RESIDENTIAL ENVIRONMENT IN RELATION TO RESPIRATORY AND ASTHMA SYMPTOMS

AMONG PRIMARY SCHOOL CHILDREN IN DIN DAENG DISTRICT BANGKOK THAILAND

Miss Nawarat Apichainan

A Thesis Submitted in Partial Fulfillment of the Requirements

for the Degree of Master of Public Health Program in Public Health

College of Public Health Sciences

Chulalongkorn University

Academic Year 2017

ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจ
และโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ในพื้นที่
เขตดินแดง กรุงเทพมหานคร ประเทศไทย

นางสาวนวรัตน์ อภิชัยนันท์

Thesis Title	RESIDENTIAL ENVIRONMENT IN RELATION TO RESPIRATORY AND ASTHMA SYMPTOMS AMONG PRIMARY SCHOOL CHILDREN IN DIN DAENG DISTRICT BANGKOK THAILAND
By	Miss Nawarat Apichainan
Field of Study	Public Health
Thesis Advisor	Assistant Professor Nutta Taneepanichskul, Ph.D.

Accepted by the College of Public Health Sciences, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

....................................Dean of the College of Public Health Sciences

(Professor Sathirakorn Pongpanich, Ph.D.)

THESIS COMMITTEE

....................................Chairman

(Associate Professor Wattasit Siriwong, Ph.D.)

....................................Thesis Advisor

(Assistant Professor Nutta Taneepanichskul, Ph.D.)

....................................Examiner

(Wandee Sirichokchatchawan, Ph.D.)

....................................External Examiner

(Benjawan Tawatsupa, Ph.D.)

นวรัตน์ อภิชัยนันท์ : ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจและโรค หืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ในพื้นที่เขตดินแดง กรุงเทพมหานคร ประเทศไทย (RESIDENTIAL ENVIRONMENT IN RELATION TO RESPIRATORY AND ASTHMA SYMPTOMS AMONG PRIMARY SCHOOL CHILDREN IN DIN DAENG DISTRICT BANGKOK THAILAND) อ.ที่ปรึกษาวิทยานิพนธ์ หลัก: ผศ. ดร. ณัฏฐา ฐานีพานิชสกุล, 171 หน้า.

บทนำ: ในปัจจุบันปัจจัยด้านสิ่งแวดล้อมเข้ามามีบทบาทสำคัญที่ส่งผลต่อสุขภาพของเด็ก แต่อย่างไรก็ตาม การศึกษาความสัมพันธ์ดังกล่าวในกลุ่มเด็กวัยเรียนที่อาศัยอยู่ในพื้นที่เขตเมืองยังมีไม่มากนัก การศึกษาครั้งนี้มีวัตถุประสงค์ เพื่อหาความชุกของกลุ่มอาการโรคระบบทางเดินหายใจและโรคหืด และเพื่อหาความสัมพันธ์ระหว่างคุณลักษณะทั่วไปของ เด็ก/สิ่งแวดล้อมบริเวณที่พักอาศัยกับอาการของโรคดังกล่าวในกลุ่มเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ในพื้นที่ เขตเมืองของกรุงเทพมหานคร ประเทศไทย

วิธีดำเนินงานวิจัย: การศึกษาแบบภาคตัดขวาง (Cross-sectional study) ทำการวิจัยในเด็กนักเรียนระดับ ประถมศึกษาตอนต้น จำนวน 658 คน อายุตั้งแต่ 6 ถึง 10 ปี ดำเนินการในช่วงเดือนเมษายน ถึง พฤษภาคม พ.ศ. 2561 โดย ใช้แบบสอบถามที่พัฒนามาจาก International Study of Asthma and Allergies in Childhood (ISAAC) เป็นเครื่องมือ ในการเก็บข้อมูลเกี่ยวกับอาการของโรคระบบทางเดินหายใจและโรคหืดของเด็ก ในรอบ 1 ปีที่ผ่านมา ซึ่งดำเนินการเก็บ ข้อมูลโดยผู้ปกครองของเด็กเป็นผู้ตอบแบบสอบถาม และใช้สถิติวิเคราะห์การถดถอยโลจิสติกทวิเพื่อหาความสัมพันธ์

ผลการศึกษา: อาการน้ำมูกไหลโดยไม่เป็นหวัด เป็นอาการที่พบมากที่สุดในรอบ 12 เดือนที่ผ่านมา (52.7%) ส่วนปัจจัยด้านสิ่งแวดล้อมทั้งบริเวณโดยรอบและภายในที่อยู่อาศัย พบหลายปัจจัยที่มีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ (AOR>1) ต่ออาการของโรคระบบทางเดินหายใจและโรคหืด ดังนี้ การอาศัยอยู่ในบ้านเช่ากับอาการหายใจเสียงวี๊ด (AOR = 2.362, 95%CI 1.156-4.828) การมีร้านตัดเย็บเสื้อผ้าอยู่ใกล้ที่พักอาศัยกับอาการหายใจสั้น (AOR = 1.935, 95%CI 1.060-3.529) การอยู่ในบริเวณที่มีควันบุหรี่กับอาการไอแห้งในเวลากลางคืน (AOR = 1.887, 95%CI 1.075-3.309) การอาศัยอยู่ ในบ้านที่มีควันธูปกับอาการหายใจสั้น (AOR = 3.767, 95%CI 1.183-11.990) การมีตุ๊กตาภายในห้องนอนกับอาการไอแห้ง ในเวลากลางคืน (AOR = 2.610, 95%CI 1.720-3.959) อาการมีเสมหะ (AOR = 2.375, 95%CI 1.618-3.488) อาการ หายใจสั้น (AOR = 2.440, 95%CI 1.164-5.11) และอาการน้ำมูกไหลโดยที่ไม่เป็นหวัด (AOR = 2.265, 95%CI 1.558-3.291) รวมถึง กรณีมีความชื้นบริเวณผนังใกล้ห้องนอนของเด็กก็มีความสัมพันธ์อย่างมีนัยสำคัญต่ออาการหายใจสั้น (AOR = 3.435, 95%CI 1.297-9.098) และอาการน้ำมูกไหลโดยที่ไม่เป็นหวัด (AOR = 2.331, 95%CI 1.034-5.257)

สรุปผลการศึกษา: สิ่งแวดล้อมบริเวณที่พักอาศัย ได้แก่ ร้านตัดเย็บเสื้อผ้า ควันบุหรี่ ควันธูป ตุ๊กตา จำนวน หน้าต่าง และความชื้นบนผนัง รวมถึงการอาศัยอยู่ในบ้านเช่า มีความสัมพันธ์เชิงบวกอย่างมีนัยสำคัญทางสถิติต่ออาการของ โรคระบบทางเดินหายใจและโรคหืด การศึกษานี้จึงเสนอว่า หน่วยงานที่มีบทบาทเกี่ยวข้องควรเข้าไปดำเนินการ ตลอดจน กำหนดให้มีแนวทางที่ชัดเจนในการปรับปรุงสิ่งแวดล้อมบริเวณที่พักอาศัยทั้งภายในและบริเวณโดยรอบ เพื่อนำไปสู่การลด ปัจจัยเสี่ยงที่ก่อให้เกิดอาการของโรคระบบทางเดินหายใจและโรคหืดในเด็กได้ต่อไป

สาขาวิชา   สาธารณสุขศาสตร์   ลายมือชื่อนิสิต _____

ปีการศึกษา   2560   ลายมือชื่อ อ.ที่ปรึกษาหลัก _____

6078821553 : MAJOR PUBLIC HEALTH

KEYWORDS: PRIMARY SCHOOL CHILDREN / RESPIRATORY SYMPTOMS / ASTHMA / RESIDENTIAL ENVIRONMENT

NAWARAT APICHAINAN: RESIDENTIAL ENVIRONMENT IN RELATION TO RESPIRATORY AND ASTHMA SYMPTOMS AMONG PRIMARY SCHOOL CHILDREN IN DIN DAENG DISTRICT BANGKOK THAILAND. ADVISOR: ASST. PROF. NUTTA TANEEPANICHSKUL, Ph.D., 171 pp.

Background: Environmental factors have played important role to children health. Limited studies were focused on residential environments and respiratory symptoms among children living in urban area. Our study sought to 1) estimate prevalence of respiratory and asthma symptoms, and 2) examine the association between children characteristic / residential environments with the symptoms among primary school children in urban area of Bangkok, Thailand.

Methods: A cross-sectional study was conducted among 658 primary school children aged 6 to 10 years between April and May 2018. Self-reported questionnaire from child's parent was used as a measurement tool. Children's history of respiratory and asthma symptoms within 1 year was modified from International Study of Asthma and Allergies in Childhood (ISAAC). Binary logistic regression models were performed to find the associations.

Results: Running nose without cold symptom was the highest reported respiratory and asthma symptom in the past 12 months (52.7%). Living in tenant residence was significantly associated with wheezing or whistling in the chest (asthma) (AOR = 2.362, 95%CI 1.156-4.828). Having garment/clothing shop near residence was significantly associated with shortness of breath (AOR = 1.935, 95%CI 1.060-3.529). Living in cigarette smoke area was significantly associated with dry cough at night (AOR = 1.887, 95%CI 1.075-3.309). Living in incense smoke area was significantly associated with shortness of breath (AOR = 3.767, 95%CI 1.183-11.990). Having doll in bedroom was significantly associated with dry cough at night (AOR = 2.610; 95%CI 1.720-3.959), phlegm (AOR = 2.375; 95%CI 1.618-3.488), shortness of breath (AOR = 2.440; 95%CI 1.164-5.11), and running nose without cold (AOR = 2.265; 95%CI 1.558-3.291) symptoms. Wall dampness near children's bedroom was significantly associated with shortness of breath (AOR = 3.435; 95%CI 1.297-9.098), and running nose without cold (AOR = 2.331; 95%CI 1.034-5.257).

Conclusions: Residential environments including tenant status, garment/clothing shop near residence, cigarette smoke, incense smoke, doll, window, and wall dampness were positive significantly associated with respiratory and asthma symptoms. Further intervention to improve residential environment should be considered to reduce respiratory and asthma symptoms among urban children.

Field of Study:	Public Health	Student's Signature
Academic Year:	2017	Advisor's Signature

ACKNOWLEDGEMENTS

CONTENTS

Page

LIST OF TABLES

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

LIST OF FIGURES

LIST OF ABBREVIATIONS

WHO	World Health Organization
WAO	World Allergy Organization
GAN	Global Asthma Network
ISAAC	The International Study of Asthma and Allergies in Childhood Questionnaires
PM_{10}	Particulate matter with the size is 10 micrometers and smaller in diameters
$PM_{2.5}$	Particulate matter with the size is 2.5 micrometers and smaller in diameters
Mg/m3	Milligram per cubic meter
µm/m3	Microgram per cubic meter

CHAPTER I

INTRODUCTION

1.1 Background and Rationale

Environmental exposure causes premature deaths among children worldwide. World Health Organization (WHO) reported more than a quarter of 5.9 million children deaths are attributable to unhealthy environments (1). The majority cause of respiratory disease and its complication are poor quality of indoor air and outdoor air. Asthma is another burden of respiratory disease among children worldwide (2) which attacked about 300 million children (3). Prevalence of respiratory and asthma symptoms in many developing countries including Thailand was continuously increasing (4). The symptoms were characterized by repeated attacks of wheezing, breathlessness, and dry cough at night which are different symptoms affected in each person (3). It interrupts their daily activities, sleeplessness, absence of school, and death among severe cases (3, 5). In Thailand, mortality rate of respiratory disease and asthma for all ages are 64.7% and 29.4%, respectively (6, 7). A higher prevalence was found among children whose age 6-7 years in Bangkok area (7, 8).

