confounding factors including age, BMI, and presence of chronic disease. Statistical significance was determined using the 95% confidence interval and p-value of 0.05.

Results

Of 619 interviewed subjects, 588 were included. 12 and 19 subjects were excluded because they were younger than 35 years and asthmatic, respectively. Table 1 shows subjects' demographic and disease characteristics. The average age of the sample population was 46.2 years (95% confidence interval (CI) = 45.5 – 46.9). The percentage of current smokers, regardless of the type, among males in our population was 63% (95% CI = 58.9 – 66.8).

Subject Characteristics	Estimate	95% CI
Age (mean, years)	46.2	45.5 – 46.9
Saudi nationality (%)	49.6	45.5 – 53.7
Employment (%)	84.0	80.8 – 86.9
BMI	29.2	28.7 – 29.6
Diabetes (%)	22.6	19.3 – 26.2
Hypertension (%)	17.0	14.1 – 20.3
Cardiovascular disease* (%)	0.12	0.04 – 0.24
Dyslipidemia (%)	0.95	0.72 – 1.22
Smoking history (any type)	62.9	58.9 – 66.8
Table 1: Subject demographic and general health characteristics.		

BMI, body mass index

*Includes ischemic heart diseases, heart failure, and stroke.

Among all smokers, the most common type of smoking was cigarette (50%, 95% CI = 45.8 – 54.2) with an average number of cigarettes smoked per day of 22 (95% CI = 20 – 24) and average duration of 22 (95% CI = 21 – 24) years. The estimated average of pack year smoking history among cigarette smokers was 27 (95% CI = 24 – 30). Less number of subjects were shisha smokers (16%, 95% CI = 13 – 19) with an average smoking frequency of 52 (95% CI = 41 – 63) times per month. Almost similar to shisha, the prevalence of muassil smoking was 16.5% (95% CI = 13.5 – 20) in our population, with an average frequency of 32 (95% CI = 22 – 42) times per month (Table 2).

Feature	Estimate	95% CI
Cigarette		
- Overall percentage	50.0	45.8 - 54
- No. of cigarette (average per day)	22.0	20.1 – 24.0
- Duration (average No. of years)	22.4	21.2 – 23.7
- Quit rate (%)	34.0	28.6 – 39.9
- Pack Year (average)	26.9	23.5 – 30.3
Shisha		
- Overall percentage	15.6	12.6 – 18.8
- No. of (average per month)	51.9	40.8 – 63.0
- Duration (average No. of years)	18.0	15.4 – 20.5
- Quit rate (%)		
Muassil		
- Overall percentage	16.5	13.5 – 19.8
- No. of (average per month)	16.5	13.5 – 19.8
- Duration (average No. of years)	14.9	12.7 – 17.0
- Quit rate (%)	31.5	21.1 – 43.4
Second hand smoking*		
- Overall percentage	61.9	55.12 – 68.4
- At home (%)	17.0	11.1 – 24.5
- At work (%)	54.1	45.3 – 62.7
- From friends (%)	79.3	71.4 – 85.8
*Among non-smokers		

Table 2: Smoking behavior

The prevalence of second hand smoking, among non-smokers, was 62% (95% CI = 55 − 68%). Exposure to passive smoking was mostly from friends (79%, 95% CI = 71 − 86%), then at work (54%, 95% CI = 45 − 63%). Exposure to passive smoking was least likely at home (17%, 95% CI = 11 − 24.5%).

Among subjects with smoking history, 33% were having chronic respiratory symptoms, 4% were having low PEF, and 0.5% were having obstructive lung defect confirmed by spirometry. When compared to non- smokers, subjects with history of smoking were three times more likely to complain from wheeze (OR= 2.55; P-value<0.001). Heavy cigarette smokers (≥30 pack-year), on the other hand, were more likely to complain from both cough and wheeze (OR= 1.84; P-value=0.04 and OR= 2.63; P-Value= 0.001, respectively). Although reduced FEV1 and obstructive defects were three times more likely among heavy smokers than non-smokers (Table 3), this did not reach to a statistical significance. In our population, second-hand smoking did not increase the risk of respiratory symptom or pulmonary function abnormality.

When we compared different types of smoking, we found that there was dose-response relationship between the frequency of smoking and respiratory symptoms with cigarette smoking (Figures 1A & 2), but not with shisha and muassil smoking (Figure 1B & 1C).

