RESPIRATORY SYMPTOMS IN RELATION TO AIR CONDITIONING AND DAMPNESS IN HOMES AND WORKPLACES AMONG THE OFFICE WORKERS IN MALÉ, MALDIVES

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A Thesis Submitted in Partial Fulfillment of the Requirements
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อาการผิดปกติของระบบทางเดินหายใจที่มีความสัมพันธ์กับระบบปรับอากาศ และความชื้นในบ้านพักอาศัย และสถานที่ทำงานต่อพนักงาน ณ เมืองมาเล ประเทศมัลดีฟ

นางอมินาท เซาฟา

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรมหาบัณฑิต
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อามินาท เชาฟา : อาการผิดปกติของระบบทางเดินหายใจ ที่มีความสัมพันธ์กับระบบปรับอากาศ และความชื้นในบ้านพักอาศัย และสถานที่ทำงานต่อพนักงาน ณ เมืองมาเล ประเทศมัลดีฟ (RESPIRATORY SYMPTOMS IN RELATION TO AIR CONDITIONING AND DAMPNESS IN HOMES AND WORKPLACES AMONG THE OFFICE WORKERS IN MALÉ, MALDIVES.) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: นพ. โรเบิร์ต เชควิค แชปแมน, 91 หน้า

มีรายงานจากหลายการศึกษาในสถานที่ต่างๆ ถึงความสัมพันธ์ของอาการโรคระบบทางเดินหายใจ ต่อเครื่องปรับอากาศ และความชื้นในบ้านพักอาศัย และสถานที่ทำงาน แต่ยังคงไม่ทราบถึงสาเหตุ อายุการใช้งานของระบบระบายอากาศ, การบำรุงรักษาเครื่องปรับอากาศที่ไม่เหมาะสม, น้ำรั่วไหล หรือความเสียหายจากน้ำและการารเติบโตของเชื้อราในอาคาร อาจเป็นปัจจัยที่เกี่ยวข้องกับอาการโรคระบบทางเดินหายใจ และภาวะการเจ็บป่วยของโรคระบบทางเดินหายใจ

การศึกษาภาคตัดขวางนี้ มีวัตถุประสงค์เพื่อหาความสัมพันธ์ของเครื่องปรับอากาศ ในบ้านพักอาศัย และสถานที่ทำงาน รวมถึงความชื้น กับความชุกของอาการและโรคระบบทางเดินหายใจของวัยผู้ใหญ่ ณ ที่ทำงานในส่วนราชการและเอกชน เมืองมาเล (Malé) เมืองหลวงของประเทศมัลดีฟส์ โดยทำการเก็บข้อมูลระหว่างเดือนมีนาคม 2553 โดยใช้แบบสอบถาม และได้รับการตอบกลับจำนวน 353 ชุด

ตัวแปรต้นของการศึกษา คือ อาการของโรค และภาวะการณ์เกิดโรค (โดยมีทั้งหมด 11 ตัวแปร ประกอบด้วย การไอ, เสมหะจากหน้าอก, การหายใจลำบากและถี่) และตัวแปรตาม 25 ตัวแปร โดยแบ่งเป็นกลุ่มได้ดังนี้ ลักษณะสังคมประชากร, ลักษณะสิ่งแวดล้อมของที่พักอาศัย และลักษณะของสถานที่ทำงาน ตัวแปรตามแต่ละตัวทำการวิเคราะห์ กับตัวแปรต้นในการวิเคราะห์แบบตัวแปรคู่

การวิเคราะห์แบบลอจิสติกพหุ นำมาใช้ในสำหรับแปรผลทั้งหมดที่ $P \leq 0.15$ สำหรับเครื่องปรับอากาศในที่พักอาศัย และ / หรือความชื้นในที่พักอาศัย ในการวิเคราะห์แบบตัวแปรคู่ รวมถึงตัวแปรตามอื่น ๆ ที่ $P \leq 0.15$ ความชุกของอาการไอ, เสมหะ และการวินิจฉัยปัญหาไซนัสจากแพทย์ มีความสัมพันธ์เชิงบวกกับ เครื่องปรับอากาศในบ้านพักอาศัย ซึ่งมีความสัมพันธ์ตามลำดับดังนี้ มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ ($p = 0.030$), มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติน้อย ($p = 0.054$) และไม่มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ ($p = 0.292$) ความชุกประเภทอื่น ๆ ไม่สามารถประเมินค่าได้กับความสัมพันธ์ ต่อเครื่องปรับอากาศในที่พักอาศัย โดยความชุกของอาการไอ, เสมหะ, การหายใจลำบากและหายใจถี่, โรคเยื่อจมูกอักเสบ และระคายเคืองตาที่บ้านพักอาศัย มีความสัมพันธ์เชิงบวกกับความชื้นในบ้านพักอาศัย ยกเว้นหายใจถี่ซึ่งไม่มีความสัมพันธ์อย่างมีนัยสำคัญ ($p = 0.352$) อาการของโรคอื่นๆทั้ง 5 อาการ พบว่ามีความสัมพันธ์อย่างมีนัยสำคัญกับความชื้นในที่พักอาศัย ($p < 0.05$)

จากการศึกษาพบว่า เครื่องปรับอากาศ และความชื้นในที่พักอาศัย เป็นปัจจัยเสี่ยงในการเกิดโรคระบบทางเดินหายใจ ความชื้นในที่พักอาศัยเป็นปัจจัยเสี่ยงมากกว่า เครื่องปรับอากาศ การศึกษานี้เสนอให้ ควรนำผลการศึกษานี้ไปใช้ในการศึกษาครั้งต่อไป เพื่อที่จะหาแนวทางในการลดการรับสัมผัสจากสภาพแวดล้อมภายในอาคาร ที่เป็นอันตรายต่อสุขภาพของระบบทางเดินหายใจ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต

ปีการศึกษา 2552 ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก Robert S. Chapman

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Respiratory symptoms in relation to air conditioning (AC) and dampness in homes and workplaces have been reported in various studies from different locations. Although the etiology remains unknown, the aging of ventilation systems, improper maintenance of the air conditioners, water leaks or water damage and mold growth in the buildings are some of the factors possibly related to respiratory symptoms and illnesses.

This was a cross-sectional study aimed to find out the associations of home and workplace air conditioning and dampness with respiratory symptom and illness prevalence among adults residing in Malé, the capital of the Maldives. Participants were workers at government and private-sector offices. Data were collected during March 2010 using a self administered questionnaire at the participants' offices. A total of 353 questionnaires were returned.

Symptom and illness prevalences were the dependent (outcome) variables in this study (total 11 outcomes, including cough, phlegm from the chest, wheezing and shortness of breath). The 25 independent variables were grouped into socio-demographic characteristics, home environmental characteristics and workplace characteristics. Each independent variable was analyzed against each dependent variable in a bivariate analysis.

Multiple logistic models were then constructed for all outcomes for which $p \leq 0.15$ for home AC and/or home dampness in bivariate analysis. These models also included other independent variables for which $p \leq 0.15$. In these models, prevalences of cough, phlegm, and doctor-diagnosed sinus trouble were positively associated with presence of home AC. Respectively, these associations were statistically significant ($p=0.030$), marginally significant ($p=0.054$), and non-significant ($p=0.292$). Other types of prevalence were not appreciably associated with presence of home AC. In these models, prevalences of cough, phlegm, wheeze, shortness of breath, rhinitis and eye irritation at home were also positively associated with home dampness. Except for shortness of breath, which was non-significant ($p=0.352$), all the other 5 symptoms showed statistically significant associations with home dampness ($p<0.05$).

In this study home AC and home dampness were both shown to be respiratory risk factors. Home dampness was a stronger risk factor than home AC. Further research is needed to determine the generalizability of these findings and to identify specific ways by which to reduce indoor environmental exposures that are harmful to respiratory health.

Field of Study Public Health Student's Signature

Academic Year : 2009 Advisor's Signature Robert S. Chapman

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LIST OF ABBREVIATIONS

AC	Air-conditioning
ETS	Environmental tobacco smoke
GYTS	Global Youth Tobacco Survey
HDM	House Dust Mite
HVAC	Heating Ventilation and Air-conditioning
IAQ	Indoor Air Quality
PM	Particulate matter
SHS	Second hand smoke
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1.1 Background and Rationale:

Indoor air quality (IAQ) is one of the major public health concerns worldwide. As people spend most of their time indoors in homes, offices, schools, health care centers or other buildings, the quality of the air they breathe indoors is very important for their health and well being. Proper ventilation can help improve the indoor air quality by controlling humidity and airborne contaminants, both of which can act as health hazards (Graudenz et al., 2005).

Air-conditioning systems are increasingly in use in hot, tropical countries to promote thermal comfort and IAQ for residents and workers. With the improvement of the living standards, the occupants require a more comfortable environment. The percentage of time people spent indoors are between 80-90% and the indoor environment has important effects on human health and also their work efficiency (Yu et al., 2009). “The factors affecting indoor environment mainly include temperature, humidity, air exchange rate, air movement, ventilation, particle pollutants, biological pollutants, and gaseous pollutants” (Graudenz et al., 2005).

Few studies have compared the people living as well as working in buildings with Heating Ventilation and Air conditioning (HVAC) systems and natural ventilation. The results of these studies reveal that people under the HVAC systems have a higher risk of respiratory problems. Some studies also revealed that people working in HVAC systems have to take more sick leaves and have to see the doctors often than people living or working in a naturally ventilated building. The major complaints the researchers found in association with HVAC are rhinitis, sinusitis, allergic wheeze, cough, and breathlessness (Graudenz et al., 2005).

Almost all the buildings that people live in will experience leaks, flooding or other forms of excessive indoor dampness at some point or the other. Excessive dampness is a problem by itself as well as a contributor to problematic exposures such as mold bacteria, dust mites, and such other types of agents that grow and flourish indoors. Likewise, wetness may cause the release of chemical particles from the building materials (Clark et al., 2004). There is evidence from the scientific reports that mold and other factors have a link to asthma symptoms in some people with chronic disorder, as well as to coughing, wheezing and upper tract symptoms in otherwise healthy people (Clark et al., 2004).

Respiratory disorders impose an enormous burden on society. According to the WHO World Health Report (2000), the top five respiratory diseases account for 17.4% of all deaths and 13.3% of all Disability-Adjusted Life Years (DALYs). Lower respiratory tract infections, chronic obstructive pulmonary disease (COPD), tuberculosis and lung cancer are each among the leading 10 causes of death worldwide.

Malé is the capital of Maldives where approximately 100,000 people live. Average temperatures vary throughout the year between 25^{o}C and 32^{o}C and the humidity ranges from 73-85%. Most of the office buildings and around 40% of the homes in Malé according to the 2006 census are air conditioned.(Planning, 2006) According to the Fortnight Epidemiological report from 18th Oct 2008 – 31st Oct 2009 (CCHCD, 2009), 48.8% cases were diagnosed with Acute Respiratory Infection (ARI) and it is the 1st leading communicable disease in Malé. To the best of my knowledge, this issue has not been studied previously in the Maldives. Therefore, it is unknown how many adults show respiratory symptoms in relation to the use of air conditioning, and the presence of dampness, at home or in the work place.

The main aim of this study was to evaluate whether respiratory symptoms, among the office workers are associated with air conditioning (AC) or dampness and to compare the strength of AC and dampness as respiratory risk factors. The study also investigated smoking as an important potential confounder in comparisons in relation to respiratory symptoms.

1.2 Objectives of the study

1.2.1. General objective

The main purposes of this study was to evaluate AC and home dampness as respiratory risk factors in persons working in offices in Malé, and to compare the strength of AC and dampness as respiratory risk factors.

1.2.2. Specific Objectives:

1. To identify the association between respiratory symptoms and the use of air conditioning at home and in the workplace.
2. To identify the association between home dampness and respiratory symptoms.
3. To compare the strength of home AC and home dampness as respiratory risk factors

1.3 Research Questions:

1. Is there an association between respiratory symptoms and the use of air conditioning at home and in the workplace?
2. Is there an association between home and work place dampness and respiratory symptoms?
3. Which is a stronger respiratory risk factor, home AC or home dampness?

1.4 Research Hypotheses:

1. There is an association between respiratory symptoms and the use of air conditioning at home and in the workplace.
2. There is an association between home and work place dampness and respiratory symptoms.
3. Home AC has a stronger risk factor than home dampness.

1.5 Benefits of the study:

The study revealed the importance of indoor air quality, in identifying the association of the common respiratory symptoms in relation to the type of ventilation in homes and work places. This, along with findings of other, related research, can be used as a guideline in giving suggestions to reduce the exposures, which can improve the indoor air quality and hence reducing respiratory symptoms of the residents in Malé. The policy makers could also use the same guideline in giving health education to the other areas of Maldives.

1.6 Conceptual Framework:

Due to the missing values and missing information the researcher was not able to analyze all the variables that were included in the questionnaire. However, among all the variables, the important independents variables that may have an association with the outcome variables were selected from the questionnaire for analysis. The independent variables were divided into socio-demographic characteristics, home environment and workplace characteristics. The outcome variables included were the respiratory symptoms and illness prevalences. It also included the absence from work in relation to the symptoms and illness prevalences. The arrangements of the independent and dependent variables are shown in figure 1. All the variables except age (continuous variable), were dichotomous or categorical in nature.