Several epidemiological studies have found an association between indoor environmental factors in relation to respiratory disease and asthma. However, the fundamental cause of asthma is still unclear. A combination of genetic predisposition and environmental exposure to inhaled substances and particles may possibly stimulate allergic reactions or irritate to developing asthma (2). Concerning on respiratory disease and housing environment such as pets, vectors,

mold, dampness, carpet, and curtain therefore, there were many studies which discovered and found their significant association with respiratory and asthma symptoms (9). For example, pets especially cats and dogs are very close to people while they are a leading cause of respiratory complication among young adult which Brunekreef et al (2012) found that people who expose to those in their early-stage of life (during 6 to 7, 13 to 14 years old) had a higher risk of asthma symptoms, rhino conjunctivitis, and eczema (10). Furthermore, exposure to house dust mites, mold, dampness, and other allergens in home are a cause of asthma exacerbation (11-13). Moreover, inner-city homes had higher indoor pollutants especially particulate matter than in non–inner-city homes (14). Kumar et al (2015) also found the highest indoor suspended particulate matter (SPM) in house located in industrial area and its level was significantly associated higher in the asthmatic children's houses than non-asthmatic ($p<0.001$) (15).

According to previous studies, respiratory and asthma symptoms in children were associated with housing environment. However, few of those previous studies in Bangkok focused on residential environments among primary school children. Given an increased understanding of respiratory and asthma symptoms among urban children, it is crucial to gain a better linkage between residential environments and risk of respiratory and asthma symptoms in urban area. And also benefit to develop guidance including new policy to improve residential environments which appropriate for children health.

1.2 Research Question

1. What is prevalence of respiratory and asthma symptoms among primary school children in Bangkok, Thailand?

2. Do children characteristics associate with respiratory and asthma symptoms among primary school children in Bangkok, Thailand?

3. Do residential environment factors associate with respiratory and asthma symptoms in primary school children in Bangkok, Thailand?

1.3 Objectives of the study

1) To estimate the prevalence of respiratory and asthma symptoms in primary school children in Bangkok, Thailand.

2) To find an association between children's characteristic and respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

3) To explore an association between residential environment factors and respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

1.4 Research Hypotheses

1) Hypotheses 1

- Null hypothesis (H_0):   Children's characteristics do not associate with respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

- Alternative hypothesis (H_1): Children's characteristics associate with respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

2) Hypotheses 2

- Null hypothesis (H_0): Residential environment factors do not associate with respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

- Alternative hypothesis (H_1): Residential environment factors associate with respiratory and asthma symptoms among primary school children in Bangkok, Thailand.

1.5 Expected Benefit and Application

To use the study results for guidance and determining new policy on improving appropriate residential environment for children health.
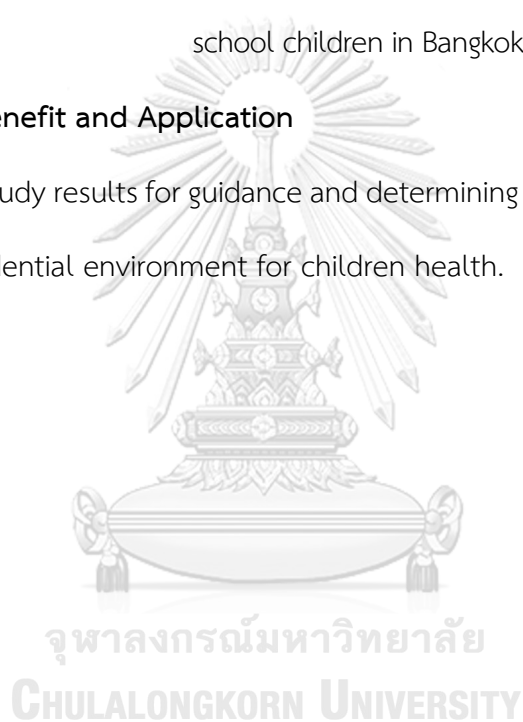
1.6 Conceptual Framework

Independent Variables

Children Characteristics
- Age
- Gender
- Height
- Weight
- Genetic

Children Activities
- Exercise and Sport
- Room (the most spending time at residence)

Residential Environments
- **Characteristics and environments near residence**
  - Types of residence
  - Age of residence
  - Owner of residence
  - Places near residence
- **Environments at residence**
  - Family member
  - Wall dampness/ water leakage
  - Home renovation
  - Housing chemical used (insecticide)
  - Pollen flowers
  - Vectors (cockroach, rat, etc.)
  - Pets (dog, cat, bird, etc.)
  - Cigarette smoke
  - Charcoal smoke (Cooking stove)
  - Incense smoke
- **Environments in children's bedroom**
  - Using cooling devices (Air conditioner, fan, misting fans)
  - Numbers of windows
  - Curtain and carpet
  - Dolls
  - Bringing pets into bedroom
  - Wall dampness near bedroom

Dependent Variables

Respiratory and Asthma Symptoms
- Wheezing or whishing in the chest
- Dry cough at night
- Phlegm
- Shortness of breath
- Running nose without cold

1.7 Operational Definitions

1) **Primary School children** define to school children (aged 6 - 10 years) who are the first three years in primary school (Prathom 1–3).

2) **School** defines to public school which under control by Bangkok Metropolitan Administration in Din Daeng district.

3) **Age** refers to age of primary school children at the same of conducting study.

4) **Gender** defines to male and female of primary school children in this study.

5) **Weight at birth** refers to child's body weight at the day when he was born.

6) **Genetic** refers to family history of asthma.

7) **Exercise and sport** refers to kind of sport that children do such as swimming, football, badminton, etc.

8) **Room (the most spending time in house)** refers to a room of children's residence which children spend most of their time when they live at residence.

9) **Type of residence** refers to size and design of residence or house in this study as follow:

   - **Single family house** is any house that is completely separated from its neighbours,
   - **Townhouse** is any house that there are houses more than one in a row sharing a "party" wall with its adjacent neighbours,
   - **Condominium/ apartment/ flat** is a type of housing wherein a very specific part of a larger property which located in a multi-story, multiunit building and accesses the ground via shared corridors, entrances and exits, and
   - **Community (slum)** is a high density of household or building in that area.

10) **Cooling devices** refer to using air conditioner or fan or misting fans at residence in this study.

11) **Numbers of window** refer to amount of windows in residence in this study which are usually opened.

12) **Family member** refers to amount of people in residence in this study.

13) **Pollen flowers** refer to carpel and pollen of plants.

14) **Vectors** refer to cockroach and rat that they can cause of respiratory and allergic symptoms.

15) **Pets** refer to dog, cat, bird, and other furry animals.

16) **Charcoal smoke** refers to smoke from cooking stove or biomass fuel which using in residence.

17) **Cigarette smoke** refers to smoke from tobacco or cigarette.

18) **Smoking area** refers to area where presenting smoke from cigarette both inside and outside residence.

19) **Housing chemicals** refer to chemical using for insect control in residence such as mosquito spray, chalk ant removal, etc.

20) **Respiratory and Asthma symptoms** refer to the definition of respiratory health outcomes were those of the ISAAC questionnaire (Lai et al., 2009) "Asthma prevalence was determined by past and current (preceding 12 months) wheezing episodes, persistent cough unrelated to colds and influenza and ever having had a lifetime history of asthma. The severity of current wheezing was defined as an affirmative response to at least one of the following questions: frequency of wheezing attacks (four or more), episodes that disturbed sleep (one or more nights per week) and episodes that limited speech (at least one). The definition of wheeze by video questionnaire was a positive response to the first scene (wheezing at rest in the last 12 months)".

CHAPTER II

LITERATURE REVIEW

2.1 Respiratory System

The respiratory system is very important for our body because it plays a major role for alive in people by exchanging gas in respiratory organs that it brings oxygen (O_2) from outside to lungs and disposes of carbon dioxide (CO_2), this mechanism calls breathing (Rice University, 2013). Breathing is when air from outside enters body through the airway via a nose or mouth and then moves down to bronchiole in the lungs (Rice University, 2013). If the bronchioles are jammed, it will make respiratory problems because less oxygen reaches the lungs.

Source: http://www.hadassah-med.com/children-site/parents/chronic-deseases/asthma
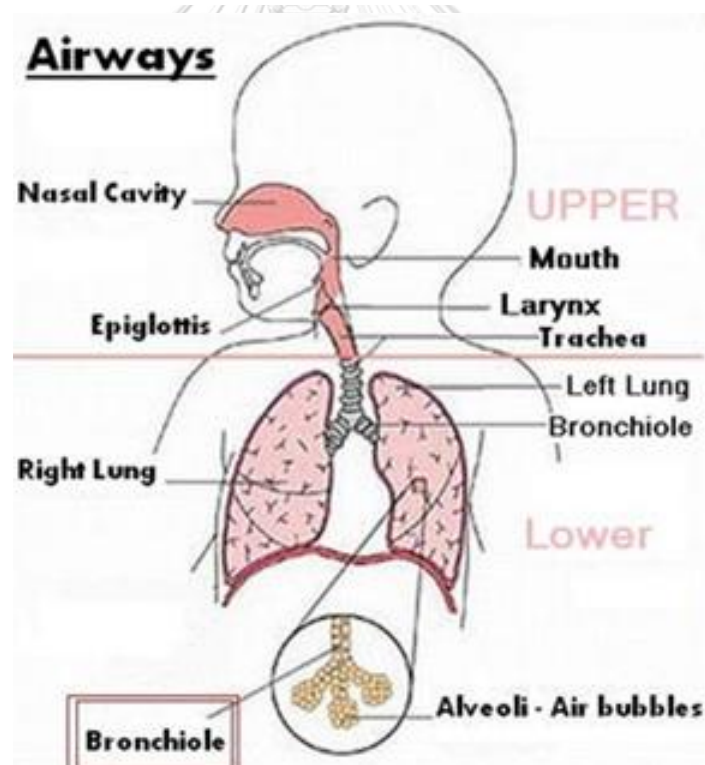
Figure 1 The components of respiratory system

