Association between passive smoking and respiratory illness:
a case control study

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ABSTRACT

Background: The adverse effect of passive smoking on human health and quality of life is a debatable matter. There is high risk of respiratory illness among spouses of smokers due to exposure to passive smoke. The objective of present study was to find an association between second hand smoke exposure and risk of developing respiratory illness in the last six months among married women aged 20 years and above and currently living together.

Methods: A case-control study was conducted during a 6-month period (January to June 2016) among married women aged 20 years and above, who have been currently living with their husband for at least past two years in Perinthalmanna. Women with known respiratory disease such as bronchial asthma and tuberculosis were excluded. The sample size was calculated to be 87 cases and 87 controls. The cases were selected from the out-patient department of MES Medical College, Perinthalmanna, Kerala, India. The controls were selected from ward 28, Perinthalmanna. From each house only one female was interviewed.

Results: The major symptoms in the cases were headache (35%), morning cough (34%) and chest pain (25%). The odds of having a respiratory illness when the husband is a smoker is 1.527 (95% C.I. 0.804 to 2.899) and the odds ratio increases to 4.7 (95% C.I.2.11 to 10.86) if the husband smokes at home.

Conclusions: The study showed that the risk of having respiratory illness is higher in females when the husband is a smoker and the risk increases four times if the husband smokes at home.

Keywords: Case control study, Passive smoking, Respiratory illness, Second hand smoking, Spouses

INTRODUCTION

Passive smoking is exposure to a mixture of smoke exhaled by smokers and smoke released from the smoldering cigarettes, cigars, pipes, beedis etc. Second hand tobacco smoke consists of both gases and particulates which change as they get diluted and distributed in the environment with time. Passive smoking can damage your body as second hand smoke contains more than 4000 chemicals, many of which are irritants and toxins and some are even known to cause cancer.1 Second hand smoke (SHS) affects the heart and blood vessels, increasing the risk of heart attack and stroke in non-smokers. Some studies have linked SHS to mental and emotional changes too. Association between involuntary inhalation of cigarette smoke and increased number of various respiratory diseases, both in children and adults have been documented in many studies.2-3

Inhaling SHS causes acute irritation in the upper and lower (to a lesser extent) airways of even healthy people. The condition worsens for those with existing airway problems. A study conducted in New Mexico, USA showed passive smoking as a risk factor for COPD among non-smokers. There are growing evidence
suggesting that passive smoking is a risk factor for adult onset asthma and COPD, although the magnitude of association is small. There are many studies reporting deleterious effects on heart and lung. There is growing evidence that exposure to SHS increases risk of developing lung cancer. People who have never smoked but live with a smoker have 30% more risk of developing lung cancer.

The effect of passive smoking on chronic respiratory symptoms have also been studied and is debatable with few studies showing a significant association, while some others studies showed no association.

The concentration of respirable particles maybe elevated substantially in closed spaces. Nicotine concentration in the air in homes of smokers typically range from 2 to 10 micrograms/m³. Hence women and children are the ones who are affected the most, as shown in many studies in India and other countries. A study done in a rural community in Islamabad showed an association between passive smoking and respiratory symptoms among married women. Females are the ones who suffer more from passive/second hand smoke exposure as they don’t have any say in this matter. This study intends to identify their risk for respiratory illness due to passive smoking.

Hypothesis

There is high risk of respiratory illness among spouses of smokers due to exposure to passive smoke.

Objectives

To study the association between second hand smoke exposure and risk of developing respiratory illness in the last six months among married women aged 20 years and above and currently living together in Perinthalmanna, Kerala.

METHODS

It was a case control study conducted for a period of 6 months, January to June 2016.

Study Setting

Cases

Outpatient Department (OPD) of MES Medical College Hospital, Perinthalmanna, Kerala, India.

Controls

Ward 28 of Perinthalmanna Municipality, Kerala, India.

Study population

Married women aged 20 years and above who have been living with their husband for at least past two years.

Women with known respiratory disease such as Bronchial asthma and history of tuberculosis were excluded from the study.

Sample size

The sample size was calculated using “Statclac Epi Info”, taking the symptom “cough” as the reference, with odds ratio 2.4, from the study done in Islamabad. The percentage of controls exposed in the study was 46%, hence the sample size was calculated to be 87 cases and 87 controls at 95% C.I and at 80% power.

Sampling technique

Cases

87 consecutive patients with respiratory illness attending the General medicine and Respiratory medicine OPD between 9am to 1pm during the study period.

Controls

First house was selected randomly from ward 28, Perinthalmanna and from each house the first married women (meeting the inclusion-exclusion criteria) were enrolled. Consecutive houses were visited till the required sample size was attained.

Working definition

Respiratory illness in spouses was defined as having any one of the following symptoms in last 6 months. Women with any two or more of the symptoms given below were enrolled as cases.

- Rhinorrhea
- Nasal irritation
- Headache
- Cough at night/morning
- Wheezing
- Morning tightness on chest
- Chest pain
- Dyspnea on exertion
- Chronic Pharyngitis
- Dysphonia
- Ear ache
- Hemoptysis

Passive smoking exposure was defined as living in the house with husband who has been smoking for at least past two years. A smoker is defined as a person who smokes more than 5 cigarettes a day.