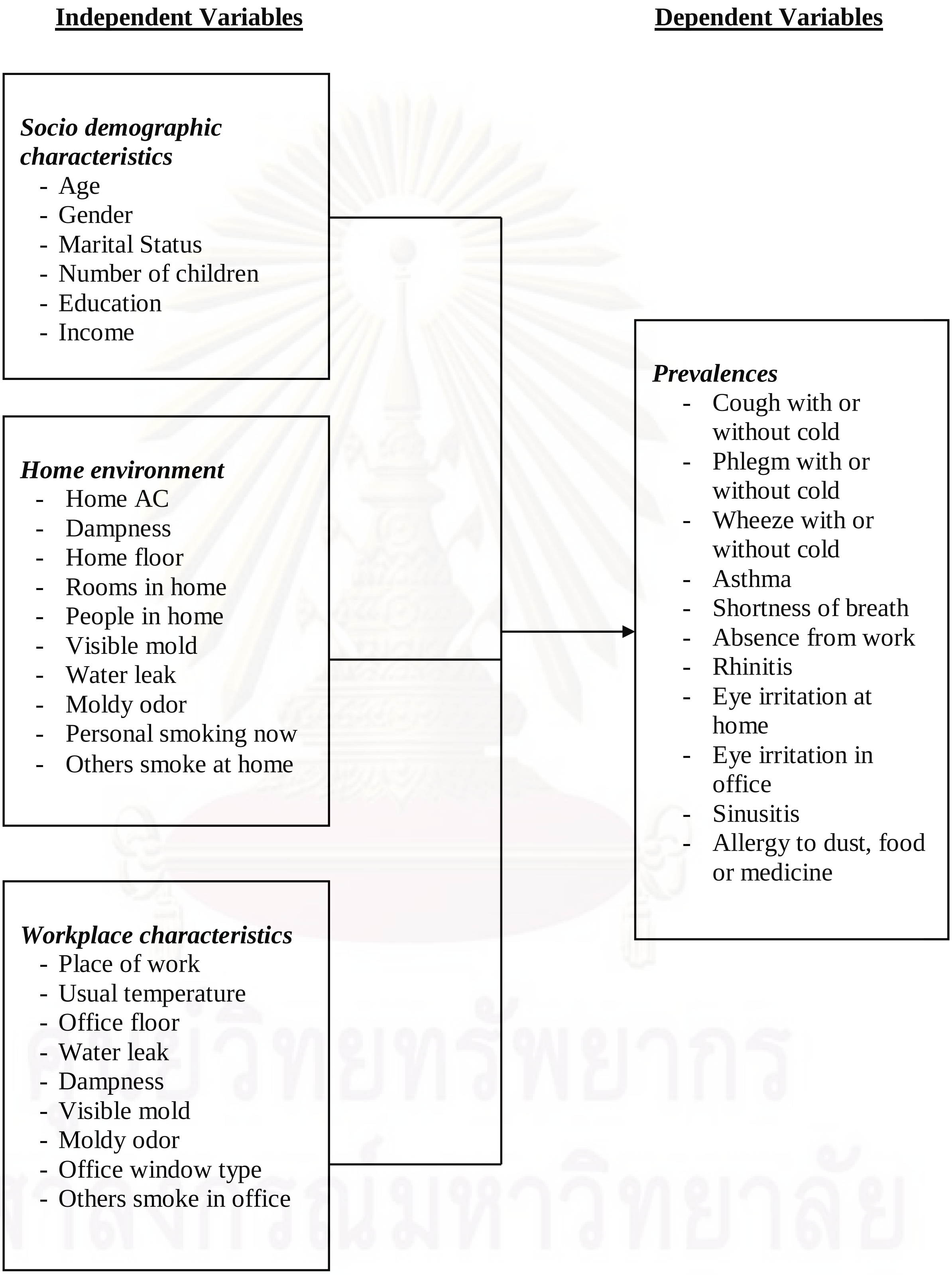
Independent Variables
Dependent Variables
Socio demographic characteristics
- Age
- Gender
- Marital Status
- Number of children
- Education
- Income
Home environment
- Home AC
- Dampness
- Home floor
- Rooms in home
- People in home
- Visible mold
- Water leak
- Moldy odor
- Personal smoking now
- Others smoke at home
Workplace characteristics
- Place of work
- Usual temperature
- Office floor
- Water leak
- Dampness
- Visible mold
- Moldy odor
- Office window type
- Others smoke in office
Prevalences
- Cough with or without cold
- Phlegm with or without cold
- Wheeze with or without cold
- Asthma
- Shortness of breath
- Absence from work
- Rhinitis
- Eye irritation at home
- Eye irritation in office
- Sinusitis
- Allergy to dust, food or medicine

Figure 1: Conceptual Framework

1.7 Operational definitions:

1. **Age** refers to the age of subjects at the time of the study
2. **Marital Status** refers to the legal status of each individual in relation to the marriage laws or customs of Maldives. This is categorized into single, married, divorced, widowed, separated and other.
3. **Number of children:** The number if children a participant had in the time of the study.
4. **Education level** refers to the highest level of education of the subjects at the time of the study. It is divided into primary, secondary, Bachelors degree, graduate study after Bachelors degree and Occupational or vocational or technical school.
5. **Income** refers to the amount of money the subject earns at the time of the study. It is divided into 6 categories; 2000-4000Rf, 4001-6000Rf, 6001-8000Rf, 80001-10,000Rf, 10,001-12,000Rf and above 12,000Rf.
6. **Air conditioning** is the cooling and dehumidification system that is used in the homes and workplace, for thermal comfort of the study participants. The participants were asked whether their homes and workplace had AC or not.
7. **Dampness:** The presence of damp stains on the walls or the ceilings of the home or workplace of the subjects in the past 12 months.
8. **Visible mold:** The presence of mold growth in the surfaces anywhere in the homes and workplace of the subjects in the past 12 months.
9. **Water leak:** Water leak or water damage in the homes and workplace of the subjects in the past 12 months.
10. **Moldy odor:** The presence of moldy odor in the homes and workplace of the subjects in the past 12 months.
11. **Moisture** was measured by using the hygrometer in the office buildings of the participants at the time of the study.
12. **Temperature** was measured by using the thermometer in the office buildings of the participants at the time of the study. The participants who use AC in their homes is asked at what temperature the AC is kept at home by using the questionnaire.

13. **Office workers** are defined as the administrative staffs who were working in a government or a private office building at the time of the study.
14. **Place of work:** The subjects worked in a government or private office.
15. **Usual temperature in the workplace:** The subjects were asked to check one answer out of the three factors; too cold, just right and too cold.
16. **Active smoking** was the intentional inhalation of smoke by a study participant at the time of the study. The participants were asked whether they ever smoked cigarettes.
17. **Passive smoking** was the inhalation of smoke from tobacco products smoked by others at the time of the study. The participants were asked whether any other person not counting themselves in their house hold or in the workplace smoked, and if they do whether they smoked in front of the subjects or not.
18. **Allergy**: Defined as a subject reporting allergy to dust, food or medicine at the time of the study.
19. **Respiratory symptoms:** The symptoms that affect the breathing systems such as coughing, phlegm from the chest, breathlessness, wheeze and runny nose.
20. **Cough:** Defined as reporting or cough with or without cold by a subject in the past 12 months.
21. **Phlegm:** Defined as reporting of bringing up phlegm or mucus from the chest of a subject when they have a cold or when they do not have a cold in the past 12 months.
22. **Wheezing:** Defined as a subject reporting of whistling sound produced during breathing in the presence or absence of a cold in the past 12 months.
23. **Asthma**: Defined as a subject reporting that asthma was diagnosed by a doctor.
24. **Shortness of breath:** Defined as reporting of breathlessness of a subject when hurrying on the level or climbing stairs.
25. **Rhinitis:** Defined as reporting the presence of a sneezing, or runny or blocked nose of a subject in the absence of a cold or flu, in the past 12 months.
26. **Sinusitis:** Defined as reporting of the sinus trouble which was ever diagnosed by a doctor.

27. **Eye irritation:** Defined as reporting of the watery or itchy eyes that a subject had during the past 12 months when she is at home or in the workplace.
28. **Absence from work:** The subjects not reporting to work due to any respiratory problems in the past 12 months.

CHAPTER II
REVIEW OF LITERATURE

2.1 Air conditioning and respiratory symptoms:

Bourbeau et al., (1997) conducted a study in Quebec City, Canada to see the prevalences of the symptoms among office workers before improvement of ventilation and six months and three years after the improvement of ventilation systems. The 7 types of symptoms included by the researchers were: eyes (dryness, irritation, or burning), nose and throat (dryness, runny nose, and nasal congestion), respiratory system (breathlessness, chest tightness, wheezing), skin (dryness, irritation, itching), fatigue, headache, and difficulty concentrating. The researcher also measured the respiratory diseases, including asthma, chronic pulmonary diseases such as bronchitis or emphysema), by the use of the self-administered questionnaire. Other factors like smoking were also assessed by using the questionnaire. The study revealed a decrease of 40-50% in the prevalence of most of the symptoms, six month after the workers were exposed to the buildings with an improvement ventilation system. The prevalences maintained the same after 3 years.

Sahakian et al., (2004) used data from 4345 adult US residents who were part of a 2004 national random mail survey. The study investigated the associations between dampness and air-conditioning in homes and offices, and the health outcomes and medical visits during 12 months. The population was divided into all subjects and office workers. For all the participants, weighted frequencies for home dampness were 26% and 79% for home AC. Among the office workers who reported home dampness showed a higher prevalence of nasal symptoms and constitutional symptoms (episodes of muscle pain, fever, chills, or disabling fatigue) in the previous year. The office workers who reported dampness in their workplace took more sick leaves related to respiratory symptoms in 12 months, and those who reported to have AC in their homes was associated in visiting a medical doctor in the previous year.

However, the study did not show any significant association between the work place and health outcomes.

Graudenz et al., (2002) conducted a study to analyze the risk factors and the association of work-related symptoms workers in Sao Paulo, Brazil. The study population were classified according to characteristics of the air conditioning system: group 1 worked in a building with ventilation machinery and ducts with> 20 years of use, group 2 with ventilation machinery with > 20 years of use plus ventilation ducts with < 2 years of use, and group 3 workers in a building that had ventilation machinery ducts with < 2 years of use. Group one had an older population and the proportions of men were larger than women, and 64.8% of the population complained of respiratory symptoms that worsened when inside the building. Based on the ventilation systems, there was no significant difference in age, smoking habits, lower respiratory symptoms, previous diagnosis of asthma, or rhinitis, family history of atopy, and number of flu like episodes. The study revealed a higher prevalence of building-related worsening of respiratory symptoms ($p<0.004$) and symptoms of rhino-conjunctivitis ($p<0.01$) in group 1. The relative humidity was significantly lower ($p<0.05$) and the temperature also insignificantly low in group 1, in comparison to the other groups. The total viable mold spores were higher in the outdoor samples than the indoors ($p<0.017$) and the levels of Der p 1 was higher in group 2 ($p<0.032$). The study revealed there was a strong association of building-related upper respiratory symptoms in places that had a ventilation system with > 20 years of use.

Graudenz et al., (2004) conducted an intervention in artificially ventilated offices in Sao Paulo, Brazil, to see the effects of an intervention in a ventilation system that is continuous use for more than 20 years. The study showed a reduction of the symptoms after renovation of the ventilation systems in comparison with the symptoms before the renovation. The symptoms that decreased after the intervention were naso-ocular symptoms, persistent cough and work-related worsening of the symptoms. The study showed the protective effect of AC renovation, in the multivariate analysis after adjusting for gender, accumulated work time and smoking habits. The study also revealed the clear association of the improvement of the symptoms after the AC renovation.

Graudenz et al., (2005) conducted a study to evaluate the association of heating, ventilation and air-conditioning systems (HVAC) and respiratory symptoms in a tropical city, in Sao Paulo, Brazil. 2000 individuals working in air-conditioned office buildings and 500 control workers in naturally ventilated buildings were selected as the study subjects. The study showed statistically significant and positive association of nasal symptoms (OR = 1.59), naso-ocular symptoms (OR = 1.58), persistent cough (OR = 3.04) sinusitis symptoms (OR=1.85) and building-related worsening of the symptoms (OR=4.92) with working in air-conditioned buildings. The study suggested that buildings with air conditioning were associated with a higher prevalence of symptoms in comparison with the naturally ventilated buildings.

Preziosi et al., (2004) conducted a cohort study to find out the association between type of ventilation in the workplace, medical visits, and sick leaves among middle-aged women, from a general population in France. The study revealed that the annual global medical attendance was higher among the people who worked in HVAC than the people who worked in a naturally ventilated building. It also showed a similar trend for the annual dermatological attendance. The study revealed a strong significant association in the sickness absence in the group with HVAC in comparison to the naturally ventilated group. The study also suggested the strong and significant risk factor in visiting the otorhinolaryngologist and the sick absence in middle aged women.

Respiratory symptoms among the office workers whose workplace have air conditioning are commonly reported according to various studies in many regions. Some studies reveal that the reason might be due to the use of not well maintained AC’s in the workplace as well as in the homes. (Mandell et al., 2008) Mandell et al., (2008) conducted a Building Assessment and Survey Evaluation Study (BASE) in US office buildings, from 1994 to 1998. The study revealed that there was a significant association between the upper respiratory symptoms and the level of the outdoor air intakes which was less than 60m above the ground. The study also revealed that the poor maintenance of the air conditioning and the less cleaning of the coils and drains of pans were associated with the increase in headache, eye symptoms, and also increase in lower respiratory symptoms among the workers. The analysis also showed that the humidification systems that were in poor condition, showed a substantial increase of the most symptoms (fatigue, difficulty concentration, skin symptoms, upper respiratory symptoms and eye symptoms). The operation of the ventilation systems between 10-12hours showed an increase of the several symptoms such as fatigue/difficulty concentration and possibly headache.

In 2006, Shah carried out a study to find out the association between air-conditioning and house dust allergy and house dust mite (HDM) infestation among the women in the city of Mumbai. Venous blood samples were taken and the serum was analyzed to detect the presence of house dust mite allergens. The participants whose homes had air-conditioning were found to have a significant association of being at risk for house dust allergy. Seventy-eight percent of the women in air-conditioned homes suffered from dust allergy when compared to the 26.3% women with naturally ventilated home. The study revealed that the women living in city of Mumbai whose homes with air-conditioning were at the risk of getting house dust mite allergy and house dust mite infestation.

Van Strien et al., (2004) conducted a study to identify the home and residents characteristics that were associated with mite allergen. The researchers collected dust samples from living rooms and mattresses of 750 homes in the northeastern US and was analyzed. Multiple linear regression was used to analyze the various characteristics on concentrations of mite allergens (Der p 1 and Der f 1) Absence of air conditioners, presence of mold or mildew, and a lower temperature were some of the characteristics that were associated with higher concentration of both mite allergens in dust from all sample locations. However, the concentrations of these factors did not change Der p 1 and Der f 1 by higher than a factor 2. The study also revealed that people of white ethnic background had a higher mite allergen concentration. Family income, family size and education level was influenced marginally with mite allergen concentration.

The case written below illustrates the possibility of air conditioning systems as non-infectious health hazards in occupational medicine in 2004. “A 35 year old male Caucasian bank-manager in Berlin, Germany, with a history of bronchial asthma from the age of 14 presented with an acute asthma attack in 2002.” (Gerber et al., 2006) He had no complains of asthma attacks in the past year, but this time had shown bronchial hyper-responsiveness. The history of the patient revealed that at noon while at his office, he sensed a smell of solvents, which made him feel unwell, irritated the conjunctivae followed with shortness of breath, cough and dyspnoea. The patient was treated successfully with a standard therapeutic treatment and no further complaints were noticed in the following four months. The direct source of the substance was not detected at his office, but further investigation of the whole building revealed that in the upper floors, painters had used a special sealing for 2 days to seal the floors. The painters did not present with any complaints as they carried safety suits and masks, but the aerosols developed from the volatile substances were transmitted via the AC to the bank managers as well as to other floors of the buildings. This case shows that improper use of toxic chemicals without exhauster and in combination with air conditioning systems may lead to incidents of inhalative exposures to non-involved employees even if the primary involved workers stick to basic precautions such as suits and masks. (Gerber at al., 2006)

2.2 Temperature variations and rhinitis:

The case-control study done in a laboratory in Sao Paulo, Brazil, in 2005 was aimed to compare the temperature variation relationship on the nasal mucosa of the participants with frequent rhinitis which was compared with a control group. “The rhinitis group showed a higher symptom score, epithelial shedding, percentage of eosinophils, total inflammatory cells, leukotriene C_4, eosinophil cationic protein, albumin, and tryptase levels compared with controls. There was also a significant increase in symptom score, total cells recovered, percentage of eosinophils, epithelial shedding, albumin, myeloperoxidase, and soluble intercellular adhesion molecule 1 in both groups compared with baseline levels” (Graudenz et al., 2006). The group with history of persistent rhinitis showed more obvious inflammatory nasal response and also activation of eosinophils due to the sudden temperature changes (Graudenz et al., 2006).