There are two parts of respiratory system systems which are upper respiratory tract (figure 2) and lower respiratory tract (figure 3).
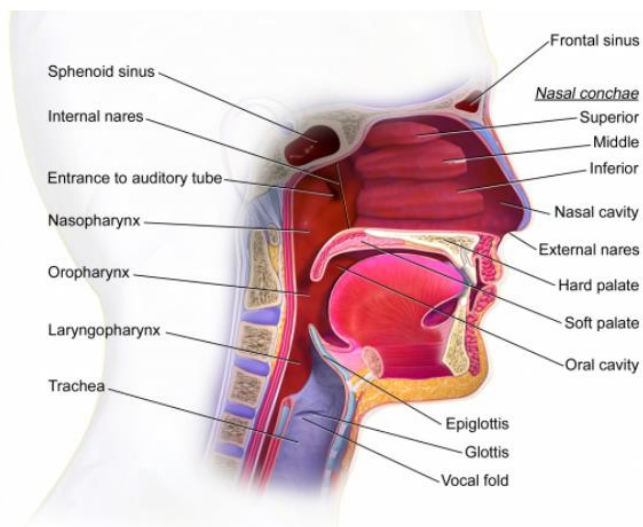
Source: Encyclopaedia Britannica, Inc, 2013

Figure 2 The structure of upper respiratory functions
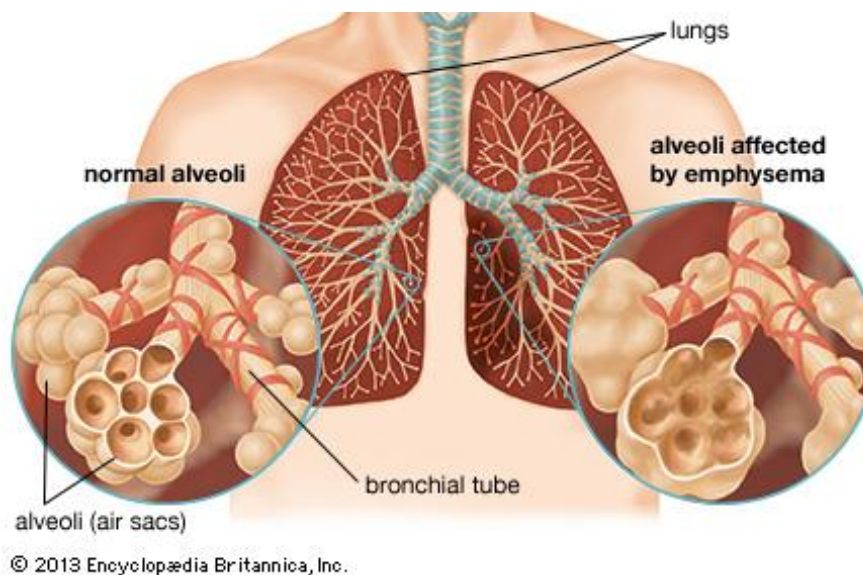
Source: Encyclopaedia Britannica, Inc, 2013

Figure 3 The structure of lower respiratory functions

The respiratory tract is the large range of disorders because it is inhaled organisms which is exposed to environment such as dust, or chemicals that may affect to health, moreover, it has a large network of capillaries which pass through

the whole output of a heart, this means if the small blood vessels have infection, it can affect to the lungs, and it may be the site of "sensitivity" or allergic phenomena that may deeply affect function.

2.2 Respiratory Disease

Respiratory disease refers to any of the diseases and disorders of the airways and the lungs that affect human respiration (David & John, 2017). There are acute and chronic diseases which infection and exposure make morbidity of respiratory structure and organs in human.

2.2.1 Prevalence and incidence of respiratory disease

In 2017, the numbers of death people annually from seasonal influenza and influenza-related such as cardiovascular disease, pneumonia, and bronchitis which are associated with respiratory diseases increases from 250,000 over ten years ago to 650,000 deaths nowadays, this is new estimated by global health partners (the United States Centers for Disease Control and Prevention (US-CDC), WHO, and others). Those are severity in the world's poorest regions: Sub-Saharan Africa, Eastern Mediterranean, and Southeast Asia respectively.

In Thailand, the mortality rates of respiratory disease and asthma for all ages are 64.7% which were from Pneumonia, Chronic disease of lower respiratory systems, and Tuberculosis (16). And there are 1,000 illnesses and deaths people of severe acute respiratory syndrome (829 severe illnesses and 171 deaths) since 2010 to 2015 (17).
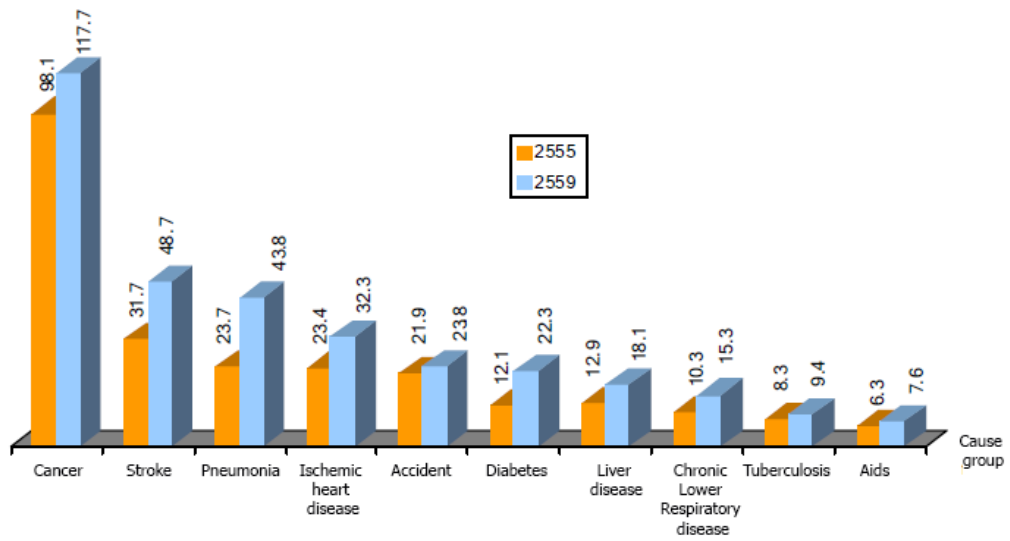
Figure 4 Mortality rates by leading cause of death per 100,000 population Thailand, 2012 and 2016
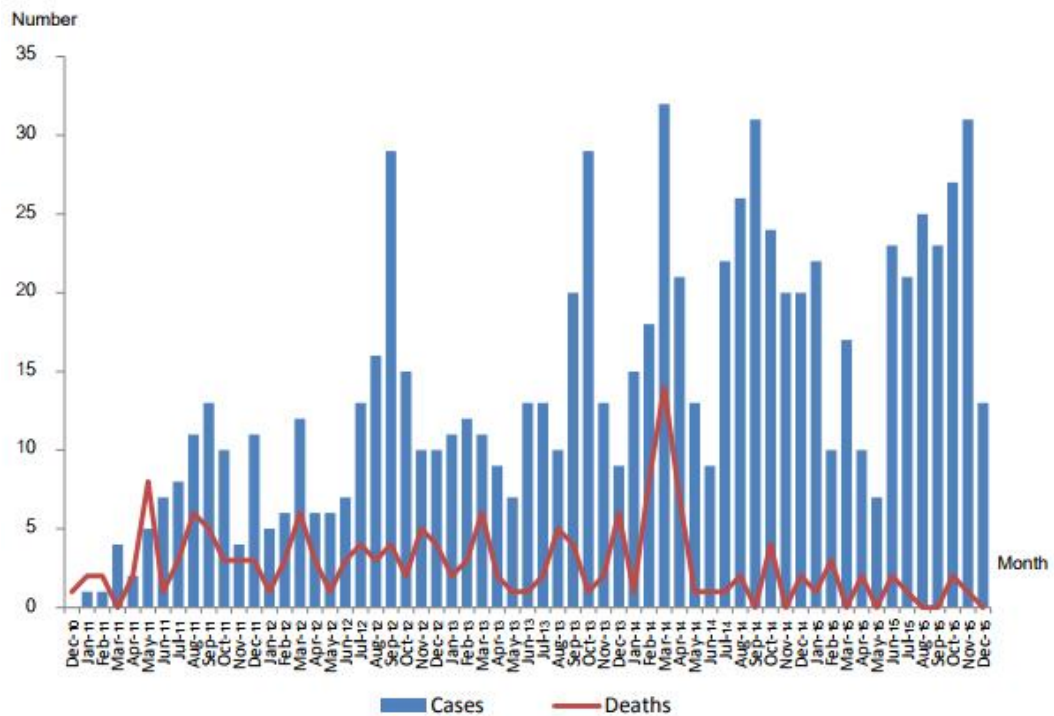
Figure 5 The numbers of illnesses and deaths people of severe acute respiratory syndrome in Thailand on December 2010 to December 2015

2.2.2 Causes and symptoms of respiratory disease

1) Causes

Viruses such as coronavirus, influenza virus, RSV, rhinovirus, Human Metapneumovirus (HMPV), adenovirus, and parainfluenza virus. These are the most important causes of communicable disease that kill people worldwide because they develop themselves rapidly to outbreak such as Acute Respiratory Syndrome (SARS). In Thailand, the Respiratory syncytial virus (RSV) was found about 61.2% (612 people from 984 people) among illness and deaths people of severe acute respiratory syndrome in 2016 (17).

Bacteria such as streptococcal pharyngitis (strep throat), Mycoplasma pneumonia, Chlamydophila pneumoniae, group A beta-hemolytic streptococci (GABHS), neisseria gonorrhoeae (gonorrhea), chlamydia pneumoniae (chlamydia), and etc.

Environmental factors such as substance in air pollution, chemical, and microbial. Mostly effects by exposure to those substances in the air and then irritate on respiratory tract. These can causes of acute and chronic respiratory diseases depending on toxicity, doses, and times to expose.

2) Symptoms

Respiratory symptoms include runny nose, cough, sore throat, body aches, and congestion both in nasal sinuses and in chest, these are common sign of lung or heart diseases in people in medical terms. They may be also occurring in conditions affecting both the lungs alone and the heart conditions. They will be different between upper and lower respiratory infection.

The common causes of respiratory symptoms are from both acute infections and chronic respiratory disease.

2.2.3 Diagnosis

The doctors focuce on breathing to diagnose the respiratory disease that they will listen to for abnormal sounds in the lungs when patient breathes to check for fluid and inflammation in the lungs. In addition, the involve organs like nose, throat and ears are checked also if the doctor believes that the infection is in the lower respiratory tract, they may be test by an X-ray or CT scan.

Moreover, the diagnosis of respiratory disease can be screening by questionnaire. One is used for notice the sign of respiratory symptoms which denotes the respiratory disease; it is developed by the International Study of Asthma and Allergies in Childhood (ISSAC) (see more detail in item 2.4). This refers to the respiratory symptoms related to asthma also.

2.2.4 Risk factors of respiratory disease

There are many factors can cause of respiratory disease both genetic and environment. Many studies show that the most important risk factors are from environment surrounding us especially air pollution both indoor and outdoor air pollutants which contain many substances to make people ill when they inhale and expose to them (18). Substances in the air such as allergens, microbial, tobacco smoke, chemical, etc.

2.2.5 Impacts of respiratory disease

Respiratory disease plays a role to kill more people around the world in every year.

Acute effect

The acute respiratory effect may be from infections or short-term exposures, which affects the normal breathing. It can affect just only upper respiratory system or only lower respiratory system or both of them. Acute upper respiratory system can start at the nose, throat, pharynx, larynx, and ends at the vocal chords. Acute lower respiratory system can start at the vocal chords and ends at bronchi in the lungs.