Study tool

A pre-designed pre-tested semi-structured questionnaire was used to elicit details about respiratory illness within
last six months and exposure to passive smoke inside the house in the past two years.

**Ethical concerns**

Informed written consent was taken from the participants. Institutional Ethical Committee approval was obtained.

**Statistical analysis**

Data was entered in microsoft excel and analyzed using Epi info. Association between respiratory illness was expressed in odds ratios. Univariate analysis, chi-square test and regression analysis were also done.

**RESULTS**

The cases and controls were similar with respect to age distribution, educational qualifications, occupational status and socio economic status (Table 1). Most of the participants in the case group (39.1%) and control group (46%) were educated up to high school. Majority in both groups were home makers. Most in both groups belonged to class III socio economic status (as per BG PRASAD’s classification).

**Table 1: Baseline characteristics.**

| Baseline variables       | Cases (N=87) | Controls (N=87) | p value |
|--------------------------|--------------|-----------------|---------|
| Age distribution         | 38.6±12.4    | 38±10.4         | 0.399   |
| Education                | n (%)        | n (%)           | p value |
| Less than primary        | 7 (8)        | 4 (4.6)         |         |
| Primary school           | 12 (13.8)    | 8 (9.2)         |         |
| Secondary school         | 24 (27.6)    | 20 (23.0)       |         |
| High school              | 34 (39.1)    | 14 (46.0)       |         |
| College                  | 11 (11.4)    | 15 (17.2)       |         |
| Occupation               | n (%)        | n (%)           | p value |
| Professional             | 2 (2.3)      | 3 (3.4)         |         |
| Semi-profession          | 1 (1.1)      | 4 (4.6)         |         |
| Skilled worker           | 3 (3.4)      | 3 (3.4)         |         |
| Semi-skilled worker      | 1 (1.1)      | 2 (2.3)         | 0.333   |
| Unskilled                | 6 (6.9)      | 4 (4.6)         |         |
| Students                 | 4 (4.6)      | 0 (0)           |         |
| Home maker               | 70 (80.5)    | 71 (81.6)       |         |
| Socioeconomic classification | n (%)       | n (%)           | p value |
| SES class I              | 1 (1.1)      | 1 (1.1)         |         |
| SES class II             | 18 (20.7)    | 17 (19.5)       |         |
| SES class III            | 38 (43.7)    | 39 (44.8)       |         |
| SES class IV             | 25 (28.7)    | 24 (27.6)       |         |
| SES class V              | 5 (5.7)      | 6 (6.9)         | 0.725   |

The major symptoms experienced by the cases were headache (35.5%) followed by cough (34.5%) and chest pain (25.3%). Symptoms like chest pain, morning tightness of chest, Rhinorhoea, nasal irritation and dysphonia showed a significant risk when the husband smokes at home (Table 2).

**Table 2: Pattern of symptoms in Cases (n=87) (multipleresponse).**

| Symptoms                        | n (%)     | Husband smoker Odds ratio (95% C.I) | Husband smokers at home Odds ratio (95% C.I) |
|---------------------------------|-----------|-------------------------------------|---------------------------------------------|
| Headache                        | 31 (35.5) | 1.00 (0.43 to 2.30)                 | 1.79 (0.76 to 4.21)                         |
| Cough at night/morning          | 30 (34.5) | 0.59 (0.23 to 1.47)                 | 1.56 (0.65 to 3.75)                         |
| Chest pain                      | 22 (25.3) | 2.37 (0.96 to 5.88)                 | 2.70 (1.05 to 6.89)                         |
| Dyspnées on exertion            | 18 (20.7) | 0.38 (0.10 to 1.40)                 | 1.79 (0.62 to 5.13)                         |
| Nasal irritation                | 16 (18.4) | 1.29 (0.44 to 3.76)                 | 3.93 (1.37 to 11.29)                        |
| Earache                         | 15 (17.2) | 4.91 (1.59 to 15.16)                | 6.19 (2.05 to 18.70)                        |
| Wheezing                        | 15 (17.2) | 0.45 (0.12 to 1.67)                 | 2.18 (0.74 to 6.44)                         |
| Morning tightness on chest      | 8 (9.2)   | 3.75 (0.86 to 16.32)                | 6.23 (1.42 to 27.38)                        |
| Pharyngitis                     | 9 (10.3)  | 1.73 (0.44 to 6.74)                 | 2.86 (0.73 to 11.23)                        |
| Dysphonia                       | 4 (4.6)   | 2.14 (0.29 to 15.65)                | 10.78 (1.09 to 106.7)                       |
| Haemoptysis                     | 1 (1.1)   | 0.99 (0.97 to 1.00)                 | 0.99 (0.97 to 1.00)                         |

Husband being a smoker was seen more in the case group (36.8%) and majority were smoking at home (96.8%). Other house members smoking at home was more in the case group (26.4%). Firewood users with chimney and without chimney were similar in cases and controls.