2.3 Dampness, mold growth and respiratory symptoms:

In 2000 a survey was conducted in two communities located in Southern Saskatchewan (Estevan and Swift current). The survey included children in grades 1 to 6 with respiratory symptoms and the questionnaire was completed by their parents (Lawson et al., 2005). The study showed that asthma was associated with respiratory allergy, early respiratory illness and also the family history of asthma. The study also showed a variation in asthma by town (Lawson et al., 2005). In Estevan, asthma was associated with home mould and dampness and was also inversely associated with air-conditioning. “The risk of asthma was increased if the child had previous exposure to environmental tobacco smoke from the mother in both the communities and there was an inverse association with current exposure to environmental tobacco from the mother in Estevan” (Lawson et al., 2005).

Kosinen at al., (1999) conducted a survey in Finland, to see how the healths of adults are affected by the presence of moisture or mold in the home. The participant’s houses were investigated to see for any signs of visual moisture or mold growth. Fifty-two percent of the homes were observed to have a moisture problem and 27% houses with mold problems. Exposure to moisture showed a significant association with sinusitis, acute bronchitis, nocturnal cough, nocturnal dyspnea and sore throat. Also the population that was exposed had shown significantly more episodes of common cold and tonsillitis. Exposure to mould also had a significant association with common cold, cough without phlegm, nocturnal cough, sore throat, rhinitis, fatigue and difficulties in concentration. “The study revealed that building related moisture or mold increased the risk of upper and lower respiratory infections and symptoms as well as of non-respiratory symptoms.”

Kilpeläinen at al., (2001) carried out a survey in Finland to assess the association of home dampness and respiratory symptoms among the first year University students aged 18 to 25 years. The dampness categories analyzed by the authors were visible mould and visible mould or damp stains or water damage during one year period. Fifteen percent of the respondents reported to have visible mould or damp stains. Adjustments were made for parental education, active and passive smoking, type and places of residence, pets and wall to wall carpets in the multivariate analysis. The study revealed a positive association between home dampness and current asthma, allergic rhinitis, atopic dermatitis, common cold and other respiratory infections. The study did not report any significant association between home dampness and allergic conjunctivitis. In this study exposure to visible mold and asthma (OR 2.21) and common colds (OR 1.49) showed the strongest association. The subjects with atopic heredity were found to be the highest at risk of current asthma in damp homes. The people living in damp homes were also at risk of getting current asthma, allergic rhinitis, and atopic dermatitis.

To find out the effects of exposure to damp housing on respiratory symptoms in men and women, a cross-sectional survey was conducted in Humboldt, Saskatchewan, Canada. The researchers examined sex differences in relation between damp housing and respiratory symptoms of 1988 adults, 18 to 74 years of age, using a self administered questionnaire. Chi-square and t- test was used to see the associations between potential factors and respiratory symptoms in men and women. The majority of the respondents (56.1%) were women in the study. The result showed that men had a significantly higher prevalence of chronic wheeze compared with women. The prevalence of chronic wheeze with shortness of breath and allergy were higher for women who reported damp housing when compared those who did not report damp housing. The study revealed that there was no significant association between damp housing and respiratory symptoms in men (Rennie et al., 2005).

The Respiratory Health in the Northern Europe (RHINE) study was a follow-up study of the subjects who participated in a cross-sectional study to see the associations between indoor dampness and respiratory symptoms. It was also followed by a longitudinal analysis of the indoor dampness as a risk factor for onset and remission of respiratory symptoms and asthma. According to the researcher this was the first time the remission of the symptoms was studied and analyzed. The results of the study revealed that wheeze, nocturnal breathlessness, nocturnal cough and asthma were significantly more prevalent in the subjects who reported the indoor dampness. The study also revealed that water damage, dampness in the floor material, and visible mold (three indicators of visible mold) were significant risk factors for all the respiratory symptoms analyzed in the study. However water leak was not found to be a significant factor for causing asthma (Gunnbjörnsdótti et al., 2006). The researchers found out indoor dampness was an independent risk factors for onset of respiratory symptoms, after adjusting for the possible confounders such as age, smoking status, age of building and sex.

2.4 Cigarette Smoking:

Tobacco is the second major cause of death in the world. It is currently responsible for the death of one in ten adults' worldwide (about 5 million deaths each year). If current smoking patterns continue, it will cause some 10 million deaths each year by 2020. Half the people that smoke today, that is about 650 million people- will eventually be killed by tobacco. (WHO, 2009)

The Maldives Global Youth Tobacco Survey (GYTS, 2004) data in the year 2004 showed that 38.7% of the boys and 17.5% girls in the school age had ever smoked and 18.4% boys and 7.8% girl's school going age currently smokes. The survey also revealed that 50.2% live in homes where others smoke in their presence. A survey done in collaboration with WHO in the year 2004 showed that 35% of the men and 10% of the men currently smokes daily and on average they started smoking at the age of 18years.

It is well known for over decades that active smoking or passive exposure to environmental tobacco smoke causes respiratory symptoms as well as long term complications. Yunesian et al., (2008) carried out a study in Tehran from July 2003 through April 2004 to see the respiratory symptoms related to smoking. The participants were interviewed by telephone among them 21.3% were males, and 3.4% females who were current smokers at the time of study. "About one third of the children and teenagers were exposed to smoking in one way or the other." The study showed there was a significant association between the adult smokers and respiratory symptoms such as cough, phlegm, breathlessness, chest tightness, and throat discomfort. “In teenage group, cough and phlegm were related to habitual smoking.” The study also revealed that the respiratory symptoms associated with smoking varied among the different age groups.

CHAPTER III

METHODOLOGY

3.1 Research Design

This was a cross-sectional study aimed to find out the associations of home and workplace air conditioning and dampness with respiratory symptom and illness prevalence among adults who were residing in Malé, during the study period. The data for this study was collected at the office.

3.2 Study area

The study was conducted in Malé, the capital city Maldives. Malé was selected as the study area due to the high population density, intermediate state of development, its humid tropical location, and also the availability of adequate data for this study. Malé has an area of roughly 5 sq kilometers and the island is administratively divided into five areas: Henveru (occupies the North-East side), Maafannu (occupies the North-West side), Galolhu (central) Machangolhi (south) and Vilimalé.

In most of the island, commercial and residential areas are not separate. The island is further divided into blocks and every block has a number assigned by Malé Municipality. Each block may enclose multiple houses, garages, shops and many other buildings. All the houses have a name unlike the numeric addresses as in other countries.

3.3 Study population

The target population of this study was the adult residents of Malé, who were about 20 - 60 years old and who were employed in a public or private administrative office.

ศูนย์วิทยทรัพยากร จุฬาลงกรณ์มหาวิทยาลัย

3.4 Sampling Technique

The data for this study was collected at the office. The sampling technique that was used for the study was stratified random sampling. The office buildings were stratified into two sub-groups, private and government buildings. A list of the government and private buildings was taken and all the school buildings, ground floor buildings, small office buildings that had less than 10 workers and buildings that had both private and government offices were excluded. Thirty large office buildings from each sector which had more than 20 workers in a floor were selected purposively. Six buildings from each sector were then randomly selected for the study. After excluding the ground floor, one floor of each building that was chosen for the study was then selected by using the random table, and all the workers in the floor were chosen as the study participants. The floors of a building varied from 2 to 8 and the number of workers in a floor varied between 20 and 70. All the study participants were between 20 and 60 years of age.

3.5 Sample Size Calculation

To calculate the sample Cochran’s formula was used.

$$n = \frac{z^2pq}{d^2}$$

n= sample size

z= the standard normal deviate for 2-tailed tests with 95% confidence

p= proportion (prevalence) of the characteristic of interest in the population

q= (p-1)

d= acceptable error (5% = 0.05)

To the best of my knowledge, respiratory symptom prevalence has never been systematically measured in Maldives. Thus, to help ensure a reliable test of air conditioning effects, I assumed symptom prevalence of 50%, which would lead to the largest possible calculated sample size.

The sample size calculation was as follows $n = (1.96^2)(0.5)(0.5) / 0.05^2 = 384.2$ which rounded up to 385. To account for missing data and refusals to participate, I added 10% (39 people), for a total sample size of 423 participants.

3.6 Inclusion criteria

1. The subject had to be working in government or private office building with air conditioning in Malé.
2. The subjects who worked in the office for at least 8 hrs on a working day.
3. The subjects, male or female who were at the age between 20 – 60 years.
4. The subjects who were willing to participate in this study.

3.7 Exclusion criteria

1. The buildings which had both private and government offices were excluded
2. Basement and ground floor of all the buildings selected for the study were excluded.

3.8 Measurement Tools

A standardized questionnaire was developed from respiratory symptom questionnaires which have been used earlier, especially the American Thoracic Society standardized questionnaire (Ferris 1978) and based on the relevant studies. The questions were directed toward gaining information about socio-demographic characteristics, home environment, workplace characteristics and the symptoms prevalences. The questionnaire was adapted with the help of the advisor, and according to comments of the ethical review committee in the Maldives. The questionnaire was then translated from English to Dhivehi (Maldivian language) and every effort was made to ensure that the meaning remained the same.

3.9 Pre-test

All the people working in a floor of one office building (government) that was not selected for the actual study were chosen and the questionnaire was pre-tested, for 35 subjects, to ensure the clarity and interpretation, and also to improve the reliability of responses of the included information. The pre-test confirmed that all the questions were clearly understood, and no changes were made in the questionnaire.

3.10 Data Collection

Data were collected from 9th to 17th March 2010, by using a self-administered questionnaire after approval from the Ethical Review Committee of the Chulalongkorn University and Maldives Research Committee. Prior to data collection, authorization from the heads of all the organization were taken and 498 questionnaires were distributed to all the workers. Participant information sheet and consent form was attached with all the questionnaires which explained the purpose of the study, and that participating in the study was voluntary and they are free to abstain from the study at any time they want, and they will not lose any of the benefits to which they were entitled. Since it was a self-administered questionnaire, and the workers did not have time to fill it in front of the researcher, out of the 498 questionnaires distributed, a total of 353 questionnaires were returned back to the researcher (83.5% of the "expanded" sample size of 423 and 91.7% of the "base" sample size of 385). Thus, the final sample was somewhat smaller than the calculated sample size. Even so, it was sufficient to test differences at a 95% confidence level for most symptoms and at a confidence level between 90 and 95% for symptoms with prevalences near 50%. Thus, the sample obtained was sufficient for the purposes of this study. The temperature and the humidity were also checked one time for the selected floors in each building by the researcher using a thermo-hygrometer.

3.11 Data Analysis

Data were processed and analyzed by using SPSS version 16 for windows. Descriptive statistics including frequency and percentage was used primarily to summarize the 25 independent variables and 11 dependent variables. The dependent variables were prevalences of 11 respiratory symptoms and illnesses, and the independent variables were divided into 3 main parts; socio-demographic characteristics, home environment and workplace characteristics (see conceptual framework). Mean and standard deviation were used to summarize the continuous variable age.

The inferential portion of the analysis was divided into bivariate and multivariable testing. In bivariate analysis, the dichotomous outcome variables were assessed in relation to one independent variable at a time. Chi-square tests were used for categorical independent variables. Logistic regression was used for the continuous independent variable, age. tested by using chi-square to test the association between the symptoms and the use of air conditioning, dampness, smoking, and other related factors.

Multivariable testing was based on the results of the bivariate analysis. For each type of prevalence, independent variables with p-values of 0.15 or less were identified. If these included home AC, all such variables were included in a logistic regression model for that type of prevalence. The same rule was followed for home dampness. This procedure yielded semi-final logistic regression models. Final models were then constructed. These included all independent variables for which $p \leq 0.15$ in semifinal models. Home AC and home dampness were included in these final models no matter what their p-value in semifinal models. When interpreting results, p-values less than 0.05 were considered statistically significant, and p-values between 0.05 and 0.10 were considered marginally significant.

3.12 Ethical Consideration:

The study was approved by the Ethical Review Committee for Research Involving Human Research subjects, Health Sciences Group, Chulalongkorn University with the certified code number 166.1/52. The study was also approved from the Maldives National Health Research Committee, Ministry of Health, Malé, Republic of Maldives. Verbal consent of the department heads were taken before distribution of the questionnaires to the participants. The participants were explained in detail, the full description of the research and confidentiality. As it was a self-administered questionnaire participant information sheet and consent form was attached with all the questionnaires which explained the purpose of the study, and that participating in the study was voluntary and they are free to abstain or withdraw from the study any time they wanted, and they would not lose any of the benefits to which they were entitled.

CHAPTER IV

RESULTS

This chapter describes the results of data analysis. The study included 25 independent variables and 11 dependent variables. The independent variables were divided into three main parts; socio-demographic characteristics, home environment and workplace characteristics.

Socio-demographic variables included were age (continuous covariate), gender (dichotomous covariate), marital status (dichotomous covariate), education (factor 3 levels), number of children (factor 3 levels) and income (factor 3 levels).

Home environment characteristics included were home floor covering (dichotomous covariate), rooms in home (factor, 3 levels), number of people in home (factor 3 levels), home AC (dichotomous covariate), visible mold in home (dichotomous covariate), home dampness (dichotomous covariate), water leak home (dichotomous covariate), moldy odor home (dichotomous covariate), smoke now (dichotomous covariate) and others smoke at home (dichotomous covariate).

The workplace characteristics included were place of work (dichotomous covariate), usual temperature in office (factor, 3 levels), office floor (dichotomous covariate), office windows sealed or not (dichotomous covariate), water leak office (dichotomous covariate), office dampness (dichotomous covariate), visible mold (dichotomous covariate) moldy odor office (dichotomous covariate) and others smoke in office (dichotomous covariate).

The outcome variables included in this study were the symptoms; cough with or without colds, phlegm with or without colds, wheeze with or without colds, asthma, shortness of breath, absence from work, rhinitis, eye irritation at home, eye irritation in office, sinusitis and allergy to dust or food or medicine. All these variables were treated as dichotomous variables.

Descriptive statistics (frequency, percentage, mean, and standard deviation) was used to primarily summarize all the variables, and the analytical portion of the analysis was tested by using chi-square to test the association between the symptoms and the use of air conditioning, dampness, smoking, and other related factors. Logistic regressions were used to analyze the continuous variable such as age of the respondents. Bivariate analyses were used to see the associations between the 11 dependent variables with 25 independent variables. Based on the bivariate analysis, the symptoms that had an association with home AC or dampness were included in the multivariable analysis and a final model was constructed to evaluate associations.

4.1. Socio-demographic Characteristics

The socio-demographic characteristics of the participants are shown in Table 1. The mean age of the subjects who participated in this study was 31 years (SD = 8.2). Majority (58.9%) of the participants were females and 62.6% were married. All the participants had some kind of education before joining the work area; among them 19.5% reported had finished primary education, 61% had finished secondary education, and 17.3% had finished higher education; degree or post graduate degree. The monthly income of the respondents were divided into three categories; 43.3% of the participant's received between Rf 2000-6000 (156 to 467 USD), 36.5% received Rf 6001-10,000 (467 to 778 USD), and 19.5% of the participants received above Rf 10,000 (>778 USD).