Most of acute respiratory diseases are from virus infections such as influenza, Middle East respiratory syndrome coronavirus (MERS-CoV), Severe Acute Respiratory Syndrome (SARS), etc., these effects rapidly kill more people worldwide.

Mostly risk people are children because they are less knowledge and low sanitary prevention, for example they always do not wash their hands after playing or touch something, and they may contact with other virus carrier kids, therefore viruses can infect them when rubbing their eyes or putting fingers in their mouths. And also, other susceptible people such as elderly and people who disorders with immune system.

Chronic effect

Chronic respiratory diseases (CRDs), mostly causes are from long-term exposure to hazard environments such as air pollution, occupational chemicals, dusts, tobacco smoke, etc. These effect are always found at the lungs, most common CRDs are chronic obstructive pulmonary disease (COPD), asthma, and lung cancer (19).

2.3 Asthma

Asthma is a chronic disease of breathing difficult in the airways which is a type of chronic obstructive pulmonary disease (COPD). The symptom will occur by recurrent attacks of breathlessness and wheezing. There are differences of severity and frequency in each person. Asthma can also attack all age groups but often starts in childhood, when the airways swell; it will react to narrow and less air can flow in and flow out of the lungs (20).

There are three major features of asthma:

1) Airway obstruction: it is tightening of the bands of muscle surrounding the airways and moving of the air is difficult; less air can pass and causes short of breathing in people with asthma. The causes may be from allergy substances, colds, environmental triggers, or respiratory viruses. When moving out of air, it will occur the whistling sound or known as wheezing.
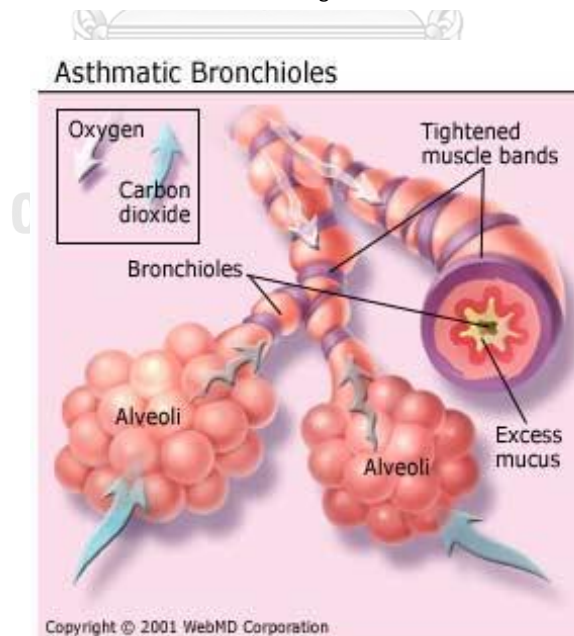
Source: WebMD Corporation, 2001

Figure 6 The structure of asthmatic bronchioles

2) Inflammation: the bronchial tubes will be red and swollen in people with asthma that it can cause the long-term damage to the lungs.

3) Airway irritability: the airways are extremely sensitive in people with asthma; it tends to overreact and narrow due to even the slightest triggers such as dust, animal dander, pollen or fumes.

2.3.1 Prevalence and incidence of Asthma

Asthma is now increasing problem in urban area in the world that it is already a problem in high-income countries more than 30 years ago and now will be also important disease in the Non-communicable disease (NCD) group in developing countries. It has become an international development epidemic issues. In term of global years lived with disability, asthma is the 14th on ranking of the most important disorder which may be as high as 334 million people with asthma in the world (21). It impacts both in terms of morbidity and economic costs, and related to death in low-income and middle-income countries.

The prevalence of asthma in the world was carried out by questionnaire about 10 years ago that is the latest survey between 2000 and 2003 by global surveys of the proportion of the population, who have asthma which is common way and feasible for large scale. The International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was measurement tool used at that time.

In 2003, ISAAC's ground-breaking survey in 233 centres in 97 countries, there are 798,685 adolescents aged 13-14 years' representative sample in this survey, they were asked about their experienced wheeze in the past 1 year. They found that world's children for these age groups about 14% were close to having

asthmatic symptoms in the last year. For childhood asthma's prevalence, it varies widely in the studied both between countries, and between centres within countries. More than 20% was generally observed in Latin America and in English-speaking countries of Australasia, Europe and North America as well as South Africa which is the highest prevalence while less than 5% was observed in the Indian subcontinent, Asia-Pacific, Eastern Mediterranean, and Northern and Eastern Europe that is the lowest prevalence, and between 10-20% was mostly observed in Africa (22). For younger children age 6-7 years the result was also found generally similar to those adolescents. And in this survey shows the prevalence of severe asthma symptoms was >7.5% in many centres in the past 12 months, these were defined as occurrence of asthma symptom on times per week; attacks of wheeze 4 or more times, waking during sleep (at night) one or more times, and any episodes of wheeze severe enough to limit speaking of children.

In 2002-2003, WHO's World Health Survey by questionnaire as ISAAC which younger adults aged 18 to 45 years were total of 177,496 people who live in 70 countries, they showed the prevalence of asthma in younger adults that overall, which reported that 4.3% of respondents were asthma (doctor diagnosis), 4.5% were either a doctor diagnosis or were taking treatment for asthma, and 8.6% were experiencing attacks of wheezing in the last year which was signal of asthma symptoms (23). In addition, distribution of asthma is globally higher burden of disease in many countries consist of Australia, New Zealand, some countries in Africa, the Middle East, South America, and North-Western Europe (7).

Moreover, many studies in many countries such as India (24), Canada (25), Brazil (26), and China (27) found that the prevalence of asthma in urban population based on symptoms; especially wheezy symptom was higher than in rural population (28).

In Thailand, the mortality rate from asthma between 2001 to 2010 is 29.48 for all ages and 4.24 for 5-34 years only which is reported by the Global Asthma Network with separately coded as a cause of death, ordered by mortality rate and country income group in the global asthma report 2014 in figure 3 and 4, respectively (7). Moreover, in 2009, the report showed situation of asthma in children 6-14 years in each region of Thailand, Bangkok is the third asthma diagnosed by doctor and it was found that dry cough at night was the highest symptoms as shown in figure 5 (29). The previous study latest in 2007 shows prevalence of asthma in Bangkok children age 6-7 years is 10.7% (8).
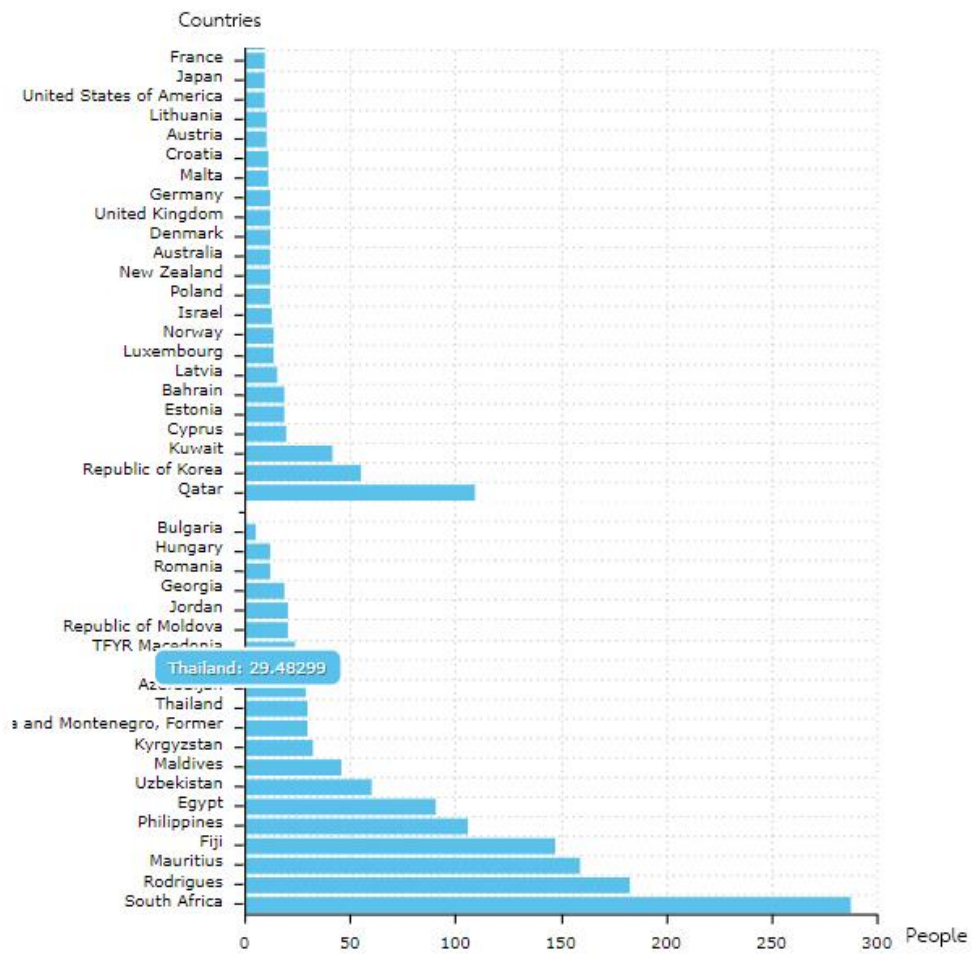
Source: Global Asthma Report, 2014

Figure 7 The mortality rate of asthma by age-standardized

for all ages, 2001-2010
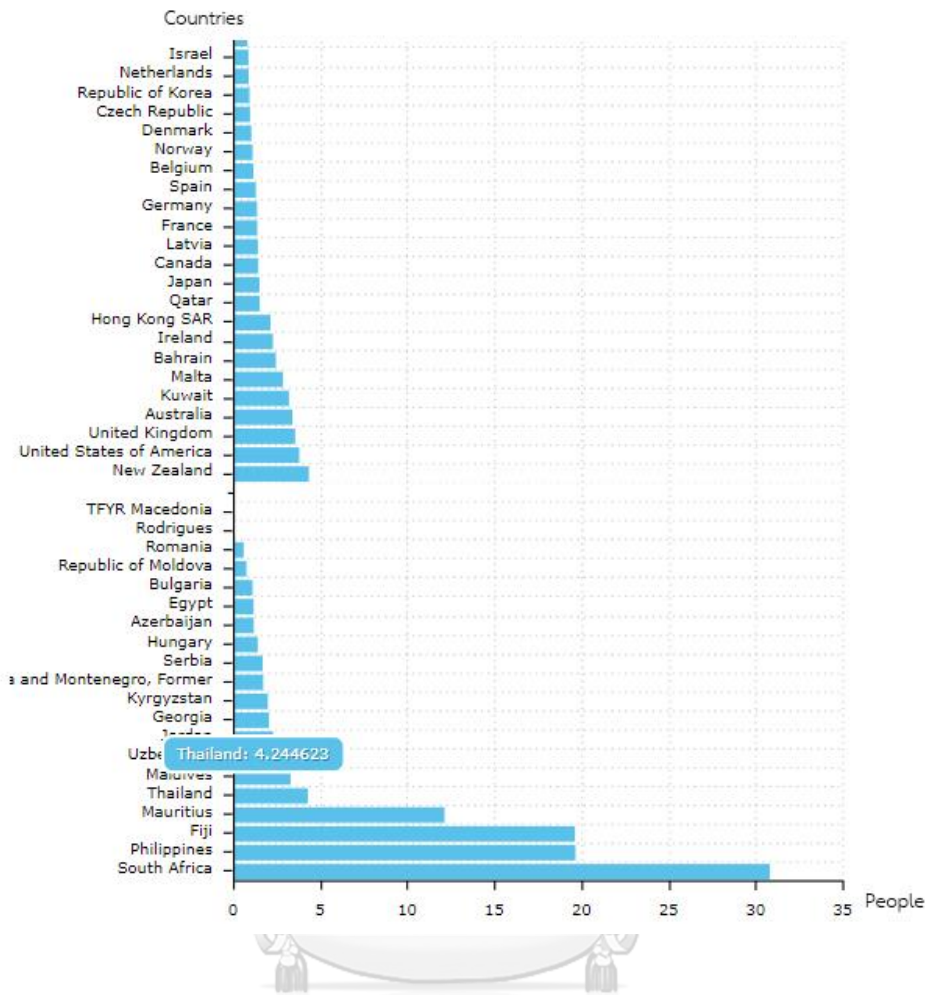
Source: Source: Global Asthma Report, 2014