Feature	Exposed (%)	Unexposed (%)	OR*	95% CI	P-value
Smoking					
- Cough	8.1	11.5	0.69	0.39 – 1.2	0.19
- **Wheeze**	**21.4**	**10.1**	**2.55**	**1.53 – 4.25**	**0.0001**
- Dyspnea	18.2	17.9	1.05	0.68 – 1.63	0.22
- Any Symptom@	32.5	25.7	1.44	0.99 – 2.1	0.08
- Low PEF&	3.8	4.1	0.92	0.39 – 2.19	0.07
- Low FVC&	1.4	2.3	0.61	0.17 – 2.15	0.26
- Obstructive defect$	0.5	0.9	0.56	0.07 – 4.09	0.63
Heavy smoking history**					
- Cough	13.5	8.2	1.84	1.02 – 3.33	0.04
- **Wheeze**	**28.9**	**13.5**	**2.63**	**1.67 – 4.14**	**0.0001**
- Dyspnea	21.2	17.4	1.31	0.82 – 2.09	0.26
- **Any Symptom@**	**42.3**	**26.3**	**2.13**	**1.43 – 3.16**	**0.0001**
- Low PEF&	5.13	3.61	1.23	0.50 – 3.03	0.65
- Low FVC&	2.56	1.44	1.62	0.43 – 6.04	0.47
- Obstructive defect$	1.28	0.48	3.18	0.42 – 24.0	0.26
Second hand smoking					
- Cough	13.3	8.43	1.60	0.62 – 4.12	0.33
- **Wheeze**	**13.3**	**4.82**	**2.77**	**0.89 – 8.60**	**0.08**
- Dyspnea	18.5	16.9	0.97	0.46 – 2.05	0.94
- Any Symptom@	28.9	20.5	1.44	0.74 – 2.81	0.28
- Low PEF&	4.44	3.61	1.38	0.33 – 5.82	0.66
- Low FVC&	2.22	2.41	0.84	0.13 – 5.40	0.86
- Obstructive defect$	0.74	1.20	0.34	0.02 – 7.21	0.49

* Adjusted for age, BMI, and presence of chronic disease.
@One or more respiratory symptoms including cough, wheeze, and dyspnea.
&Lower than 80% predicted value.
$FEV1/FVC ratio of ≤ 70%.
**Pack-year smoking history of ≥ 30.
PEF, peak expiratory flow rate; FVC, forced vital capacity; FEV1, forced expiratory volume in the first second.

Table 3: Respiratory features associated with smoking behaviors

Discussion

We found that almost two thirds of our population were either actively or previously smokers, regardless of the type smoking. This number is larger than the 2005 Saudi ministry of health (MOH) report where smoking prevalence among this age group was 50.5%, [10] and smaller than a more recent national survey done in 2013 by Maziar Moradi-Lakeh et al. where the prevalence was 70% [11].

Cigarette was the most common type of smoking followed by shisha and muassil. The average duration of cigarette smoking was 22 years. Considering that the average age of our population was 46 years, the estimated age of starting smoking is within the second decade of life, which can be targeted for educational preventive programs.

One sixth of our population were shisha smokers, which is more than the number reported in the MOH survey (10% of the Saudi population), while less than the number reported in the 2013 national survey (21.6% of the Saudi population) [10,11]. The average frequency of shisha smoking was 52 times per month. Similarly, Muassil smokers made up one sixth of all smokers; however, with lower smoking frequency per month compared to shisha. The popularity of waterpipe smoking is believed to be related in general to the misconception that shisha and muassil are less harmful than cigarettes [11].

Almost two thirds of the non-smoking subjects were exposed to second hand smoking, which is alarming considering what has been reported that 890,000 of tobacco related deaths are due to second hand smoking [12] Interestingly, more than half of them exposed to second hand smoking at work, which highlight the importance of strict application for smoking ban rules in work places.

One third of smokers reported respiratory symptoms, and small proportion were detected to have undiagnosed obstructive lung defect. Cough and wheeze were more likely to be detected among heavy smokers (≥30 pack-year) as compared to non-smokers; however, we could not find statistically significant differences in pulmonary function measurements, which probably related to inadequate sample size.

We identified a clear dose-response relationship between the amount of cigarette smoking and the presence of respiratory symptoms (subjects who smoke larger number of cigarettes for longer time are more likely to have respiratory symptoms). This dose-response relationship was not obvious with shisha and muassil smoking. Our study has multiple limitations. Although the sample size was adequate to determine differences in respiratory symptoms between smokers and non-smokers, it was not adequate to identify differences in the pulmonary function measurements. Another limitation is that we did not include female subjects in our population, which restrict generalizability of our findings to male subjects only. For feasibility, we performed spirometry using portable machine in public area, which may not be as precise in the hospital sittings.

Conclusion

Two-third of our male population smoked during their lifetime. The most frequently used type of smoking is cigarette. One-third of smokers suffer from respiratory symptoms and small proportion were detected to have undiagnosed obstructive pulmonary defect. When compared to non-smokers, respiratory symptoms (mainly cough and wheeze) were significantly higher among heavy smokers.

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