Table 1: Socio-demographic characteristics (n=353)

Socio-demographic characteristics	Number	Percentages *
Age, mean = 31.2, SD = 8.2 (continuous covariate)		
Gender (dichotomous covariate)		
Male	145	41.1
Female	208	58.9
Marital status (dichotomous covariate)		
Married	219	62.6
Unmarried	131	37.4
Number of children (factor, 3 levels)		
None	173	49.0
1	77	21.8
>1	93	26.3
Education level (factor, 3 levels)		
Primary	69	19.5
Secondary	217	61.5
Higher education	61	17.3
Income (factor, 3 levels)		
Rf 2000-6000	153	43.3
Rf 6001-10,000	129	36.5
Rf >10,000	69	19.5

*Percentage of 353

4.2. Characteristics of the home environment

Characteristics of the home environment are displayed in Table 2. Majority (92.6%) of the participant's homes, have tiles and other types of floor covering were less commonly used. Among all participants, 47% people lived in an air-conditioned home while 51% lived in a naturally or ventilated home. In this study 26.6% of the subjects reported exposure to home dampness during the previous 12 months. Visibility of mold growth was reported by 11.9% of the subjects, water leakage reported by 25.8% and presence of a moldy odor by 45%. Most (n=265, 75.1%) of the participants reported not having smoked ever in their life however, 21.5% of the participants are smokers or had ever smoked. Others at home smoked were reported by 49.9% of the participants showing the environmental exposure of tobacco smoke among the non-smokers.

Table 2: Home environmental characteristics (n=353). Percentages are given with 353 as the denominator.

Home environment	Number	(%)*
Home floor covering (dichotomous covariate)		
Tiles	327	92.6
Others	22	6.2
Rooms in home (factor, 3 levels)		
1-2	130	36.8
3-4	139	39.4
>4	81	22.9
Number of people in home (factor, 3 levels)		
1-5	97	27.0
6-10	158	44.8
>6	73	20.7
Air conditioning (AC) (dichotomous covariate)		
Yes	166	47.0
No	180	51.0
Home dampness (past year) (dichotomous covariate)		
Yes	94	26.6
No	257	72.8

*Percentage of 353

Table 2: Home environmental characteristics (n=353). Percentages are given with 353 as the denominator. (continued)

Home environment	Number	(%)*
Visible mold (past year) (dichotomous covariate)		
Yes	42	11.9
No	309	87.5
Water leak (past year) (dichotomous covariate)		
Yes	91	25.8
No	259	73.4
Moldy odor (past year) (dichotomous covariate)		
Yes	45	12.7
No	305	86.4
Smoke now (dichotomous covariate)		
Yes	76	21.5
No	265	75.1
Others smoke at home (dichotomous covariate)		
Yes	176	21.5
No	171	48.4

*Percentage of 353

4.3. Workplace characteristics

The prevalence of the workplace characteristics reported by the participant's is shown in Table 3. 61.8% of the participants worked in the government while 38.2% of them work in a private organization. The average years, a subject had worked in the allocated office building was 4.9 (SD = 5.85). The floor covering of most of the respondents was tiles, while only 19.3% had other types of floor covering. In the workplace 24.1% of the participants reported exposure to dampness, water damage was reported by 32%, visibility of mold by 16.4% and presence of a moldy odor was reported by 17.8%. Among the participants who responded that others in the office smoke were 18.1%.

Table 3: Prevalence of workplace characteristics (n=353)

Workplace characteristics	Number	Percentage*
Place of work (dichotomous covariate)		
Government	218	61.8
Private	135	38.2
Usual temperature in office (factor, 3 levels)		
Too cold	54	15.3
Just right	277	78.5
Too warm	21	5.9
Office floor (dichotomous covariate)		
Tiles	277	78.5
Others	68	19.3
Office window (dichotomous covariate)		
Sealed	65	18.4
Not sealed	287	81.3
Water leak (past year) (dichotomous covariate)		
Yes	113	32.0
No	237	67.1
Dampness (past year) (dichotomous covariate)		
Yes	85	24.1
No	267	75.6
Visible mold (past year) (dichotomous covariate)		
Yes	58	16.4
No	292	82.7

*Percentage of 353

Table 3: Prevalence of workplace characteristics (n=353) (continued)

Workplace characteristics	Number	Percentage*
Moldy odor (past year) (dichotomous covariate)		
Yes	63	17.8
No	288	81.6
Others smoke in office (dichotomous covariate		
Yes	64	18.1
No	280	79.3

*Percentage of 353

4.4. Symptom prevalence

Symptom prevalences reported by the participants are presented in Table 4. Among all the respondents, cough with or without a cold was reported by 48.7%, phlegm with or without a cold by 29.5%, wheeze with or without a cold by 30.0%, asthma by 8.8% shortness of breath by 26.1%, absence from office by 12.5% rhinitis without a cold by 28.3%, eye irritation at home by 26.3%, eye irritation in home 24.1%, sinus trouble diagnosed by a doctor was reported by 34% and allergic to dust, food or medicine by 47.9%.

Table 4: Prevalences of symptoms (n = 353)

Symptom characteristics	Number	Percentage*
Cough with or without cold		
Yes	172	48.7
No	181	51.3
Phlegm with or without cold		
Yes	104	29.5
No	248	70.3
Wheeze with or without cold		
Yes	106	30.0
No	246	69.7
Asthma		
Yes	31	8.8
No	319	90.4
Shortness of breath		
Yes	92	26.1
No	260	73.7
Absence from work		
Yes	44	12.5
No	306	86.7
Rhinitis without cold		
Yes	100	28.3
No	253	71.7
Eye irritation at home		
Yes	93	26.3
No	260	71.7
Eye irritation in office		
Yes	85	24.1
No	267	75.6

*Percentage of 353

Table 4: Prevalences of symptoms (n = 353) (continued)

Symptom characteristics	Number	Percentage *
Sinus trouble		
Yes	120	34.0
No	233	66.0
Allergic to dust, food or medicine		
Yes	169	47.9
No	182	51.6

*Percentage of 353

4.5. Symptom prevalence in relation to the presence of home air conditioning

Table 5 presents the symptom prevalences in relation to the presence of home air conditioning. Out of the 11 outcome variables in table 5 cough with and without colds (55.4%), phlegm with and without colds (35.2%) and sinus trouble (39.2%) were in the positive direction and showed a higher prevalence among those who lived in air conditioned homes in comparison with the homes without AC. The direction was also positive for the symptoms wheeze with or without colds (30.7%), asthma (9.1%), and allergy for dust, food or medicine (50.9%) even though the prevalences were slightly higher among those who lived in air conditioned homes than in those who lived in homes without AC.

Table 5: Frequencies and percentages of symptoms in relation to presence of home air conditioning

	Home AC status			
	Yes		No	
Symptom	frequency	%	Frequency	%
Cough with or without colds	92	55.4	74	41.1
Phlegm with or without colds	58	35.2	44	24.4
Wheeze with or without colds	51	30.7	53	29.6
Diagnosed asthma	15	9.1	16	8.9
Shortness of breath	43	26.1	48	26.7
Absence from work	20	12.0	23	13.0
Rhinitis without cold	42	25.3	54	30.0
Eye irritation at home	39	23.5	52	28.9
Eye irritation eyes in office	37	22.3	45	25.1
Diagnosed sinus trouble	65	39.2	52	28.9
Allergy to dust, food or medicine	84	50.9	83	46.4

4.6. Symptom prevalences in relation to the presence of home dampness

Table 6 presents the symptom prevalences in relation to the presence of home dampness. All the 11 symptoms analyzed showed a positive direction in relation to the presence of home dampness. The prevalences were higher among the subjects who reported home dampness in comparison to the subjects who reported no dampness in their homes.

Analysis was also done to see the relationship between home AC and home dampness. The result showed was p=0.224, which suggested there was little or no co-linearity between the home air conditioning and home dampness, and thus that home AC and dampness were independent risk factors.

Table 6: Frequencies and percentages of symptoms in relation to dampness in the home

	Home dampness			
	Yes		No	
Symptom	Frequency	%	Frequency	%
Cough with or without colds	56	59.6	116	45.1
Phlegm with or without colds	36	38.3	68	26.6
Wheeze with or without colds	41	44.1	65	25.3
Diagnosed asthma	9	9.8	22	8.6
Shortness of breath	30	31.9	61	23.8
Absent from work	15	16.1	29	11.4
Rhinitis without cold	35	37.2	65	25.3
Eye irritation eyes at home	35	37.2	58	22.6
Eye irritation eyes in office	27	29.0	58	22.6
Diagnosed sinus trouble	34	36.2	86	33.5
Allergy to dust, food or medicine	48	51.6	121	47.3

4.7. Bivariate associations between socio-demographic factors, home environment, workplace characteristics and the symptoms

Bivariate analysis was done to see the associations between the dependent and independent variables in this study. Each outcome variable (symptoms) was analyzed with 25 independent variables. This analysis was used as the basis for constructing multiple logistic regression models for the 11 outcomes.

4.7.1 Cough with or without cold in the past 12 months.

Table 7 shows the association of cough with and without cold and the socio-demographic factors, home environment and workplace characters. The socio-demographic characters did not show any significant association with cough. Among the home environment characteristics, home AC (p=0.008), home dampness (p=0.017), and others at home (p=0.036) showed significant associations. However the number of people at home showed a positive, marginal association (p=0.099) with cough with and without cold. Among the workplace characteristics, moldy odor in office (p=0.005) and others smoking in office (p=0.015) showed statistically significant association. However, visible mold in office (p=0.103) showed positive, marginally significant association.

Table 7: Bivariate analysis of cough with or without cold in the past 12 months

	Cough with or without colds		
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	1.133	1	0.287
Gender	0.329	1	0.566
Marital Status	1.219	1	0.270
No. of children	2.226	2	0.329
Education	0.974	2	0.614
Income	0.109	2	0.947
Home environment			
Home floor	2.259	1	0.133
Rooms at home	0.694	2	0.707
People at home	4.618	2	0.099
Home AC	7.086	1	0.008
Visible Mold home	0.218	1	0.641
Home dampness	5.741	1	0.017

Table 7: Bivariate analysis of cough with or without cold in the past 12 months (continued)

	Cough with or without colds		
	χ^2	df	p-value
Home environment			
Water leak home	0.309	1	0.578
Moldy odor home	2.566	1	0.109
Smoke now	0.537	1	0.464
Others smoke at home	4.409	1	0.036
Workplace characteristics			
Place of work	2.206	1	0.137
Usual temp of office	4.442	2	0.108
Office floor	0.386	1	0.534
Water leak office	1.201	1	0.273
Office dampness	0.133	1	0.715
Visible mold office	2.652	1	0.103
Moldy odor office	7.941	1	0.005
Office window type	0.502	1	0.479
Others smoke in office	5.874	1	0.015

4.7.2. Phlegm with or without cold in the past 12 months.

Table 8 shows the association between the socio-demographic factors, home environment, workplace and phlegm with and without cold. The result did not show any significant relationship between phlegm and socio-demographic factors. The subjects who reported to have air conditioning (p=0.029) and dampness (p=0.033) in their homes was shown to be significantly associated with phlegm. The subjects who smoked during the survey showed positive, marginal association with phlegm (p=0.074), while others smoking at home had a higher significant association (p=0.012). In the workplace water leak (p=0.002), moldy odor (p=0.002) and visible mold (p=0.023) showed higher significant association with phlegm. Others smoke in office also showed significant association (p=0.013).

Table 8: Bivariate analysis of phlegm with or without colds in the past 12 months

	Phlegm with or without colds		
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	0.015	1	0.903
Gender	1.120	1	0.290
Marital Status	0.162	1	0.687
No. of children	2.668	2	0.263
Education	2.012	2	0.366
Income	1.487	2	0.475
Home environment			
Home floor	1.442	1	0.230
Rooms at home	2.608	2	0.271
People at home	2.784	2	0.249
Home AC	4.739	1	0.029
Visible mold home	1.605	1	0.205
Home dampness	4.534	1	0.033
Water leak home	1.251	1	0.263
Moldy odor home	4.522	1	0.033
Smoke now	3.187	1	0.074
Others smoke at home	6.315	1	0.012
Workplace characteristics			
Place of work	0.746	1	0.388
Usual temp of office	1.243	2	0.537
Office floor	0.609	1	0.435
Water leak office	10.068	1	0.002
Office dampness	1.269	1	0.260
Visible mold office	5.193	1	0.023
Moldy odor office	9.795	1	0.002

Table 8: Bivariate analysis of phlegm with or without colds in the past 12 months (Continued)

	Phlegm with or without colds		
	χ^2	df	p-value
Workplace characteristics			
Office window type	1.404	1	0.236
Others smoke in office	6.148	1	0.013

4.7.3. Wheeze with or without colds in the past 12 months.

Table 9 presents the association of socio-demographic factors, home environment, workplace characteristics and wheeze with cold. None of the socio-demographic characteristics showed marginal or significant association with wheeze with or without cold in the past 12 months. In the home environment factors, home floor (p=0.010), visible mold (p=0.025), dampness (p=0.001) and moldy odor (p=0.043) showed to have significant association. Water leak in the workplace showed a higher significant association (p=0.006), while presence of moldy odor (p=0.064) showed positive, marginal significant association with wheeze with or without a cold.

Table 9: Bivaraite analysis of wheeze with or without colds in the past 12 months

	Wheeze with or without cold		
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	1.158	1	0.282
Gender	2.237	1	0.135
Marital Status	0.881	1	0.348
No. of children	1.945	2	0.378
Education	3.251	2	0.197
Income	0.713	2	0.700
Home environment			
Home floor	6.622	1	0.010
Rooms at home	1.462	2	0.481
People at home	4.350	2	0.114
Home AC	0.051	1	0.822
Visible Mold home	5.054	1	0.025
Home dampness	11.424	1	0.001
Water leak home	2.844	1	0.092
Moldy odor home	4.105	1	0.043
Smoke now	2.130	1	0.144
Others smoke at home	0.720	1	0.396
Workplace characteristics			
Place of work	0.639	1	0.424
Usual temp of office	0.309	2	0.857
Office floor	0.569	1	0.451
Water leak office	7.532	1	0.006
Office dampness	0.817	1	0.366
Visible mold office	2.035	1	0.154
Moldy odor office	3.430	1	0.064
Office window type	0.018	1	0.894
Others smoke in office	0.401	1	0.527

4.7.4. Doctor-diagnosed asthma

Table 10 shows the association between socio-demographic factors, home environment, workplace characteristics and asthma. Gender (p=0.010) and education (p=0.028) showed to have a significant association with asthma, while income (p=0.073) showed positive, marginal significant association. Among the home environmental factors, home floor only showed to have a marginal significant association with asthma. Place of work (p=0.043) and office window type (p=0.012) showed significant association with asthma.