Figure 8 The mortality rate of asthma by age-standardized

for ages 5-34 years only, 2001-2010
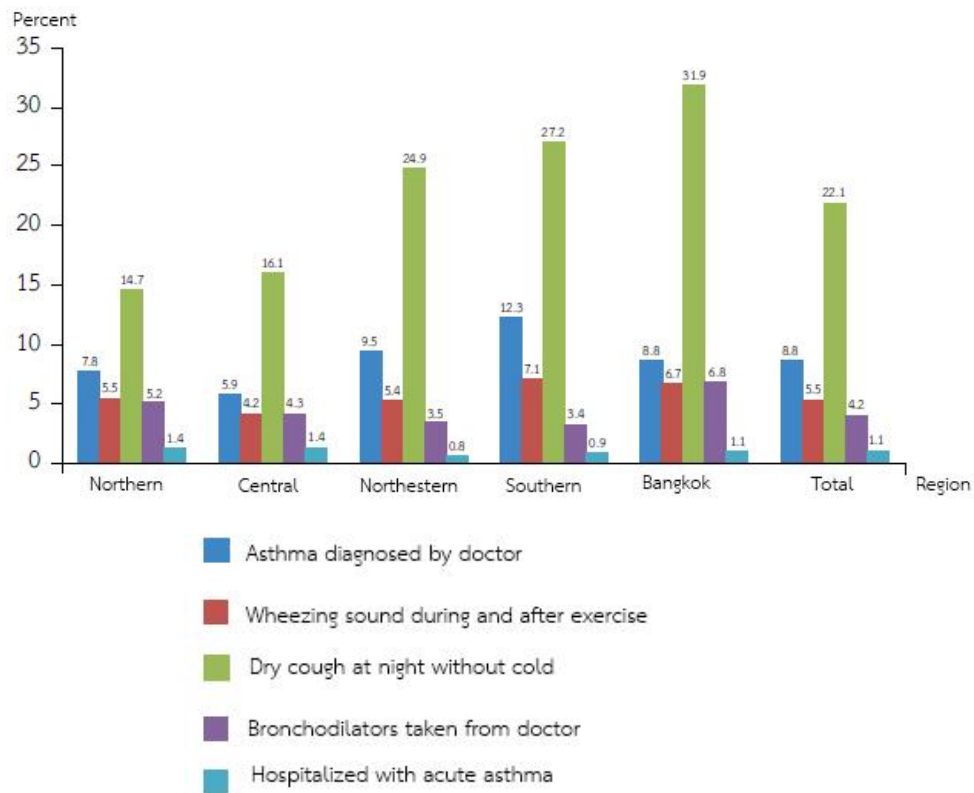
Percent

Source: Ministry of Public Health, 2016

Figure 9 Percentage of asthma diagnosis in children 6-14 years separate region
in Thailand between 2008 and 2009

2.3.2 Causes and symptoms of asthma

Asthma can be found in people all age groups but it is common in childhood. Furthermore, increasing risk of developing the disease in children when they have family history of asthma (30, 31). And many studies found that environment can cause to increase asthma, for example, Muhammad, et al (2004) found that exposures to environmental factors; wood or oil smoke, soot or exhaust, cockroaches, herbicides, pesticides, and farm crops/ farm dust/ farm animals since the first year of life were associated with childhood asthma (AOR>1) (32). And the symptoms will be different occurred in each person with asthma.

1) Causes

It remains difficult to pinpoint and unclear the exact causes of asthma and developing asthma in people. The allergies and triggers in the environment can be cause of asthma symptoms and asthma severity including genetics can also play a role. The same characteristic of triggers may can cause an asthma attack which were shared both childhood asthma and adult-onset asthma. The common triggers of asthma attacks include:

- breathing polluted air or breathing in allergens; allergy-causing substances such as dust, molds, mildew, dust mites, animal dander or saliva, cockroaches, etc.,

- exposure to airway irritants, smoke such as tobacco or cigarette smoke, wood smoke, charcoal smoke, humidity and weather (cold temperature or dry air),

- an upper respiratory infection, such as a cold, flu, sinusitis, or bronchitis and other infections with fungi, bacteria, or parasites,

- inhaling other respiratory irritants such as perfumes, chemicals or cleaning products,

- emotional excitement or stress,

- physical exertion or exercise,

- reflux of stomach acid known as gastro esophageal reflux disease, or GERD,

- sulfites, an additive to some foods and wine, and

- In some women, asthma symptoms are closely tied to the menstrual cycle.
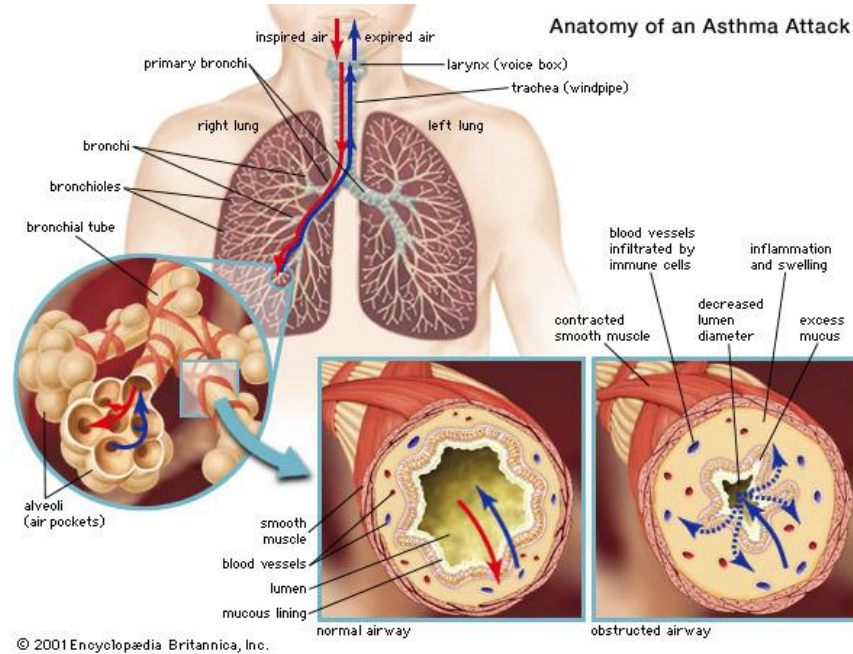
Source: Encyclopaedia Britannica, Inc., 2001

Figure 10 The anatomy of an asthma attack

2) Symptoms

The symptoms of asthma both childhood and adult-onset asthma are the same but more sensitive to allergens in children than adult. Because of children bodies are still developing so they are more disposed to asthma attack. Moreover, family history of asthma influences to increase risk of asthma developing of people in their family (33). The common symptoms of asthma include wheezing or whistling in the chest, coughing; especially at night, shortness of breath after physical activity, and chest tightness or congestion, pain, or pressure in the chest. And other symptoms such as increasing mucus secretion in the airways, difficulty sleeping.

Coughing usually occurs at night or during the early hours of morning (1 a.m. to 4 a.m.) due to nocturnal asthma (nighttime asthma) which is without phlegm or mucus and also may occur with wheezing.

Wheezing is whistling sound in the chest when breathing. This sound will occur when there is obstruction in the air passages into the lungs in person who has asthma. In children with severe asthma this symptom can occur while they breathe in. presenting of wheezing in children of asthma related to exercise (exercise-induced asthma) usually occur only during or after exercise, while nocturnal asthma, wheezing may occur during sleeping at night.

Shortness of breath in people with asthma refers to feeling breathless or having difficulty breathing, usually occur after physical activity.

Chest tightness is tight when breathing in. children may feel congestion or may be pain in the chest with or without other symptoms of asthma.

Other symptoms such as increasing mucus secretion in the airways, difficulty sleeping. Children with asthma may get cough every time when they get a cold.

2.3.3. Classification and Diagnosis

1) Classification

Classification of asthma will help the doctor easily to provide appropriate treatment, then, severity of asthma was used to classify the category of them. In 2007 and 2009, the asthma was categorized by the NAEPP guidelines and the VA/DoD into three types which depended on the different reflect classification in each age group

include 0-4 years, 5-11 years, and 12 years and older. Therefore, the classification by the NAEPP includes 1) intermittent asthma, 2) mild persistent asthma, 3) moderate persistent asthma, and 4) severe persistent asthma.

In 2016, the newer categories of asthma by the 2016 Global Initiative for Asthma (GINA) guidelines categorize them, depend on severity including: mild, moderate, or severe. The retrospectively from the level of treatment required to control symptoms and exacerbations is used to assess the severity, as follows:

(1) Mild asthma: meaning that can be well controlled with as-needed reliever medication alone or with low-intensity controller treatment such as low-dose inhaled corticosteroids (ICSs), leukotriene receptor antagonists, or chromos.

(2) Moderate asthma: meaning that can be well controlled with low-dose ICS/long-acting beta2-agonists (LABA).

(3) Severe asthma: meaning that it requires high-dose ICS/LABA to prevent it from becoming uncontrolled, or asthma that remains uncontrolled despite this treatment.

The 2016 GINA guidelines stress the importance of differentiating between severe asthma and uncontrolled asthma, which can notice the latter symptoms that is a much more common reason for persistent symptoms and exacerbations, and it may be easier to improve. Before a diagnosis of severe asthma, there are the most common problems which need to be excluded as follows:

- Poor inhaler technique

- Poor medication adherence

- Incorrect diagnosis of asthma, with symptoms due to alternative conditions such as upper airway dysfunction, cardiac failure, or lack of fitness

- Comorbidities and complicating conditions such as rhino sinusitis, gastro esophageal reflux, obesity, and obstructive sleep apnea

- Ongoing exposure to sensitizing or irritant agents in the home or work environment.

2) Diagnosis

(1) Asthma diagnosis by physician, a doctor will ask patient about medical history and performing a physical exam such as a lung function test, sinus X-ray.