**Table 3: Variables related to passive smoke exposure.**

| Variables related to passive smoke | Cases (N=87) | Controls (N=87) |
|------------------------------------|--------------|-----------------|
| Husband smoker                     | 32 (36.8)    | 24 (27.6)       |
| Husband smoking at home (n=husband smoker) | 31 (96.8)    | 9 (37.5)       |
| Other members smoking at home      | 23 (26.4)    | 3 (3.4)         |
| Firewood with chimney               | 6 (6.9)      | 13 (4.9)        |
| Firewood without chimney            | 61 (70.1)    | 58 (66.7)       |
| No LPG                              | 21 (24.1)    | 18 (20.7)       |
In univariate analysis, the odds for having respiratory illness if the husband is a smoker was 1.527 (0.804 to 2.899). And the odds increased 3 times if the husband smoked inside the house 4.728 (2.114 to 10.86). The odds further increased to 6.917 (1.859 to 24.740) when other family members also smoked inside the house (Table 4).

Table 4: Risk analysis.

| Univariate analysis | p value | Odds ratio | 95% C.I. Upper | 95% C.I. Lower |
|---------------------|---------|------------|----------------|----------------|
| If husband is a smoker | 0.194 | 1.527 | 0.804 | 2.899 |
| If the husband smokes at home | 0.008 | 4.728 | 2.110 | 10.86 |
| if any other family member smoked in home | 0.001 | 6.917 | 1.859 | 24.740 |

| Multivariate analysis | p value | Odds ratio | 95% C.I. Upper | 95% C.I. Lower |
|----------------------|---------|------------|----------------|----------------|
| If husband is a smoker | 0.255 | 0.836 | 0.306 | 2.284 |
| If the husband smokes at home | 0.009 | 5.481 | 1.520 | 19.764 |
| if any other family member smoked in home | 0.004 | 9.582 | 1.524 | 60.232 |

The Binary logistic regression model was adjusted for factors such as age, education, occupation, socioeconomic status, firewood use and type of fuel used. Smoker husband, husband and/or other member smokes at home were adjusted as per condition. The model had an R2 value of 0.261 (Cox and Snell R square). After adjusting the odds increased for both husband smoking at home to 5.481 (1.520 to 19.764) and other family members smoking at home increased to 9.582 (1.524 to 60.232) (Table 4).

**DISCUSSION**

In the present study, the two major symptoms seen were headache (35.5%) and cough (34.5%) similar to the Islamabad study done in a rural community, where the two major respiratory symptoms that were found to be associated with passive smoking were sinusitis and cough. An Italian study dyspnoea and rhinoconjunctivitis was the most frequently reported condition. The odds for having respiratory illness if the husband is a smoker was 1.527 (0.804 to 2.899) and the odds ratio increased to 4.7 (2.11 to 10.86) if the husband smokes at home. On multivariate analysis, we found a significant association between husband smoking in the house and respiratory illness (adjusted odds 5.481). This finding was similar to Islamabad study where an association between passive smoking and respiratory symptoms among married women was seen. A significant association was found between passive smoking and respiratory symptoms in many studies, while many reported no such association. The effect of SHS in non-smokers married to smokers was found to be 1.41 to 1.87 compared to those married to non-smokers according to the National Research Council.

Here symptoms like chest pain (2.70; 95%CI 1.05 to 6.89), morning tightness of chest (6.23; 95%CI 1.42 to 27.38), rhinorrhea (3.93; 95%CI 1.37 to 11.29), nasal irritation (6.19; 95%CI 2.05 to 18.70) and dysphonia (10.78; 95%CI 1.09 to 106.7) showed significant risk when the husband smokes at home. In the Islamabad study the odds of sinusitis was 2.2 (1.3 to 3.5) and cough 2.4 (1.2 to 4.8). In an Italian study dyspnoea showed an odds of 1.24 (0.97-1.58), rhinoconjunctivitis had odds 1.29 (1.06 to 1.57), shortness of breath at rest 1.41 (1.03 to 1.93) and cough with odds of 1.29 (1.01 to 1.66). In a population based cross sectional study done in Singapore, exposure to one or more smokers at home was weakly associated with allergic rhinitis having an odds ratio 1.43 (.094 to 2.18). Similar results have been shown in study done in France, where there was reduction in lung function of the women exposed to SHS. According to surgeon general report, there is sufficient evidence to infer a causal relationship between second hand smoke exposure and nasal irritation. The evidence is suggestive but not sufficient to infer a causal relationship between second hand smoke exposure and acute respiratory symptoms including cough, wheeze, chest tightness, and difficulty breathing among healthy persons.

**CONCLUSION**

The study showed that the risk of having respiratory illness is higher among females when the husband is a smoker and the risk increases three times if the husband smokes at home.

**Recommendations**

Since adverse effects of passive smoking on human health and quality of life, have been ascertained there is a need to promote awareness about the risks associated with passive smoking.

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**Ethical approval:** The study was approved by the Institutional Ethics Committee

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