Table 10: Bivariate analysis of asthma diagnosed by a doctor

		Asthma	
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	0.018	1	0.894
Gender	6.668	1	0.010
Marital Status	0.313	1	0.576
No. of children	1.299	2	0.522
Education	7.133	2	0.028
Income	5.234	2	0.073
Home environment			
Home floor	2.450	1	0.118
Rooms at home	0.034	2	0.983
People at home	0.936	2	0.626
Home AC	0.002	1	0.961
Visible Mold home	0.183	1	0.668
Home dampness	0.118	1	0.731
Water leak home	0.708	1	0.400
Moldy odor home	0.000	1	0.991
Smoke now	0.510	1	0.475
Others smoke at home	0.062	1	0.803
Workplace characteristics			
Place of work	4.093	1	0.043
Usual temp of office	4.476	2	0.107
Office floor	0.886	1	0.347
Water leak office	0.598	1	0.439
Office dampness	0.058	1	0.809
Visible mold office	2.576	1	0.109
Moldy odor office	0.621	1	0.431
Office window type	6.380	1	0.012
Others smoke in office	0.577	1	0.447

4.7.5. Shortness of breath

Table 11 shows the association between socio-demographic factors, home environment, workplace characteristics and shortness of breath. Gender (p=0.028) showed to have a higher significant relationship with shortness of breath. Income of the respondents showed a marginal significant association (p=0.053). Even though current smokers had no association with shortness of breath, positive marginal significant association (p=0.067) was seen between the others smoke at home. The analysis did not show any significant association between shortness of breath and workplace characteristics. Workplace characteristics did not show any association with shortness of breath.

Table 11: Bivariate analysis of shortness of breath

	Shortness of breath		
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	0.049	1	0.825
Gender	4.809	1	0.028
Marital Status	0.014	1	0.907
No. of children	0.810	2	0.667
Education	1.484	2	0.476
Income	5.858	2	0.053
Home environment			
Home floor	0.015	1	0.901
Rooms at home	3.431	2	0.180
People at home	0.716	2	0.699
Home AC	0.016	1	0.898
Visible Mold home	0.119	1	0.730
Home dampness	2.337	1	0.126
Water leak home	2.378	1	0.123
Moldy odor home	0.038	1	0.846
Smoke now	0.308	1	0.579
Others smoke at home	3.361	1	0.067
Workplace characteristics			
Place of work	0.032	1	0.858
Usual temp of office	0.727	2	0.695
Office floor	0.059	1	0.808
Water leak office	1.036	1	0.309
Office dampness	0.075	1	0.784
Visible mold office	0.099	1	0.753
Moldy odor office	0.015	1	0.904
Office window type	0.857	1	0.355

Table 11: Bivariate analysis of shortness of breath (continued)

	Shortness of breath		
	χ^2	df	p-value
Workplace characteristics			
Others smoke in office	1.178	1	0.278

4.7.6. Absence from work in the past 12 months

Table 12 shows the association between socio-demographic, home environment and workplace characteristics and absence from work for respiratory reasons during the past 12 months. Education was seen as one of the factor that was associated (p=0.019) with being absent to office during the past year due to any respiratory symptoms that was analyze in this study. Among the home environment characteristics home floor covering (p=0.034), showed significant association and the number of people at home (p=0.090) showed positive, marginal significant association with absence from work. Out of the workplace characteristics only usual temperature of office was found to have statistically significant association with absence from work.

Table 12: Bivariate analysis of absence from work due to respiratory symptoms in the past 12 months

	Absence from work		
	χ^2	df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	0.070	1	0.791
Gender	1.117	1	0.291
Marital Status	0.301	1	0.583
No. of children	1.844	2	0.398
Education	7.914	2	0.019
Income	0.254	2	0.881
Home environment			
Home floor	4.485	1	0.034
Rooms at home	3.913	2	0.141
People at home	4.813	2	0.090
Home AC	0.070	1	0.791
Visible Mold home	1.309	1	0.253
Home dampness	1.396	1	0.237
Water leak home	0.287	1	0.592
Moldy odor home	0.474	1	0.491
Smoke now	0.334	1	0.563

Table 12: Bivariate analysis of absence from work due to respiratory symptoms in the past 12 months (continued)

		Absence from work	
	χ^2	Df	p-value
Home environment			
Others smoke at home	1.702	1	0.192
Workplace characteristics			
Place of work	0.574	1	0.449
Usual temp of office	6.062	2	0.048
Office floor	2.104	1	0.147
Water leak office	0.385	1	0.535
Office dampness	0.736	1	0.391
Visible mold office	0.023	1	0.878
Moldy odor office	0.188	1	0.665
Office window type	0.001	1	0.977
Others smoke in office	0.631	1	0.427

4.7.7. Rhinitis without cold or flu in the past 12 months.

Table 13 presents the association between socio-demographic, home environment and workplace characteristics and rhinitis without a cold in the past 12 months. The home floor covering (p=0.004) and dampness (p=0.028) in the home showed a positive and highly significant association between rhinitis. None of the socio-demographic characteristics showed significant association with rhinitis, but age showed positive, marginal significant (p=0.086) association. Among all the work place characteristics, place of work of the respondents was found to have significant association (p=0.045) whereas as other characteristics showed non-significant association.

Table 13: Bivaraite analysis of rhinitis without cold or flu in the past 12 months

		Rhinitis	
	χ^2	Df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	2.955	1	0.086
Gender	0.546	1	0.460
Marital Status	0.000	1	0.989
No. of children	2.515	2	0.284
Education	1.541	2	0.463
Income	1.061	2	0.588
Home environment			
Home floor	8.143	1	0.004
Rooms at home	0.844	2	0.656
People at home	1.205	2	0.547
Home AC	0.951	1	0.329
Visible Mold home	0.549	1	0.459
Home dampness	4.818	1	0.028
Water leak home	0.291	1	0.590
Moldy odor home	0.649	1	0.421
Smoke now	0.075	1	0.785
Others smoke at home	0.416	1	0.519
Workplace characteristics			
Place of work	4.015	1	0.045
Usual temp of office	0.913	2	0.633
Office floor	0.864	1	0.353
Water leak office	0.188	1	0.664
Office dampness	0.756	1	0.385
Visible mold office	0.250	1	0.617
Moldy odor office	0.884	1	0.347
Office window type	0.007	1	0.932
Others smoke in office	1.829	1	0.176

4.7.8. Eye irritation at home in the past 12 months.

Table 14 presents the bivariate analysis of eye irritation in the past 12 months when the respondents were at home. Gender (p=0.044), and home dampness (p=0.006) showed a significant association with eye irritation. People at home (p=0.080), office floor (p=0.086) and water leak in the office (p=0.058) showed a positive, marginal significant association with rhinitis of the respondents in the past 12 months.

Table 14: Bivariate analysis of eye irritation at home in the past 12 months

	Eye irritation (home)		
	χ^2	Df	p-value
Socio-demographic characteristics			
Age (continuous, yrs)	0.233	1	0.629
Gender	4.057	1	0.044
Marital Status	1.950	1	0.163
No. of children	0.270	2	0.873
Education	2.194	2	0.334
Income	1.269	2	0.530
Home environment			
Home floor	1.372	1	0.241
Rooms at home	4.277	2	0.118
People at home	5.047	2	0.080
Home AC	1.297	1	0.255
Visible Mold home	0.106	1	0.745
Home dampness	7.601	1	0.006
Water leak home	1.978	1	0.160
Moldy odor home	0.621	1	0.431
Smoke now	0.406	1	0.524
Others smoke at home	0.277	1	0.599
Workplace characteristics			
Place of work	0.127	1	0.722
Usual temp of office	1.325	2	0.516
Office floor	2.939	1	0.086
Water leak office	3.591	1	0.058
Office dampness	1.646	1	0.199
Visible mold office	0.809	1	0.368
Moldy odor office	1.087	1	0.297
Office window type	1.573	1	0.210
Others smoke in office	0.243	1	0.622

4.7.9. Eye irritation in office in the past 12 months.

Table 15 presents the bivariate analysis of watery itchy eyes in the past 12 months when the respondents were in office. Among all the 25 dependent variables analyzed in this study, water leak in the office (p=0.009) was the only variable that showed to have a highly significant association with eye irritation while other variables showed non-significant association.

Table 15: Bivariate analysis of eye irritation in office in the past 12 months

	Eye irritation in office		
	χ^2	Df	p-value
Socio-demographic factors			
Age (continuous, yrs)	0.380	1	0.537
Gender	2.138	1	0.144
Marital Status	0.493	1	0.483
No. of children	0.102	2	0.950
Education	0.902	2	0.637
Income	1.459	2	0.482
Home environment			
Home floor	0.151	1	0.697
Rooms at home	3.671	2	0.160
People at home	2.273	2	0.321
Home AC	0.386	1	0.534
Visible Mold home	0.212	1	0.645
Home dampness	1.552	1	0.213
Water leak home	0.098	1	0.754
Moldy odor home	0.004	1	0.950
Smoke now	0.388	1	0.533
Others smoke at home	1.449	1	0.229
Workplace characteristics			
Place of work	0.024	1	0.878
Usual temp of office	0.333	2	0.847
Office floor	0.794	1	0.373
Water leak office	6.880	1	0.009
Office dampness	1.850	1	0.174
Visible mold office	0.122	1	0.726
Moldy odor office	0.052	1	0.820
Office window type	1.231	1	0.267
Others smoke in office	1.763	1	0.184

4.7.10. Doctor-diagnosed sinus trouble.

Table 16 showed the bivariate analysis of sinus trouble. Out of the socio-demographic characteristics age and gender showed a highly significant association (p=0.023, p=0.002 respectively), while number of children (p=0.088) of the respondents showed to have a positive and marginally significant association. Home AC showed significant association with sinusitis (p=0.044) while other home environment characteristics showed non-significant association. Among the workplace characteristics, office floor covering (p=0.018) was found to have a significant association with sinus trouble, however usual temperature of office (p=0.058) showed a positive direction and was marginally associated with sinus trouble diagnosed by a doctor.

Table 16: Bivariate analysis of sinus trouble diagnosed by a doctor

	Sinus trouble		
	χ^2	Df	p-value
Socio-demographic factors			
Age (continuous, yrs)	5.133	1	0.023
Gender	9.216	1	0.002
Marital Status	1.121	1	0.290
No. of children	4.871	2	0.088
Education	4.347	2	0.114
Income	0.628	2	0.730
Home environment			
Home floor	0.449	1	0.503
Rooms at home	1.978	2	0.372
People at home	0.740	2	0.691
Home AC	4.068	1	0.044
Visible Mold home	0.669	1	0.413
Home dampness	0.224	1	0.636
Water leak home	2.217	1	0.136
Moldy odor home	0.601	1	0.438
Smoke now	0.007	1	0.935
Others smoke at home	0.094	1	0.759
Workplace characteristics			
Place of work	0.516	1	0.472
Usual temp of office	5.698	2	0.058
Office floor	5.550	1	0.018
Water leak office	1.406	1	0.236
Office dampness	2.504	1	0.114
Visible mold office	0.193	1	0.660
Moldy odor office	0.018	1	0.892

Table 16: Bivariate analysis of sinus trouble diagnosed by a doctor (continued)

		Sinus trouble	
	χ^2	Df	p-value
Workplace characteristics			
Office window type	0.089	1	0.766
Other smoke in office	0.743	1	0.389

4.7.11. Allergy to dust, food, or medicine.

Table 17 presents the bivariate analysis of allergy to dust, food or medicine. Among the socio-demographic characteristics gender (p=0.014) showed a significant association with any of the allergies. Among the home environment characteristics, visible mold in the homes showed a positive direction and was marginally associated with allergy. Out of the workplace characteristics office floor covering (p=0.042) and others smoke in office (p=0.009) was significantly associated with allergy.

Table 17: Bivariate analysis of allergy to dust, food or medicine

	Allergy to dust food or medicine		
	χ^2	Df	p-value
Socio-demographic factors			
Age (continuous, yrs)	0.226	1	0.635
Gender	6.058	1	0.014
Marital Status	0.515	1	0.473
No. of children	1.230	2	0.541
Education	0.809	2	0.667
Income	3.140	2	0.208
Home environment			
Home floor	0.321	1	0.571
Rooms at home	2.550	2	0.279
People at home	0.178	2	0.915
Home AC	0.709	1	0.400
Visible Mold home	3.088	1	0.079
Home dampness	0.516	1	0.472
Water leak home	1.243	1	0.265
Moldy odor home	0.304	1	0.581
Smoke now	1.099	1	0.295
Others smoke at home	0.004	1	0.950
Workplace characteristics			
Place of work	0.000	1	1.000
Usual temp of office	3.629	2	0.163
Office floor	4.194	1	0.042
Water leak office	0.043	1	0.836
Office dampness	0.488	1	0.485
Visible mold office	0.590	1	0.443
Moldy odor office	0.035	1	0.851
Office window type	0.366	1	0.545
Others smoke in office	6.878	1	0.009

4.8. Logistic regression models

Final multiple logistic regression models are summarized below. In all, there were 7 of 11 types of prevalences for which such models were constructed. Prevalences for which p>0.15 for both home AC and home dampness in bivariate analysis were diagnosed asthma, absence from the workplace, eye irritation at the office, and allergy.

4.8.1. Final model of cough with or without colds, in the past 12 months

The final model for cough with or without cold is presented in table 18. Home AC (p=0.030), home dampness (p=0.040) and others smoke at home (p=0.020) was found to have a significant association with cough with and without colds. The number of household members also showed a marginal association.

Table 18: Cough with or without colds, final model. (χ^2 for model = 20.79, df = 5, p=0.001)

		Cough with or without cold		
Independent variable	Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home AC (yes vs. no)	1.67	1.05 , 2.64	4.68	0.030
Home dampness (yes vs. no)	1.73	1.03 , 2.90	4.22	0.040
Household members (3 categories)			4.64*	0.096
1-5 vs. >10	1.30	0.67 , 2.51	0.61	0.434
6-10 vs. >10	0.71	0.40 , 1.28	1.23	0.254
Others smoke at home (yes vs. no)	1.77	1.10 , 2.87	5.43	0.020

* Wald χ^2 and p-value for factor as a whole, not for any specific independent variable.

4.8.2. Final model of phlegm with or without colds in the past 12 months

The final logistic regression model is presented in table 19. Phlegm with and without cold had positive and significant associations with home dampness and others smoking in the home, and had a positive, marginally significant association with home AC (p=0.054).

Table 19: Phlegm with or without colds, final model. (χ^2 for model = 14.98, df = 3, p=0.002)

	Phlegm with or without cold			
Independent variable	Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home AC (yes vs. no)	1.61	0.99 , 2.61	3.70	0.054
Home dampness (yes vs. no)	1.74	1.03 , 2.94	4.33	0.038
Others smoke at home (yes vs. no)	1.75	1.08 , 2.85	5.10	0.024

4.8.3. Final model of wheeze with or without colds in the past 12 months

Table 20 presents the final logistic model of wheeze with or without colds. Home dampness was found to have a strong positive association with wheeze (OR=2.35, p=0.002). Home floor covering (p=0.024) and water leak in office (p=0.034) were also significantly associated with wheeze. Wheeze was marginally significantly associated with number of household members.

Table 20: Wheeze with or without colds, final model. (χ^2 for model = 25.08, df =5 , p<0.001).

	Wheeze with or without cold			
Independent variable	Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home dampness (yes vs. no)	2.35	1.37 , 4.03	9.67	0.002
Home floor covering (tile vs. other)	2.98	1.16 , 7.69	5.09	0.024
Household members (3 categories)			5.28*	0.071
1-5 vs. >10	2.34	1.12 , 4.91	5.10	0.024
6-10 vs. >10	1.97	0.97 , 3.96	3.56	0.059
Water leak at office (yes vs. no)	1.74	1.04 , 2.93	4.48	0.034

* Wald χ^2 and p-value for factor as a whole, not for any specific independent variable.