(2) Asthma diagnosis by ISAAC questionnaire, it refers to the symptoms related to asthma which frequency happens in during time. This is the screening of asthma symptoms include wheezing or whistling in the chest and dry cough at night (see more detail in item 2.4).

2.3.4 Risk factors of asthma symptoms

1) Genetic and Family history

The prevalence of asthma in female is more than male (34). And according to a CDC report that 3 - 6 times in people who has parent with asthma was more likely to develop asthma than someone whose parent did not have asthma. Furthermore, the study by Liu et al (2009) found a significant association between a family history of asthma and asthma (35). Their results showed that a genetic has a tendency to develop asthma if mother smoked cigarette during pregnancy, her newborn may be appear the problems in lower lung function when

compared to those whose mothers did not smoke (35). And also the study by Hofhuis et al (2003) found that smoking in mother during pregnancy can be a risk factor for developing asthma in premature birth (36).

2) Childhood allergies and viral respiratory infections

Allergies and asthma often cohabit; therefore, indoor allergies are used for a predictor of asthma diagnosis on risk person. For example, the study by Williams et al (2005) showed that levels of bacterial toxins; endotoxins in house dust were directly related to asthma symptoms (37).

Furthermore, many studies also showed the results about viral respiratory infections during infancy can lead to childhood allergies and can be possible cause of asthma in the future including respiratory problems during childhood can cause wheezing which is sign of asthma. For example, the study by El-Gamal et al (2011) found that viral infections in infants lead to immunologic derangements, especially for asthma in persistent wheezing people; this can be indicative and prediction to be possible of having asthma. Likewise, Gern (2008) (38), and Saglani (2013) (39), they try to find the linkage between viral respiratory infections and development of asthma in children which for the better progression on therapy and prevention of asthma.

Moreover, allergic condition such as atopic dermatitis (eczema) or allergic rhinitis (hay fever) is also a risk factor for developing asthma this supporting by the study by Wadonda-Kabondo et al (2004) which found the strong association (OR>1, 95%CI) between parental eczema and childhood atopic dermatitis in both maternal eczema and paternal eczema (40).

Sources of viral carrier can be indoor allergens such as animal proteins from pet's dander, dust mites, cockroaches, fungi, and mold.

3) Environmental exposure

Unclean air both indoor and outdoor air is importance role to cause of asthma symptoms in people with asthma when they expose to them. Many substances in the air such as particulate matter (PM; $PM_{2.5}$, PM_{10}), chemicals, smoke (factory smoke, vehicle smoke, fuel smoke, charcoal smoke, cigarette smoke, etc.), animal dander, microbial, etc., which are difference in urban and rural area especially in urban areas have high concentration of those than in rural areas

For example, the study in India which conducted in difference of pollution source in 8 areas; they found that industrial areas related to increasing of indoor suspended particulate matter (SPM) concentration and occurrence of asthma in children that 7.9% children in this study were diagnosed as having asthma which was the highest in industrial areas, residential areas, and village areas which were 11.8%, 7.7% and 3.9%, respectively (15). And this study showed the significant ($p<0.001$) association between SPM level and asthma which was higher in the houses of children who had asthma than others without asthma (15). And supporting this reason by the study of Keet et al (2017) which also found the stronger association between exposure to fine PM and increasing asthma diagnosis than exposure to coarse PM (41).

While many studies found the association between exposures to indoor air substances and asthma, for example the studies by Brunekreef et al (2012) (10), Salo et al (2004) (42), Chen et al (2011) (11), and Salam et al (2004) (32)

they were also supported that exposures to indoor air substances such as pet's dander, smoke in house, vectors, mold, carpet were both associated with asthma symptoms and can be possible increasing risk of asthma especially when children expose to them since early life.

4) Behavior and other disease

Some diseases such as obesity can be risk of asthma occurrence, for example the study by Fitzpatrick et al (2012) found the association between obesity and increasing of asthma (43). And also, the study by Alvarez et al (2014) found that obesity in children was related to asthma symptoms which had an increased risk and more severity in girls than boys (44). Furthermore, Feitosa et al (2011) found that presence of behavioral problems was associated with asthma symptoms occurrence among children (45).

2.3.5 Impacts of asthma

● **Acute effect**

In acute asthma, patients will show increasing shortness of breath, tightness in chest, coughing, and/or wheezing (46). This severity of asthma can cause of death in people with asthma, especially in children.

● **Chronic effect**

Long term or chronic asthma can increase risk of lung cancer which the recent study by Qu et al (2017) found the significant (OR>1) association between chronic asthma and increasing the risk of lung cancer (47).

2.4 The International Study of Asthma and Allergies in Childhood

Questionnaires (ISAAC)

The International Study of Asthma and Allergies in Childhood (ISAAC) is a unique worldwide epidemiological research programme for investigating about asthma, rhinitis and eczema in children. This programme was established in 1991 due to considerable concern from increasing of those conditions in western and developing countries. There are more than 100 countries and nearly 2 million children involving in this programme, therefore, it has become the largest worldwide collaborative research project ever undertaken and involving. The aims of ISAAC is to develop environmental measures and disease monitoring in order to form the basis for future interventions to reduce the burden of allergic and non-allergic diseases, especially in children in developing countries.

The ISAAC findings have shown that these diseases are increasing in developing countries while they still have little to do with them. Therefore, they try to promote about the further population studies which are urgently needed to discover more about the underlying mechanisms of non-allergic causes of asthma, rhinitis and eczema and the burden of these conditions (48).

2.4.1 Diagnosis of respiratory and asthma symptoms by using ISAAC

The respiratory and asthma symptoms diagnosis by ISAAC questionnaire, it refers to screening of symptoms related to respiratory and asthma which depends on frequency happening during the past time. Furthermore, this questionnaire also screening about environmental factors related to respiratory and asthma symptoms. The symptoms include wheezing or whistling in the chest and dry cough at night.

The environmental factors include cooking fuel, heating fuel, animal such as pets (dog), farm animal (cattle, pigs, goats, sheep, and poultry), and cigarettes smoke.

The ISAAC questionnaire screening in children two age groups include 6-7 years and 13-14 years. The positive answer of question to these symptoms was estimated that they may be has asthma symptom. The questions are including: "Have you (has your child) had wheezing or whistling in the chest in the past 12 months?" as recommended by the World Allergy Organization (49).

2.5 Association between environmental exposures and respiratory and asthma symptoms

Living place environments, there are many allergens that can be possible cause and risk of respiratory and asthma symptoms. Both outdoor air and indoor air are containing them such as particulate matter, vector scraps, pet's dander, smoke, plant spores, chemicals, etc. Environmental exposures which related to respiratory and asthma symptoms include:

1) **Particulate matter (PM)**

It is a mixture of solid particles and liquid droplets such as metals solid, dust particles, chemicals (Nitrate, Sulfate, Ammonium icon, etc.), heavy metal, and bacterial of fungi which are in the air (50). The significant particulate matter in relation to respiratory and asthma symptoms include:

- **PM_{10}:** coarse particle, with the size is 10 micrometers and smaller in diameters; and

- **$PM_{2.5}$:** fine inhalable particle, with the size is 2.5 micrometers and smaller in diameters

Table 1 WHO Guidelines and standard of PM

Type of particles	Standard	Duration
PM$_{2.5}$	10 µg/m^3	Annual mean
	25 µg/m^3	24-hour mean
PM$_{10}$	20 µg/m^3	Annual mean
	50 µg/m^3	24-hour mean

Many epidemiological studies use PM as the exposure indicator for represents the particle mass which enters the respiratory tract. The PM both coarse particles (PM$_{10}$) and fine particles (PM$_{2.5}$) are considered to contribute to the health effects observed which is high complexity in urban areas, especially in cities around the world, depending on local geography, meteorology, and specific PM sources. The PM smaller size can get deep into human lungs, and some may even get into the bloodstream, especially PM$_{2.5}$is concerned more than larger size (51). For example, the study by Keet et al (2017) which showed that exposure to fine PM was stronger associated with increasing asthma diagnosis than exposure to coarse PM (41).

2) Residential environment and indoor air allergens

Residential environment refers to household and environment surrounding. The indoor air allergens at residence such as cigarette smoke, cooking smoke (from charcoal using), pet's dander (such as cat, dog, and bird), vectors (such as cockroach, rat), plant spores (such as pollen of flowers), housing chemicals (such as mosquito control spray) which those can cause of irritate and increasing risk of respiratory symptom occurrence especially in respiratory diseases people, and

susceptible people more than others. There are many substances in air, although we may feel it is clean air in our home.

Many studies found the association between exposures to indoor air allergens in house and respiratory symptom including asthma as following:

- **Animal dander**

The study about animal dander from pets such as cat and dog which usually close to people especially and some of them bring their pets into bedroom, those may be the cause of asthma occurrence. Brunekreef et al (2012) found the association between exposures to cat and dog in children and asthma symptom which were among children age 6–7 years old who exposures to cat in the first year of life had presenting current symptoms of asthma, and children age 13–14 years old who exposures to both cat and dog had presenting asthma symptom prevalence in more-affluent and less-affluent countries (10).

- **Smoke in house**

Smoke in house such as cooking stove (charcoal, wood), soot, exhaust, cigarette smoke is also risk factors of increasing asthma symptoms. For example the study by Salo et al (2004) found the strongest associations (OR>1, 95%CI) between smoking (cigarette smoke) in the home and respiratory symptoms; cough and phlegm without colds among children, including the association between coal burning for cooking and wheezing (42). And also the study by Chen et al (2011) and Muhammad et al (2004) are also support on exposures to those smoke can be possible and increasing risk of asthma when children expose to them since early life (11), (32).

- **Vectors**

Vectors such as cockroach were found in many studies that it was associated with asthma. For example, Chen et al (2011) found the association among children who expose to cockroaches since early in life and asthma (OR=2.16; 95% CI 1.15-4.07) (11). And also, Kim et al (2005) found similar results (52) while Do et al (2016) reviewed and also found many studies showed the results on linkage of cockroaches allergen-induced asthma (53).

- **Dampness and mold**

Dampness in building can cause to produce mold and milder odors which is also risk factor of respiratory symptoms like the study by Chen et al (2011) found that expose to visible mold, mildew odors, and carpet were associated with asthma (OR>1, 95%CI) (11). Likewise, the study by Nguyen et al (2010) found that the presence of mold was positive significantly associated with current asthma (AOR = 2.1, 95%CI 1.3-3.3) (12), and Wang et al (2014) which found the association between water damage and allergic asthma (OR=2.56, 95%CI 1.34-4.86) (54).

2.6 Summary environmental risk factors of respiratory and asthma symptoms

Table 2 Summary risk factors of respiratory and asthma symptoms

Risk factor	symptoms	
	respiratory	asthma
Genetic and family history	-	/
Particulate matter (PM; PM_{10}, $PM_{2.5}$)	/	/
Smoke (charcoal, cigarette)	/	/
Pets (cat, dog, etc.)	/	/
Vectors (cockroach, rat, etc.)	/	/
Microbial (Molds, fungi, bacteria)	/	/
Housing chemical	/	/

2.7 Review related article

There are many studies found association between exposures to environmental factors and respiratory and asthma symptoms among children. The table is used to explain the detail about environmental factors which increased risk of respiratory and asthma symptoms in each study that summary as shown in table 3.