4.8.4. Final model of shortness of breath in the past 12 months

Table 21 presents the final model of shortness of breath. Gender (p=0.033) was the only variable that showed to have a significant association with shortness of breath in the final model. Risk of shortness of breath was higher in females than males. Smoking in household members showed a positive, marginally significant association (p=0.063). However home dampness and water leak in homes showed no substantial relation with shortness of breath.

Table 21: Shortness of breath, final model. (χ^2-for model = 12.39, df =4 , p=0.015).

Independent variable	Shortness of breath Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home dampness (yes vs. no)	1.31	0.74 , 2.29	0.87	0.352
Gender (male vs. female)	0.57	0.34 , 0.96	4.53	0.033
Water leak at home (yes vs. no)	1.51	0.86 , 2.65	2.01	0.157
Others household members smoke (yes vs. no)	1.60	0.98 , 2.64	3.47	0.063

4.8.5. Final model of rhinitis in the past 12 months

The final logistic regression model is shown in Table 22. Home dampness (OR=1.87, p=0.021) was positively and significantly associated with rhinitis. There was also a significant association with home floor type, and a marginally significant negative association with age.

Table 22: Rhinitis, final model. (χ^2 for model = 15.08, df =3, p=0.002).

Independent variable	Modeled odds ratio	Rhinitis 95% C.I.	Wald χ^2	p-value
Home dampness (yes vs. no)	1.87	1.10 , 3.18	5.30	0.021
Age (years)	0.97	0.94 , 1.01	2.75	0.097
Home floor (tile vs. other)	3.26	1.33 , 7.97	6.71	0.010

4.8.6. Final model of eye irritation at home in the past 12 months

The final logistic regression model of eye irritation at home is shown in Table 23. The analysis showed a positive and significant association of eye irritation with home dampness (OR=2.28, p=0.004). Gender, number of rooms in the home, and number of household members were also significantly associated with presence of eye irritation.

Table 23: Eye irritation at home, final model (χ^2 for model = 32.61, df =8, p<0.001).

	Eye irritation			
Independent variable	Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home dampness (yes vs. no)	2.28	1.29 , 4.03	8.09	0.004
Gender (male vs. female)	0.53	0.31 , 0.93	4.87	0.027
Rooms in home (3 categories)			7.08*	0.029
1-2 vs. >4	1.09	0.42 , 2.81	0.03	0.865
3-4 vs. >4	0.47	0.19 , 1.17	2.64	0.104
Household members (3 categories)			9.81*	0.007
1-5 vs. >10	1.43	0.48 , 4.28	0.41	0.521
6-10 vs. >10	3.19	1.24 , 8.19	5.82	0.016
Office floor (tile vs. other)	0.52	0.25 , 1.10	2.91	0.088
Water leak at office (yes vs. no)	1.58	0.90 , 2.76	2.55	0.110

* Wald χ^2 and p-value for factor as a whole, not for any specific independent variable.

4.8.7. Final model of sinus trouble diagnosed by a doctor

The final logistic regression model is presented in Table 24. In the final model, home AC was positively but not significantly associated with sinus trouble. Significant associations were observed for age, gender, office floor covering, and office dampness.

Table 24: Sinus trouble diagnosed by a doctor, final model. (χ^2 for model = 28.48, df =7 , p<0.001).

	Sinus trouble			
Independent variable	Modeled odds ratio	95% C.I.	Wald χ^2	p-value
Home AC (yes vs. no)	1.28	0.78 , 2.10	1.11	0.292
Age (years)	1.05	1.01 , 1.09	5.50	0.019
Gender (male vs. female)	0.45	0.27 , 0.77	8.62	0.003
No. of children (3 categories)			3.70*	0.157
None vs. >1	1.74	0.81 , 3.76	1.98	0.159
1 vs. >1	2.05	0.98 , 4.30	3.61	0.057
Office floor covering (tiles vs. others)	0.44	0.22 , 0.89	5.22	0.022
Dampness in office (yes vs. no)	1.83	1.03 , 3.24	4.27	0.039

* Wald χ^2 and p-value for factor as a whole, not for any specific independent variable.

4.9. Multiple logistic model results for home air conditioning and home dampness.

Table 25 summarizes final multiple logistic model results for home air conditioning and home dampness. In the regression analysis the directions of the associations were positive. Home air conditioning showed 3 outcomes that had a positive direction; cough with or without cold, phlegm with or without cold and sinusitis. One outcome (cough with or without cold) was significant, one was marginally significant (phlegm with or without cold) and the other outcome (sinusitis) was not significant. In contrast home dampness had 6 outcomes that showed a positive direction and out of them 5 symptoms showed significant association. The result of the analysis showed that home air conditioning was associated with respiratory symptoms, but that home dampness was more strongly associated with them.

Table 25: Summary of final multiple logistic model results for home air conditioning and home dampness.

	Home AC		Home dampness	
Outcome	Direction of association	Statistically significant?	Direction of association	Statistically significant?
Cough with or without colds	Positive	Yes	Positive	Yes
Phlegm with or without colds	Positive	Marginal	Positive	Yes
Wheeze with or without colds	NA*	NA	Positive	Yes
Shortness of breath	NA	NA	Positive	No
Rhinitis	NA	NA	Positive	Yes
Eye irritation at home	NA	NA	Positive	Yes
Sinus trouble	Positive	No	NA	NA

*NA: Was not entered in multiple logistic model because p>0.15 in the bivariate analysis

CHAPTER V

DISCUSSION, RECOMMENDATION AND CONCLUSION

5.1. DISCUSSION

In this chapter a brief description of the study, major significance and associations will be discussed and compared with the research done earlier in elsewhere. In the end recommendations based on the result and with a summary of the conclusion will be given.

The total number of subjects included in this study was 353. This number does vary in specific results (frequencies and percentages) due to the non-response and missing observations.

5.1.1. Air conditioning

Maldives being near to the equator and a hot tropical country, the use of air conditioning in homes and workplaces in the capital city are increasingly in use to promote thermal comfort. This study suggests that home air conditioning is associated with higher prevalences of respiratory symptoms. The prevalences of symptoms were shown to be high among the respondents who lived in air conditioned homes in comparison with the homes that had no air conditioning. In this study 47% of the homes and 100% of the office buildings were air conditioned. Therefore, the researcher was not able to test effects of office AC on prevalences. Cough with and without cold (55.4%), phlegm with and without cold (35.2%), wheezing with or without cold (30.7%), diagnosed asthma (9.1%), sinus trouble (39.2%) allergy to dust (50.9%) showed to have a positive relationship with the respondents living in AC homes in comparison to the respondents who lived in non AC home. These prevalences although not the same are in accordance with the other similar studies done in Brazil (Graudenz et al., 2005, 2004 and 2002) The intervention study done in Brazil, showed higher prevalences of symptoms before the intervention which reduced substantially after the intervention (Graudenz et al., 2004).

Various researches in different parts of the world has identified the relationship between home or workplace air conditioning and lower and upper respiratory symptoms, eye and skin symptoms, headache and other allergic symptoms. The rationale behind this is that the moisture in the air condition allows the growth of microorganisms which spread in the indoor causing allergenic and toxic reactions among those who are exposed. Surprisingly few studies have assessed the association between the moisture in the ventilation systems and the health outcomes among the office workers (Mendell et al., 2004). The people who have history of allergies and respiratory symptoms are at more risk, however making the healthier people also at risk due to these hazardous exposures.

Among the studied symptoms, cough with and without cold (p=0.008), phlegm with and without cold (p=0.029), and sinus trouble (p=0.044) was found to be significantly associated with home air conditioning in the bivariate analysis. The association of cough and sinusitis in response to AC was similar to the Brazil study (Graudenz et al., 2005). However, in the final model of logistic regression, unlike in Brazil study sinusitis did not show any significant association with air conditioning in the present study.

Symptoms such as wheezing, asthma did not show any significant association with air conditioning in this study. This is in accordance with the similar study done in Brazil (Graudenz et al., 2005). In consistence with the US study, home air conditioning did not show any significant association with being absent from work. The reason for this could be the strict monitoring and evaluation of the workers in the government and private sectors. In contrast to this study, the cohort study done in France showed a higher prevalence in the sickness absence and medical visits due to the symptoms related to air conditioning (Preziosi et al., 2004).

In Graudenz et al., (2002) the researchers found out the associations with respiratory symptoms in relation to the aging of the ventilation systems. In this study, the types of AC and the aging of the air conditions were not addressed and the respiratory symptoms in relation to this cannot be ruled out. Further study should address this important factor, to confirm the associations of air conditioning and respiratory symptoms.

The researcher analyzed to see if there was any relationship between the air conditioning and home dampness. There was no significant association between use of home AC and presence of home dampness (p=0.224). This suggests that home AC and dampness analyzed in this study were largely independent factors with respect to their associations with respiratory symptom rates.

5.1.2. Dampness

Dampness is a problem by itself and also a contributor for various factors that leads to the growth of bacteria, fungi, mold, which acts as a risk factor for the healthy people and also worsening the condition of the people with history of upper and lower respiratory tract problems (Clark et al., 2004). Dampness, water leak, visible mold and moldy odor in the homes and work places in the past 12 months were frequently reported in this study. The prevalence of home dampness (26.6%) in this study was a little less than the US study which was 29% (Shahakian et al., 2009) and higher than that was reported by Rennie (10.2%). The prevalence of water leakage (25.8%) and visible mold (11.9%) in this study were higher in comparison with the RHINE study that reported 13.4% and 6.7% respectively (Gunnbjörnsdóttir et al., 2006).

In a similar pattern the prevalences of water leak, dampness, mold growth and moldy odor in the workplace reported were also higher; 32% for water leak, 24.1% for dampness, 16.4 % for mold growth and 17.8% for the presence of moldy odor. Moldy odor in any building confirms the mold growth, and is reported to have an association with the respiratory symptoms (Rennie et al., 2005). All the 11 symptoms that were analyzed were in the positive direction. The prevalences of all the symptoms were higher among the subjects who reported to have dampness in their homes in comparison with the subjects who reported no dampness in their homes. Water leakage and moisture are some of the common factors that allow the mould to flourish and grow causing health hazards in the people. It also releases various forms of chemicals into the indoor spaces, leading to exacerbation of the respiratory problems (Clark et al., 2004).

In the bivariate analysis, home dampness was found to have a significant association with 6 symptoms. Strong positive association was seen with the symptoms; cough with or without colds (p=0.017), phlegm with or without colds (p=0.033), wheeze with or without colds (p=0.001), rhinitis (p=0.028), eye irritation in home (p=0.006). The RHINE study showed a similar strong association of dampness with wheeze. The five symptoms (wheeze, nocturnal breathlessness, nocturnal cough, productive cough, and asthma) analyzed both in the present study and the RHINE study showed stronger associations (p<0.001) (Gunnbjörnsdóttir et al., 2006). The present study, unlike the RHINE study, did not show any association of dampness with asthma. Other studies done among the adults as well as children also have suggested strong statistical association between home dampness and mold growth (Tham K.W.et al., 2007; Cox-Ganser et al., 2009; Andriessen J. et al., 1998). The reason for this difference could be because of the higher number of missing values in this study which is one of the limitations when questionnaires are self-administered. In contrast to the US study which showed significant association between home and work place dampness and any work days lost due to respiratory problems, this study did not show any significant association (Sahakian et al., 2009).

The symptoms that had an association with home dampness were included in the multiple logistic regression analysis, and final models were constructed. All the 6 symptoms mentioned above showed a positive direction of association with dampness. However, 5 symptoms (cough with or without colds, phlegm with or without colds, wheeze with or without colds, rhinitis, and eye irritation) were found to have statistically significant association in the final model. Shortness of breath even though in the positive direction did not show any statistically significant association. This study suggests strong association of respiratory symptoms with home dampness, in accordance with the other similar epidemiological studies done in other countries.

Smoking is a factor worldwide known to cause respiratory symptoms. In this study both aspects of smoking (active and passive) was asked to the subjects as it is one of the confounding factor of respiratory symptoms. The percentage of the current smokers in this study was 21.5% and it was the same for the others smoke at home. Others smoke in the office was 18.1%. These results should be interpreted with caution since there was a lot of missing values in the analysis. In the bivariate analysis the others smoke at home showed to have a statistically significant association with cough with and without colds (p=0.036), phlegm with or without colds (p=0.012), and marginal association was seen with shortness of breath (p=0.067). Current smokers showed to have a positive, marginally significant association with phlegm with or without colds (p=0.074). Others in the office smoke also showed strong significant association with cough with or without colds (p=0.015), phlegm with or without colds (p=0.013) and allergy (p=0.009). In the multivariate analysis current smokers did not show significant associations with any of the respiratory symptoms. In multivariable analyses, others smoking at home was strongly associated with cough with or without colds, phlegm with or without colds, shortness of breath. However, regarding others smoking in the office, none of the symptoms that were significant in the bivariate analysis showed significant associations in the multivariate analysis.

5.2 LIMITATONS

1. As it was a cross-sectional study, it did not allow causal inference.
2. Self administered questionnaires can lead to bias in this study. The respondents might have given over estimated or under estimated answers.
3. There may be possible selection bias due to the over-representation of under-representation of persons with respiratory problems. Such bias would not have been substantial.
4. 100% of offices had AC, so it was not possible to test the effects of office AC on prevalences.
5. The study is not generalizable to the whole population of Maldives; due to the difference of the development status in the other inhabited islands.
6. Unmeasured exposures in the work area (e.g. dust, chemicals, etc) might be a confounding factor.

5.3 RECOMMENDATIONS

1. Removing AC is not a realistic solution to reduce the exposures. However, suggestions of proper maintenance of AC systems may prevent indoor air pollution and hence prevent the exposures.
2. Reducing these hazardous exposures in the indoors is important for all the residents to reduce the health outcomes. This can be achieved by educating the people, about the ways they can prevent or minimize these exposures in the future.
3. This study does not represent the exposures and risk factors in the country as a whole as the study was done in the capital city of Maldives as there is a huge difference in the development in the other inhabited islands. In the future studies should be done in the other areas as well.
4. Further studies are needed to confirm the findings in this study, in order to give suggestions to the people that may allow the reduction of the symptoms.

5.3.1 Future research suggestions:

1. As this study does not represent the country as a whole, future studies should be conducted in other inhabited islands, to see the associations of home dampness and respiratory symptoms.
2. Future studies must focus on the different types and aging of the ventilation systems which act as a risk factor for respiratory symptoms.
3. In future intervention studies are needed to determine the causal relationship between home AC, home dampness and respiratory symptoms.

5.4 CONCLUSION

The findings of this study suggest that AC and home dampness were two independent factors with respect to their associations with respiratory symptom rates. Having AC in the homes was a risk factor that showed associations with some of the respiratory symptoms analyzed. The presence of dampness was more strongly associated with the respiratory symptoms in this study. The study confirmed the importance of the indoor air quality in Maldives that needs to be taken into account. It also suggested the importance of further study to confirm and extend these findings and an effort should be made to minimize harmful exposures.

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APPENDICES

APPENDIX A
ENGLISH-LANGUAGE QUESTIONNAIRE

Part I: General Information

Date and time of Interview: _____________

Interviewer Code: _____________

Participant Serial No: __________

Age: ________

Gender: ( ) Male ( ) Female

Marital Status: ( ) Single ( ) Married

( ) Widowed ( ) Separate/Divorced

Number of children (enter zero if no children): _________

Educational Status: ( ) Primary ( ) Secondary

( ) Bachelor's degree ( ) Graduate study after bachelor's

( ) Occupational or vocational or technical school

Monthly Income (unit in Rufiya):

( ) 2000 – 4000 ( ) 4001 – 6000 ( ) 6001 - 8000

( ) 8001 – 10000 ( ) 10,001 - 12,000 ( ) above 12,001

Part II: Home information

1. What is the type of home you are living?

   ( ) Apartment ( ) House ( ) Other (please specify)________________

2. What is the main type of floor covering in your home? (Please check only one.)

   ( ) Tiles ( ) Carpet

   ( ) Linoleum or plastic ( ) Other (please specify) __________________

3. If carpet is used, what is the type of carpet that is used in your home? (please check one)

   ( ) Wall to wall carpet ( ) Single carpet

4. How many rooms are there in your home? Please do not count hallways or bathrooms.

   ________ Rooms

5. How many people are living in your home?

   ________ People

6. Do you have air conditioning in your home?

   ( ) Yes ( ) No

   If no, please skip to question 15

   If yes please go to question 7

7. How many rooms have air condition in your home?

__________ Room (s)

8. For how many years has your home had air conditioning?

____

9. On the average, the air conditioning is on for about how many hours each day?

___________ Hrs

10. On the average, how many hours do you spent in A/C when you are at home?

___________ Hrs

11. At which temperature do you usually keep the home air conditioning?

__________ Degrees C

12. On the average, about how many times do you clean the home air conditioning in a year?

_____________ Times

13. About how many months ago was it cleaned most recently?

___________ Months ago

14. Is the air condition cleaned according to the instructions given by the company?

( ) Yes ( ) No

Home Dampness:

15. In the past 12 months, have you noticed mould growth on the surfaces anywhere in your home?

( ) Yes ( ) No

16. In the past 12 months, have you had damp stains, for example on the walls or on the ceilings of your home?

    ( ) Yes ( ) No

17. In the past 12 months has there been water leak or water damage in your home?

    ( ) Yes ( ) No

18. In the past 12 months, have you ever noticed a moldy odor in your home?

    ( ) Yes ( ) No

Part III: Work Place information

Place of work: ( ) Private ( ) Government

Other (please specify) ________________

Position: ____________________

Working hour's ___________________

Air conditioning:

19. Can windows be opened in your office area?

    ( ) Sealed (cannot open windows) ( ) Able to open windows

    If "able to open windows", please answer 20

20. How often the windows at your workplace are kept open? (please check only one)

    ( ) Never ( ) Rarely ( ) Sometimes ( ) Often

21. What is the main type of floor covering at your workplace? (please check one)

( ) Ceramic tiles ( ) Linoleum or plastic
( ) Carpet ( ) Other (please specify) ___________________

22. If carpet is used, what is the type of carpet that is used at your workplace? (please check one)

( ) Wall to wall carpet ( ) Single carpet

23. Is your workplace air-conditioned?

( ) Yes ( ) No

24. On average about what temperature is the air conditioning kept in the work place?

_______________ degrees C

25. Do you have any knowledge of about how often the air condition in the office is cleaned? (please check one)

( ) once a month ( ) once in two months

Other (please specify): ______________ ( ) Don't know

26. How would you describe the usual temperature of your workplace? (Please check only one)

( ) Too cold ( ) Just right ( ) Too warm

27. To the best of your knowledge for how long have you been working in this building? ______________

Office Dampness:

28. To the best of your knowledge, in the past 12 months has there been water leak or water damage in the office?

( ) Yes ( ) No ( ) Don't know

29. To the best of your knowledge, in the past 12 months have you had damp stains, for example on the walls or on the ceilings at your office?

( ) Yes ( ) No ( ) Don’t know

30. In the past 12 months have you seen mold growth on the surfaces anywhere in your office area?

( ) Yes ( ) No ( ) Don’t know

31. To the best of your knowledge, have you noticed a moldy odor in your office?

( ) Yes ( ) No

Tobacco Smoking:

32. Have you ever smoked cigarettes?

( ) Yes ( ) No

If ‘No’ please skip to question 37

33. Do you now smoke cigarettes (within the past month)?

( ) Yes ( ) No ( ) Does not apply

34. If you have ever quit smoking, about how long ago was the last time you quit?

____

35. For about how many years, total, have you smoked? ____________

36. During the time that you have smoked, about how many cigarettes per day have you smoked on the average?

Cigarettes per day _________ ( ) Does not apply

37. Not counting yourself, does any other person in your household smoke?

( ) Yes ( ) No

ศูนย์วิทยทรัพยากร จุฬาลงกรณ์มหาวิทยาลัย

If 'No' skip to question 39

38. Do they smoke in front of you at home?

( ) Yes ( ) No ( ) Sometimes

39. Does anybody else smoke indoors, in your presence, while you are at work.

( ) Yes ( ) No

Part IV Respiratory Symptoms

Cough:

40. In the past 12 months do you usually have a cough when you have a cold?

( ) Yes ( ) No

41. In the past 12 months when you do not have a cold, do you usually have a cough?

( ) Yes ( ) No

If No, skip to question 43

42. In the past 12 months, you have coughed like this for about how many months? (please check one)

____ less than 1 month _____ 1- 2 months _____ 3 months or more

Phlegm:

43. In the past 12 months, when you have a cold, do you usually bring up phlegm or mucus from your chest? Do not count phlegm from your nose or throat.

( ) Yes ( ) No

44. In the past 12 months when you do not have a cold, do you usually bring up phlegm or mucus from your chest?

( ) Yes ( ) No

If no Skip questions 46

45. In the past 12 months, you have brought up phlegm or mucus from your chest for about how many months? (please check only one)

____ less than 1 month _____ 1- 2 months _____ 3 months or more

Breathlessness:

46. Are you ever troubled by shortness of breath when hurrying on the level or climbing stairs?

( ) Yes ( ) No

47. Do you have to walk slower than people of your age on the level because of breathlessness?

( ) Yes ( ) No

Wheezing:

48. In the past 12 months, does your chest ever sound wheezy or whistling? You may check more than one choice.

a. When you have a cold? ( ) Yes ( ) No

b. Sometimes apart from colds? ( ) Yes ( ) No

c. Most days or nights? ( ) Yes ( ) No

Nasal Symptoms:

49. In the past 12 months, during times when you have not had a cold or the flu, have you ever had sneezing, or a runny or blocked nose? (please check one)

( ) Yes　　( ) No　　( ) Don't remember

50. In the past 12 months, during times when you have not had a cold or the flu, have you ever had watery or itchy eyes when you were at home?

( ) Yes　　( ) No　　( ) Don’t remember

51. In the past 12 months, during times when you have not had a cold or the flu, have you ever had watery or itchy eyes when you were at work?

( ) Yes　　( ) No　　( ) Don’t remember

Headache:

52. To the best of your knowledge in a month, on average, how often would you say that you get a headache? (Please check only one.)

Never _____　　1 or 2 times _______　　3 or 4 times _______

5 times or more ______

53. Do you think the headache gets worse when you are working in A/C?

Yes ( )　　No ( )　　Others ____________

Allergies:

54. Are you allergic to:

Dust?　　( ) Yes　　( ) No　　( ) Don't know

Food?　　( ) Yes　　( ) No　　( ) Don't know

Medicine?　　( ) Yes　　( ) No　　( ) Don't know

Personal medical history:

55. As best you can recall, has a doctor ever told you that you had any of the following conditions?

Sinus trouble　　( ) Yes　　( ) No

Emphysema	( ) Yes	( ) No
Bronchitis	( ) Yes	( ) No
Pneumonia	( ) Yes	( ) No
Heart trouble	( ) Yes	( ) No
Asthma	( ) Yes	( ) No

If a doctor has ever said that you have asthma, please answer question 56.
Otherwise skip to question 57

56. If a doctor has ever said that you have asthma, do you still have asthma now?

( ) Yes ( ) No

Family medical history

57. To the best of your knowledge, have any of your blood relatives ever had any of the following conditions? Do not count your husband or wife.

Asthma	( ) Yes	( ) No
Emphysema or other chronic lung disease	( ) Yes	( ) No
Heart trouble	( ) Yes	( ) No
Allergies	( ) Yes	( ) No

58. In the past 12 months, have you ever been absent from work due to any respiratory problem?

( ) Yes ( ) No

If 'Yes', about how many days? _________ days

APPENDIX B

DHIVEHI-LANGUAGE QUESTIONNAIRE

ސުވާލު ކަރުދާސް

ބާބު 1 :އާންމު މައުލޫމާތު

އިންޓަވިއު ކުރި ތާރީހާއި ގަޑި: ____________________

އިންޓަވިއު ކޯޑް: ____________________

ބައިވެރިވާމީހާ/މައުލޫމާތު ދިން ފަރާތުގެ ސީރިއަލް ނަމްބަރ: __________

އުމުރު: ________

ޖިންސް: އަންހެން ( ) ފިރިހެން ( )

ކައިވެނީގެ ގޮތުން: އިނދެގެން ( ) ނުއިނދެ ( )
ހުވަފަތްވެފަ ( ) ވަރިވެފަ / ވަކިވެފަ ( )

ކުދިންގެ އަދަދު (ނެތް ނަމަ 0 ޖަހައްސަވާ): ________

ކިޔެވުމުގެ/ތައުލީމީ ފެންވަރު: ޕްރައިމަރީ/ލޯވަރސެކަންޑަރީ ( ) ސެކަންޑަރީ/މަތީ ތައުލީމު (
) ޑިގްރީ/ތައުލީމީ ދަރަޖަ ( )
ޑިގްރީ އިން މަތީ/ފުރަތަމަ ދަރަޖައިން މަތީ( )
އޮކިއުޕޭޝަނަލް(އާންމު މަސައްކަތް) / ވޮކޭޝަނަލް(ހުނަރު ނުވަތަ
ފަންނީ) މަސައްކަތް/ ޓެކްނިކަލް ސެޓްފިކެޓް/ފަންނީ އިލްމު ( )

އާމްދަނީ (މަހަކު): 2000 - 4000 ( ) 4001- 6000 ( )
6001 - 8000 ( ) 8001 -10،000 ( )
10،001- 12000 ( ) 12001 އިން މަތީ ( )

ބާބު 2: ގޭގެ މައުލޫމާތު

1.މާލޭގަ ދިރިއުޅުއްވަނީ ކޮންކަހަލަ ބާވަތެއްގެ/އިމާރާތެއްގަ ތޯ؟

( ) އެޕާޓްމަންޓް/ފްލެޓް ( ) ގެ

އެހެނިހެން (ބަޔާންކުރޭ): _______

2. މައިގަނޑު ގޮތެއްގައި ގޭގެ ބައިމީހުން ދަތުރު ކުރަނީ ކޮބައިތޯ؟

( ) ބައިސްކަލް/ސައިކަލް ( ) ކާރު/ޓެކްސީ ( ) [illegible]

އެހެނިހެން(ބަޔާންކުރޭ): _________________

3. ދޫނި އަޅާފަ ހުންނަ ނަމަ ދޫނި އަޅާފައި ހުންނަނީ ކިހިނެއްތޯ؟

( ) އޮޅިގަ ( ) ބަންދުނުކޮށް

4. ގޭގަ ހުންނަނީ ކިތައް ކޮޓަރިތޯ؟ (ފާޚާނާ / ސިޓިންގް ރޫމް ނުލާ)

_________ކޮޓަރި

5. ތިގޭގައި/ގޭބިސީގައި ކިތައްމީހުން ދިރިއުޅޭތޯ؟

_______ މީހުން

6. ގޭގައި އެއަރ ކަންޑިޝަން (އޭސީ) ހުރިތޯ؟

( ) އާއެކޭ ( ) ނޫނެކޭ

ނޫން ކަމުގައި ވާނަމަ، 15 ވަނަ ސުވާލަށް ޖަވާބު ދެއްވާ
އާއެކޭ ކަމުގައި ވާނަމަ 7 ވަނަ ސުވާލަށް ޖަވާބު ދެއްވާ

7· ގޭގަ އޭސީ ހުންނަނީ ކިތައް ކޮޓަރިގަތޯ؟

__________ ކޮޓަރި

8· ގޭގަ އޭސީ ބޭނުން ކުރާތާ ކިހާ ދުވަސް ވެއްޖެ ތޯ؟

____

9· އާއްމުކޮށް ގޭގަ އޭސީ ޖައްސާފަ ހުންނަނީ ދުވާލު ކިތައް ގަޑިއިރުތޯ؟

__________ ގަޑި

10· އާ◌ައްމުކޮށް ގޭގަ އުޅުއްވާއިރު/ވަގުތުގައި އޭސީގަ ހޫނު ކުރުވުމީ ކިހާ ވަގުތެއްތޯ؟

__________ ގަޑި

11· ގޭގެ އޭސީ އާއްމު ގޮތެއްގަ ބަހައްޓަވަނީ ކޮން ފިނި މިނެއްގަތޯ؟

__________ ސެލްސިއަސް/ފެރެންހައިޓުގެ ދަރަޖަ

12· އާއްމު ގޮތެއްގައި އޭސީ ސާފުކުރައްވަނީ އަހަރަކު ކިތައްފަހަރުތޯ؟

__________ ފަހަރު

13· އެންމެ ފަހުން ސާފުކުރެއްވީ◌ީ ކިތައްމަސް ކުރިންތޯ؟

__________ މަސް ކުރިން

14· އޭސީ ސާފުކުރައްވަނީ ވަކިފަރާތަކުން ޚިދުމަތައިގަންނާ އިރުޝާދުއްގެ ދަރުސްތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ގޭގެ ތެތްފިނިކަން:

15. ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ގޭގެ އެއްވެސް ތަނެއްގައި ފަންގަސް އަރައި ކަޅު ކުލަ ޖަހާފައި ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

16. ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ގޭގެ ފާރު ނޫނީ ފަންގިފިލާ ތެތް، ފިނިހިރި ފައްޖެހިފައިވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

17. ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ގޭގެ އެއްވެސް ފެންހިންގާ ނިޒާމް ފެން ލީކުވާ ފަދަ އެއްވެސް މައްސަލައެއް ދިމާވެފައި ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

18. ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ގޭގައި ތެތްފިނިކަން ވަރަށް ހުންނަ ކަމަށް ފާހަގަ ކުރެވިފައި ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ބާބު 3: މަސައްކަތް ކުރައްވާ ތަނުގެ މަޢުލޫމާތު

މަސައްކަތް ކުރައްވާ ތަން: އަމިއްލަ ( ) ސަރުކާރު ( )