For example, the study about Indoor air pollution such as SO_2, NO_2 and SPM (suspended particulate matter) which was conducted in Delhi, India by Kumar et al (2015) (15), particulate matter ($PM_{2.5}$) by Isabella et al (2015) (55) in French, and fine Particulate matter ($PM_{2.5}$) and coarse Particulate matter ($PM_{10-2.5}$) by Corinne et al (2017) (41) in The United State, all studies found the association between indoor air exposures and respiratory and asthma symptoms.

Furthermore, the studies about allergens such as pet's dander; horse, dog, cat, house dust mites, and cockroach were also found the association between those factors and respiratory and asthma symptoms among children. For example, the

study which was conducted in school by Kim et al (2005) (52) in Sweden, and the study by Brunekreef et al (2012) (10) which conducted in population across the world as well.

In addition, the study about environmental at household such as tobacco smoke, mildew odors, and carpet by Chen et al (2011) (11) in Taiwan, Pollen flower exposure by Erbas et al (2013) (56) in Australia, presence of mold, air cleaners, dehumidifiers, humidifiers by Nguyen et al (2010) (12) in New York State, and Pirastu et al 2013 (13) in Italy were also found the similar results as well.

Moreover, the study by Muhammad et al (2004) (32) in Southern California, they studied about wood or oil smoke, soot, or exhaust, cockroaches, herbicides, pesticides, and farm substances; farm crops, farm dust, or farm animals which also found the similar results like other studies that mention before.

Table 3 Summary of environmental factors increased risk of respiratory and asthma symptoms

Reference	Factors	Study Population	Study design	Result
Kumar R et al, 2015 (Delhi, India)	Indoor air pollution (SO_2, NO_2 and SPM (suspended particulate matter))	3,104 children (Conducted in 8 locations based on the source of pollution (industrial, residential and villages).)	A cross-sectional study	The results of study found that: - Children exposure to tobacco smoke (32.4%) and biomass fuels for cooking (31.5%), - 7.9% having asthma (doctor-diagnosed); the highest in industrial areas (11.8%), followed by residential areas (7.5%), and village areas (3.9%), respectively, - Indoor SPM was the highest in industrial area, and SPM level was significantly (p < 0.001) higher in the asthmatic children's houses, - This study concluded that industrial areas related to increasing of indoor SPM concentration and occurrence of asthma in children.
Isabella Annesi-Maesanoa et al, 2015 (French)	Particulate matter ($PM_{2.5}$)	5,338 school children (10-11 years)	A cross-sectional study (semi-individual)	This study found that past year atopic asthma was significantly higher than 1 in residential setting with $PM_{2.5}$ concentrations exceeding 10 mg/m^3 (WHO air quality limit values).
Corinne A Keet et al, 2017 (The United State)	Fine Particulate matter ($PM_{2.5}$) and coarse Particulate matter ($PM_{10-2.5}$)	7,810,025 children (5-20 years)	A cross-sectional study (a log-linear regression model)	The results of study found that: - Exposure to fine PM was stronger associated with increased asthma diagnosis prevalence than exposure to coarse PM. - Exposure to coarse PM was associated with increased asthma diagnosis prevalence (RR for 1μg/m^3 increase in coarse PM level: 1.006, 95%CI: 1.001-1.011), hospitalizations (RR: 1.023, 95%CI: 1.003-1.042), and emergency department (ED) visits (RR: 1.017, 95%CI: 1.001-1.033) when adjusting for fine PM.

38

Table 3 Summary of environmental factors increased risk of respiratory and asthma symptoms (Continued)

Reference	Factors	Study Population	Study design	Result
J. L. Kim et al, 2005 (Sweden)	Allergens in the school environment (horse, dog, cat, house dust mites, and cockroach)	1,482 Pupils (5–14 years)	A cross-sectional study	This study found that horse allergen and dog allergen in school were significantly associated with wheeze, daytime breathlessness, current asthma and atopic sensitization (P < 0.05) while cat allergen was no significantly association. In conclusion, dog allergen and horse allergen could be a risk factor for asthma and atopic sensitization.
Brunekreef et al, 2012 (Across the world)	Cats and dogs in home	206,332 children (6-7 years) from 72 centres in 30 countries and 329,494 adolescents (13-14 years) 114 centres in 42 countries	A cross-sectional study (logistic regression)	The results of study found that: − Exposure to cat in the first year of life among children age 6–7 years old was associated with current symptoms of asthma. − Exposure to cat and dog among children age 13–14 years old were positive association with symptom prevalence in more-affluent and less-affluent countries.
Yang-Ching Chen et al, 2011 (Taiwan)	Dampness (visible mold), pets, environmental tobacco smoke (ETS), cockroaches, mildew odors, and carpet	579 mothers of (12-14 years) school children	A case-control study (1:2 matched, interviewed by telephone)	This study interviewed environmental exposures in children since before they were 5 years old. The study found that: − Childhood asthma was associated with exposure to early life environmental factors, such as cockroaches (OR = 2.16; 95% CI, 1.15–4.07), visible mold (OR = 1.75; 95% CI, 1.15–2.67), mildew odors (OR = 5.04; 95% CI, 2.42–10.50), carpet (OR = 2.36; 95% CI, 1.38–4.05), pets (OR = 2.11; 95% CI, 1.20–3.72), and more than one hour of ETS per day (OR = 1.93; 95% CI, 1.16–3.23), − During early childhood exposure to mildew odors, feather pillows, and ETS found association with late-onset asthma.

Table 3 Summary of environmental factors increased risk of respiratory and asthma symptoms (Continued)

Reference	Factors	Study Population	Study design	Result
Erbas B et al, 2013 (Australia)	Pollen flower exposure	620 infants with a family history of allergic	A cohort study	The results of study found that: - Cumulative exposure to pollen concentrations up to 6 months was associated with aeroallergen sensitization with the highest risk occurring at 3 months (aOR = 1.34, 95% CI 1.06-1.72), - Cumulative exposure to pollen up to 3 months was also associated with hayfever (aOR = 1.14, 95% CI 1.009-1.29) and between 4 and 6 months exposure with asthma only (aOR=1.35, 95% CI 1.07-1.72), - Persistent pollen exposure in infancy appears to increase the risk of asthma and hayfever in children.
Nguyen T et al, 2010 (New York State)	Presence of mold, air cleaners, dehumidifiers, humidifiers	1,412 households with at least one member with current asthma and 2,290 control households answered questions about their home environment (For children younger than 18 years of age)	A case-control study (within the cross-sectional NAS-NYS)	The results of study found that: - Statistically significant positive associations between current asthma and the presence of mold (adjusted odds ratio (AOR 2.1, 95%CI 1.3, 3.3), air cleaners (AOR 1.5, 95% CI 1.1, 2.1), dehumidifiers (AOR 2.0, 95% CI 1.4, 2.7), and humidifiers (AOR 1.6, 95% CI 1.1, 2.3), - Using of a wood-burning stove or fireplace was significantly more prevalent in control homes while there were no statistically significant associations with the presence of cockroaches, pets, or tobacco smoke.

Table 3 Summary of environmental factors increased risk of respiratory and asthma symptoms (Continued)

Reference	Factors	Study Population	Study design	Result
Muhammad Towhid Salam et al, 2004 (Southern California)	Wood or oil smoke, soot, or exhaust, cockroaches, herbicides, pesticides, and farm crops, farm dust, or farm animals.	a population-based study of > 4,000 school-aged children	A case-control study	The results of study found that: – Environmental exposures during the first year of life are associated with childhood asthma risk, – In children, who had asthma diagnosis before 5 years of age, they were associated with exposures to wood or oil smoke, soot, or exhaust (OR = 1.74; 95% CI, 1.02-2.96), cockroaches (OR = 2.03; 95% CI, 1.03-4.02), herbicides (OR = 4.58; 95% CI, 1.36-15.43), pesticides (OR = 2.39; 95% CI, 1.17-4.89), and farm crops, farm dust, or farm animals (OR = 1.88; 95% CI, 1.07-3.28).
Pirastu R et al, 2013 (Italy)	Environmental tobacco smoke (ETS), dampness.	4,122 primary schools	A cross-sectional study	This study found that the prevalence for current wheeze and current asthma were increased when: – both parents were smoker; almost doubled in comparison with never smokers, – among mothers smoking in pregnancy, – exposure to ETS; almost tripling of prevalence for current wheeze and more than four times for current asthma, – Exposure to "dampness" both during the first year of life and currently. In conclusion, childhood exposure to ETS will be causal role to develop respiratory symptoms and asthma.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Study Design

This cross-sectional study was conducted among primary school children aged 6 to 10 years between April and May 2018. The study designed to identify environmental factors of residential environment in relation to respiratory and asthma symptoms among children in urban area of Bangkok Thailand.

3.2 Study Area

The study was conducted at Din Daeng district in Bangkok, Thailand which was in inner area of Bangkok (inner Bangkok, there are 21 districts include Din Daeng, Phra Nakhon, Pom Prap Sattru Phai, Samphanthawong, Pathum Wan, Bang Rak, Yan Nawa, Sathon, Bang Kho Laem, Dusit, Bang Sue, Phaya Thai, Ratchathewi, Huai Khwang, Khlong Toei, Chatuchak, Thon Buri, Khlong San, Bangkok Noi, Bangkok Yai, and Watthana)

According to air quality statistics by Pollution Control Department of Thailand showed that Din Daeng had been accounted as the highest polluted area in Bangkok in 2016 as shown in table 4. Polluted area was defined as the area where air quality had exceeding standard level (Pollution Control Department, 2016). Din Daeng was purposively selected because there was no the study which had been focused on the association between residential environment and respiratory and asthma symptoms including prevalence of those symptoms.

Table 4 Air quality in Bangkok measured on roadside by Pollution Control

Department (2016)

| Area (Roadside station) | 24-hour mean (µg/m^3) | | | | | |
| | Particulate matter less than 10 micrometers (PM$_{10}$) | | | Particulate matter less than 2.5 micrometers (PM$_{2.5}$) | | |
	Maximum	Minimum	Times > Std.	Maximum	Minimum	Times > Std.
Rama IV Rd., Pathumwan district	131	50	2/76	#	#	#
Intharaphithak Rd., Thonburi district	106	10	0/214	81	9	22/188
Lat Phrao Rd., Wang Thonglang district	34	12	0/72	#	#	#
Dindeang Rd., Dindeang district	156	26	11/308	103	20	37/134
Standard of PM	50 µg/m^3			25 µg/m^3		

\# does not have measured

3.3 Study Population

The target population of the study was primary school children aged 6-10 years who register as full-time students in primary public schools under Bangkok Metropolitan Administration.

3.4 Sample and Sample size

3.4.1 Sampling Technique

- Step 1: School selection

This study was purposively selected all public schools under Bangkok Metropolitan Administration in Din Daeng district which there were only 3 primary schools in this area. In this report, the characters "A", "B" and "C" were used for representative the name of those schools.