މަގާމް ____________________

މަސައްކަތް ކުރައްވާ ގަޑި: ________________

19. ތިޔަ އިމާރާތުގެ ނުވަތަ ބައިގެ ކުޑަދޮރުތައް ހުންނަނީ ހުޅުވާ ގޮތަށްތޯ؟

( ) ހުޅުވާ ގޮތަށް ( ) ނުހުޅުވާ ގޮތަށް

ދޮރު ހުޅުވާނަމަ 20 ވަނަ ސުވާލަށް ޖަވާބު ދެއްވާ

20. ކުޑަދޮރުބައް އާއްމުކޮށް ހުޅުވާލަ ހުންނަނީ ކިހާ ވަރަކަށްތޯ؟

( ) އެއްގޮތަކަށް ވެސް ނުހުޅުވާ ( ) ވަރަށް މަދުން

( ) މަދުން ( ) އާއްމުކޮށް

21. މައިގަނޑު ގޮތެއްގައި އޮފީހުގެ ތަޅުމުގެ ޖަހާފަ ހުންނަނީ ކޮބައިތޯ؟

( ) ޓައިލްސް ( ) ކާރޕެޓް ( ) ބަރުދާލް

އެހެނިހެން(ބަޔާންކޮށް): ____________________

22. ކާރޕެޓް އަޅާފަ ހުންނަ ނަމަ އޮފީހުގެ ކާރޕެޓް އަޅާފަ ހުންނަނީ ކޮން ގޮތަކަށްތޯ؟

( ) އެކީގަ ( ) ބަންކޮވެއްގަ

23. އޮފީސް ހުންނަނީ އޭސީ ކޮށްފަތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

24. އޮފީހުގެ އޭސީ އާއްމު ގޮތެއްގަ ހުންނަނީ ކިހާ ފިނި މިނެއްގަތޯ؟

____________ ޑިގްރީސް

25. އޮފީހުގެ އޭސީ އާއްމު ގޮތެއްގައި ސާފު ކުރަނީ ކިހާ އަވަހަކުން ކަން އިނގޭތޯ؟

( ) މަހަކު އެއްފަހަރު ( ) ދެ މަހުން އެއްފަހަރު

އެހެނިހެން(ބަޔާންކޮށް) ____________________ ( ) ނޭނގޭ

26. މަސައްކަތް ކުރައްވާ ތަނުގެ ފިނި ހޫނުމިނާ ދާބޯރާގައި ވިދާޅުވެދީ ކިހާތޯ؟

( ) މާ ފިނި ( ) ރަނގަޅު ( ) މާ ހޫނު

27· މި އޮފީސް/އިމާރާތުގައި ގައި މަސައްކަތް ކުރަންވާތާ ކިހާ ދުވަހެއް ވެއްޖެ؟ ____________

އޮފީހުގެ ތެތްފިނިކަން

28· ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އޮފީހުގެ އެއްވެސް ފެންހޮޅިއަކުން ފެން ލީކުވެ ފެނުގެ
އެއްވެސް މައްސަލައެއް ޖެހިފައި ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ނޭނގެ ( )

29· ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އޮފީހުގެ ފާރު ނޫނީ ސީލިންގް ތެމި ނޫނީ ފައްޖެހިފަވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ނޭނގެ( )

30· ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އޮފީހުގެ އެއްވެސް ތަނެއްގައި ފަންގަސް އަރާ ކަޅު ކުލަ ޖަހާފައި
ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ނޭނގެ ( )

31· ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އޮފީހުގައި ތެތްފިނި ވަހެއް ހުންނަ ކަމަށް ގަބޫލު ކުރެވިފައި
ވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ދުންފަތުގެ އިސްތިއުމާލު ކުރުން

32· އެއްވެސް އިރެއްގަ ސިނގިރެޓް ހިއްޕަވަންތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ނޫނެކޭ ނަމަ ސުވާލު 37 ކަށް ޖަވާބު ދެއްވާ

33. މިހާރު ވެސް ސިނގިރޭޓް ހިއްޕަވަންތޯ؟

(   ) އާއެކޭ   (   ) ނޫނެކޭ

34. ދުންފަތުގެ އިސްތިޢުމާލު ކުރުން ހުއްޓަވާލެއްވިނަމަ، ހުއްޓަވާލެއްވީ ކިހާ ދުވަހެއް ކުރިން؟

____

35. ދުންފަތުގެ އިސްތިޢުމާލު ކުރައްވަމުން ހުންނެވީ ޖުމުލަ ކިތައް އަހަރުތޯ؟

____

36. ދުންފަތުގެ އިސްތިޢުމާލު ކުރައްވާ އުޅުއްވިއިރު ދުވާލަކު ކިތައް ސިނގިރޭޓް ހިއްޕަވާ ހުންނަނީތޯ؟

____________ ސިނގިރޭޓް ދުވާލަކު   (   ) ނޭނގޭ

37. ތި ބޭފުޅާ ދިރިއުޅުއްވާ ގޭގެ އިތުރު އެހެން މީހަކު ދުންފަތުގެ އިސްތިޢުމާލު ކުރޭތޯ؟

(   ) އާއެކޭ   (   ) ނޫނެކޭ

ނޫނެކޭ ނަމަ 38 ވަނަ ސުވާލު ދޫކޮށްލައްވާ

38. އެމީހުން ދުންފަތުގެ އިސްތިޢުމާލު ކުރަނީ ގޭތެރޭގައިތޯ؟

(   ) އާއެކޭ   (   ) ނޫނެކޭ   ބައެ◌އްފަހަރު (   )

39. އަށްވެސް މިހާރު އޮފީސް ތެރޭގައި/ގޭތެރޭގައި ދުންފަތުގެ އިސްތިޢުމާލު ކުރޭތޯ؟

( ) އާއެކޭ   ( ) ނޫނެކޭ

ބާބު 4: ނާޒޫކުގެ ނިޒާމާ ބެހޭ މައުލޫމާތު

ކެއްސުން:

40· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އާއްމު ގޮތެއްގައި ރޭގަ ޖެހި ކެއްސާތީ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

41· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އާއްމު ގޮތެއްގައި ރޭގަނޑުޖެހި ކެއްސާތީ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ނޫނެކޭ ނަމަ 42 ވަނަ ސުވާލު ދޫކޮށްލައްވާ

42· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި މިގޮތަށް ކެއްސާތީ ކިހާ ދުވަހެއް ވެއްޖެތޯ؟
_______ މަދުވެގެން 1 މަސް ________ 1 - 2 މަސް

______ 3 މަ◌ަހަށް ވުރެ ގިނަ

މޭގެ އަޑިދަދުސް ހިފުން

43· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ރޭގަ ޖެހުމާއި ގުޅިގެން މޭގެ އަޑިދަދުސް ހިފާ ކެއްސާފަ އެއްޗެހި އާދޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

44· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ރޭގަ ނުޖެހި ކެއްސާފަ އެއްޗެހި އާދޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ނޫނެކޭ ނަ◌ަމަ 45 ވަނަ ސުވާލު ދޫކޮށް ލައްވާ

45· މިދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ދިގުތަން ކުއްސާލާ އެއްޗެހި އަންނަނީ ކިހާ ދުވަހަކު ފަހުންތޯ؟

________ މަދުވެގެން 1 މަސް ________ 1 - 2 މަސް

________ 3 މަ◌ަހަށް ވުރެ ގިނަ

ނޭވާކުރުވުން:

46·އެއް ފަށް ތަނެއްގައި ބޭރަށް ހިނގާއިރު ނޫނީ ސިޑިން މައްޗަށް އަރާއިރު ހާސްވާ ގޮތެއްވޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

47· ނޭވާ ކުރުވުމާ ގުޅިގެން ހިނގާފައި އެއް އުމުރުގެ މީހުންނަށް ވުރެ މަޑުންތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

ނޭވާ◌ަލަން އުނދަގޫ ކުރުން

48· ވޭތުވެ ދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި އެއްވެސް އިރަކު ނޭވާލާ އިރު އަޑުއިވޭތޯ؟

ހ· ރޭގަނޑުގެ ހުސްނަ އިރު ( ) އާއެކޭ ( ) ނޫނެކޭ

ށ· ބަހައްދުފަހަރު ރޭގަ ނިދިހުސްނަސް ( ) އާއެކޭ ( ) ނޫނެކޭ

ނ· އާއްމުކޮށް ( ) އާއެކޭ ( ) ނޫނެކޭ

ނޭފަތުގެ މައްސަލަތަށް

49· ވޭތުވެ ދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ރޭގަ ނުވަތަ ހުމަކާ ނުލާ ނޭފަތުން ފިނި ފައިބާ، ކިރިސިތި އެރި، ނޭފަތް ބަންދު ވެއްޖޭތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ( ) ހަދާނެއްނުވޭ

50. ވޭތުވެ ދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ރޯގާ ނުވަތަ ހުމަކާ ނުލާ ގޭގައި އުޅުއްވާއިރު ބޯރިހުން
ފެންއަރައިސް، ދެ ހިތުވާ ގޮތްވީތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ( ) ހަދާނެއްނުވޭ

51. ވޭތުވެ ދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ރޯގާ ނުވަތަ ހުމަކާ ނުލާ އޮފީހުގައި އުޅުއްވާއިރު ބޯރިހުން
ފެންއަރައިސް، ދެ ހިތުވާ ގޮތްވީތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ ( ) ހަދާނެއްނުވޭ

52. އާއްމު ގޮތެއްގައި މަހަކު ކިތައްފަހަރު ބޭރުގެ ދިއުމާ ކަމަން ފާހަގަ ކުރައްވާތޯ؟

އެއްގޮތަކަށްވެސް ނުދިއައްސާ ___________ 1-2 ފަހަރު _________

3-4 ފަހަރު ___________ 5 ނުވަތަ އެއަށްވުރެ ގިނައިން __________

53. އާއިލާގެ މެންބަރުންގެ ކުރައްވާ އިރު ބޭރުގައި (ދިއުމާއި ސަލާމަތް) ދިރުން ބޭނުވާ ކަމަށް ފާހަގަ ކުރައްވާތޯ؟

( ) އާ އެކޭ ( ) ނޫނެކޭ

އުފާވެރި:

54. ތިރީގައި ބަޔާން ކުރެވިފައިވާ އެއްވެސް އެއްޗަކަށް އުފާވެރިވޭތޯ؟

ހ. ހިތަފުސް؟ ( ) އާއެކޭ ( ) ނޫނެކޭ ( ) އެނގިފައެއް ނުވޭ

ށ. ކާއެއްޗިހި؟ ( ) އާއެކޭ ( ) ނޫނެކޭ ( ) އެނގިފައެއް ނުވޭ

ނ. ބޭސް؟ ( ) އާއެކޭ ( ) ނޫނެކޭ ( ) އެނގިފައެއް ނުވޭ

އަމިއްލަ ސިއްޙަތާ ބެހޭ މައުލޫމާތު

55. ތިރީގައި މިވާ އެއްވެސް ބައްޔެއް ހުންނަކަމަށް އެއްވެސް އިރެއްގަ ޑޮކްޓަރަކު ވިދާޅުވެފައި◌ ވޭތޯ؟

ހ. ސައިނަސް މައްސަލަ ( ) އާއެކޭ ( ) ނޫނެކޭ

ށ. އެމްފައިސީމާ/ފުއްޕާމޭ ދޭ ( ) އާއެކޭ ( ) ނޫނެކޭ

ނ. ބްރޮންކައިޓިސް ( ) އާއެކޭ ( ) ނޫނެކޭ

ރ. ނިއުމޯނިއާ ( ) އާއެކޭ ( ) ނޫނެކޭ

ބ. ހިތުގެ މައްސަ◌ލަ ( ) އާއެކޭ ( ) ނޫނެކޭ

ޅ. ނޭވާލަން އުނދަގޫހުރުން ( ) އާއެކޭ ( ) ނޫނެކޭ

ނޭވާލަން އުނދަގޫ ހުރިކަމަށް އެއްވެސް އިރެއްގައި ޑޮކްޓަރަ◌ކު ވިދާޅުވެފައި ވާނަމަ 57 ވަނަ ސުވާލަށް ޖަވާބު ދެއްވާ.

57. މިހާރުވެސް ނޭވާލަން އުނދަގޫ ހުރޭތޯ؟

( ) އާއެކޭ ( ) ނޫނެކޭ

އާއިލީ ބަލި ގުޅޭ މައުލޫމާތު

ތިރީގައި ވާ ބަލިތަކުން ކޮން ބައްޔެއް ތިމާއާ ގާތް ގުޅުން ހުރި މީހެއްގެ ގައިގައި ހުރޭތޯ؟

ހ. ނޭވާލަން އުނދަގޫ ހުރުން ( ) އާއެކޭ ( ) ނޫނެކޭ

ށ. ފުއްޕާމޭގެ އެހެން ބައްޔެއް ( ) އާއެކޭ ( ) ނޫނެކޭ

ނ. ހިތުގެ މައްސަލަ ( ) އާއެކޭ ( ) ނޫނެކޭ

ރ. އެލާރޖީ ( ) އާއެކޭ ( ) ނޫނެކޭ

58· ވޭތުވެދިޔަ 12 މަސް ދުވަހުގެ ތެރޭގައި ނޭވާލުމުގެ ނިޒާމްގެ ބައްޔަކާ ގުޅިގެން އޮފީހަށް، މަސައްކަތަށް ހާޟިރު ނުވެ ހުރިންތޯ؟

( ) އާއެކޭ ( ) ނޫނެކޭ

އާއެކޭ ނަމަ ގާތްގަނޑަކަށް ކިހާ ދުވަހެއް ވަންދެންތޯ؟ ______ ދުވަސް

APPENDIX C

TIME SCHEDULE

Research Project Activities	Sep 09	Oct 09	Nov 09	Dec 09	Jan 10	Feb 10	Mar 10	Apr 10	May 10
Literature Review / Tool Development	▨	▨							
Writing thesis proposal			▨	▨					
Submission of proposal and exam				▨					
Proposal revision / submission to ethical committee					▨				
Data collection						▨	▨		
Data analysis							▨	▨	
Thesis and article writing								▨	
Thesis Final exam									▨
Thesis / article submission									▨

APPENDIX D

BUDGET

Contents	**Cost Of One Item**	**Amount**	**In Thai Bhat**	**In US $**
Ticket to Maldives		Return (Srilankan Airlines)	16,335	495
Quest(pilot + data collection)	1 Rf per page (Total 9 pages)	500 copies	11,700	354
For the interviewees	250Rf / interviewee/day	5 Interviewees for 4days	13,000	393
Binding of the final thesis	200 bhat/book (maximum 150 pages)	6 copies	1,200	36
TOTAL			**42,235**	**$ 1278**

* One dollar = 33 bhat

* 1 Rufiya = 2.6 bhat

VITAE

PERSONAL INFORMATION

Name: Ms. Aminath Shaufa

Date of Birth: March 17, 1974

Place of Birth: S. Hithadhoo / Maldives

Nationality: Maldivian

Current Address: V. P. Tower
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PROFESSIONAL QUALIFICATION

September 2000 – September 2002
Post RN, BSc Nursing Degree
Baqai College of Nursing
Baqai Medical College
Karachi, Pakistan

WORKING EXPERIENCE

June 2007 – May 2009
Senior Registered Nurse
Indira Gandi Memorial Hospital
Malé, Republic of Maldives

Oct 2002 – June 2007
Registered Nurse Grade 2
Indira Gandi Memorial Hospital
Malé, Republic of Maldives

Mar 1995 – 1996
Medical Records Officer Trainee
Indira Gandi Memorial Hospital
Malé, Republic of Maldives

Oct 1994 – Mar 1995
Personal Services Officer Trainee
Indira Gandi Memorial Hospital
Malé, Republic of Maldives