- Step 2: Classroom selection

In each school, all primary classrooms were purposively selected which include:

- School A: 30   classrooms

- School B: 12   classrooms

- School C: 12   classrooms

- Step 3: Student selection

All students in primary class level in 3 schools were purposively selected to participate in this study.
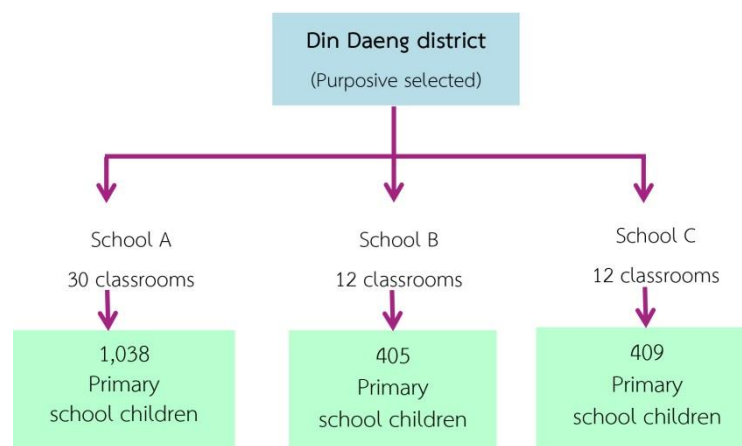
Figure 11 Sampling technique procedure

3.4.2 Sample size

This study was recruited all primary school children age between 6-10 years of 3 primary schools in Din Daeng district which was under Bangkok Metropolitan Administration and they were willing to participate in this study. A total of 1,852 primary school children were selected but only 2 primary schools were willing to participate in this study. Therefore, totally the sample sizes were 814 primary school children included to this study.

Because we used equation for calculate the sample sizes from prevalence of respiratory symptom in children in Thailand from the report by The Allergy, Asthma, and Immunology Association of Thailand. And use program n4Studies application version 1.4.0 distributed by Chetta Ngamjarus to calculate sample size.

The output of the sample size calculation from n4Studies: For estimating the infinite population proportion

$$n = \frac{z_{\alpha/2}^2 P(1-P)}{d^2}$$

; P = Proportion = 0.127

d = Delta = 0.05

α = Alpha = 0.05

Z (0.975) = 1.959

n = Sample size = 171

The calculated sample size was 171. However, this study was collected data from all primary school children in Din Daeng district, Bangkok, Thailand.
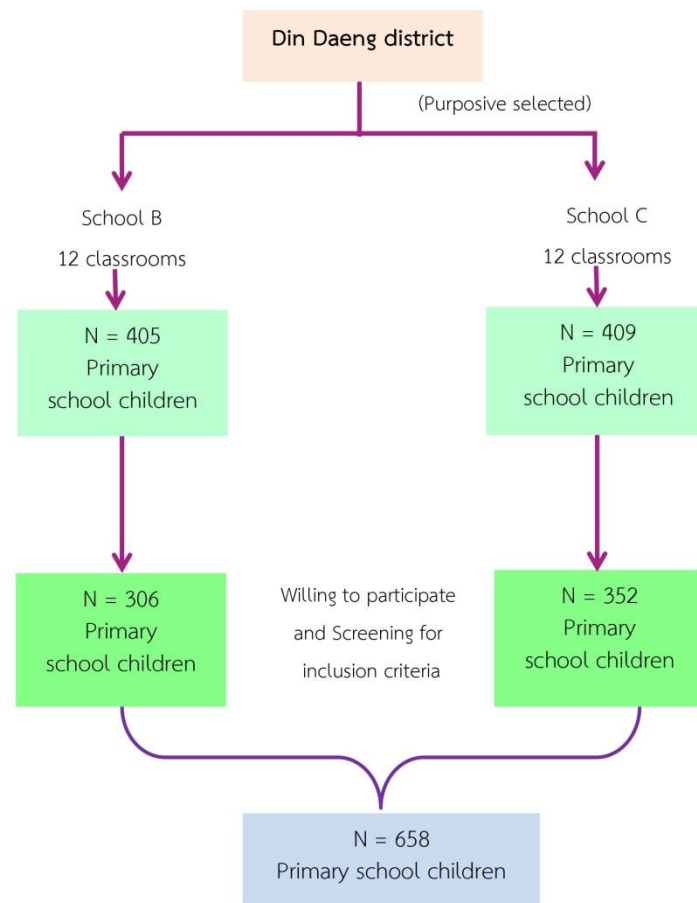
Figure 12 Sample sizes calculation procedure

3.4.3 Inclusion criteria:

1. Children whose age between 6 - 10 years

2. Children who register as full-time students in primary level (grade 1 – 3) of 3 selected public schools

3. Children residing in this residence more than 1 year.

4. Children, parent and family of children were willing to participate in the study (replied questionnaire).

3.4.4 Exclusion criteria:

1. Children who have respiratory complication disease, those were sinus surgery, and chronic rhino sinusitis.

2. Children who did not live in Din Daeng district.

3.5 Measurement Tools

(1) Screening questionnaire:

The Screening questionnaire was used to exclude children who were sinus surgery and chronic rhino sinusitis, and did not live in Din Daeng district which was not inclusion criteria of this study. It had 4 questions which were asked about those exclusion criteria, and period of time living in their residence.

(2) Questionnaire:

The questionnaire divided into five parts consists of:

- **Part 1:** Children characteristics

There were six questions related to personal characteristics of children such as personal profiles, which included age, sex, height and weight.

- **Part 2:** Children's parent information

There was a question about relationship between children.

- **Part 3:** Children activity

There were four questions related to activity of children about sport and spending their time at residence.

- **Part 4:** Respiratory and Asthma symptoms of children

There were twenty-three questions related to respiratory and asthma symptoms of children which were wheezing or whistling in the chest, dry cough at night, phlegm, shortness of breath, and running nose.

These questions were modified from The International Study of Asthma and Allergies in Childhood Questionnaires (ISAAC). The positive answers of question to those symptoms were estimated that they may have respiratory and asthma symptoms. Each symptom was set a question "Have your child had wheezing or whistling in the chest in the past 12 months?". If parent reported "Yes", their child was considered as having those respiratory and asthma symptoms. Children who had experienced in wheezing or whistling in the chest during the past 12 months were also considered as having asthma according to World Allergy Organization to diagnosis asthma symptoms of children (48).
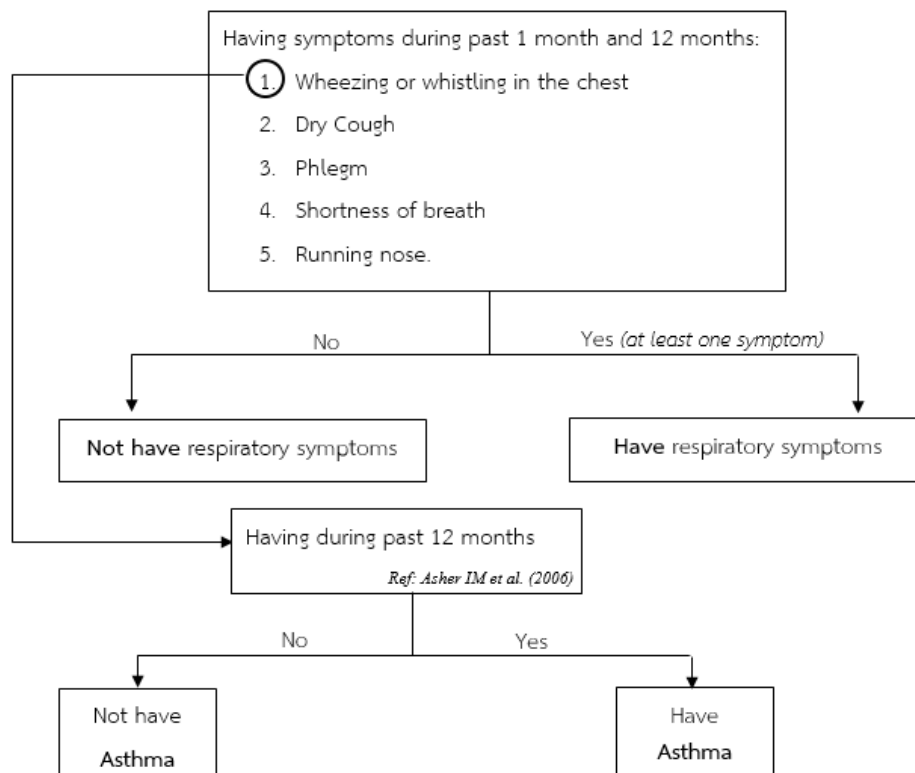
Figure 13 Diagram diagnoses of respiratory and asthma symptoms by ISAAC

- **Part 5:** Residential Environment

There were thirty questions related to residential characteristics and residential environment which were questions about types of residence, places surrounding residence, environment at residence, and in children's bedroom including exposures to those environments of children. Environment such as flowers with pollen, vectors (cockroach, rat, etc.), pets (dog, cat, bird, etc.), smoke in house such as cigarette smoke, charcoal smoke from cooking, and incense smoke. All questions were modified from the International Study of Asthma and Allergies in Childhood Questionnaires (ISAAC).

Validity of questionnaire

The validity was considered by 3 experts in the major of environmental and public health. An evaluation using the index of item-objective congruence; IOC (Rovinelli & Hambleton, 1977) (57) was a process where content experts rate individual items on the degree to which they did or did not measure specific objectives list by the test developer. A content expert was evaluated each item by giving the item a rating of 1 (for clearly measuring), -1 (clearly not measuring), or 0 (degree to which it measured the content area was unclear) for each objectives. Index of Item Objective Congruence (IOC) score was a satiated questionnaire at 0.83 which was over 0.5 as recommendation.

3.6 Data collection

The data was collected by self-reported questionnaire from children's parents or children's family at school on the parents meeting day.

A request letter conducted a research from college of Public Health Science, Chulalongkorn University was written to the managing director of the selected schools. After getting permission from schools, researcher communicated with teacher who was deputy director of the selected schools in each school about how to collect the data.

This study had one researcher assistant; he was trained by researcher before collecting data about how to do the process of data collection and understanding purpose of the study including structure of questionnaire (self-report). He helped to distribute, collect back the questionnaires, and answer some simple questions from participants.

The participants were screened by screening questionnaire before answered the questionnaire. When finished school parents meeting activity, the consent form and questionnaires were distributed to children's parents who only were inclusion criteria. And then researcher and researcher assistant described the purpose of study and structure of questionnaire (self-report).

In addition, the detail of study and its purpose was provided for participants through information sheet in order to participants can directly contact researcher when they had any question about questionnaire.

The questionnaire was checked for its completeness by researcher and researcher assistant during collecting.

Figure 14 Data collection

3.7 Data Analysis (statistics)

Analysis focused on the relationship between residential environment (independent variable) and symptoms (yes/no) (dependent variable) with appropriate adjustment for other independent variables.

3.7.1 Descriptive statistics:

The categorical data was reported by frequency and percentage. Continuous data was tested normality distribution by Kolmogorov–Smirnov test. Normalized data was reported by mean, standard deviation (S.D.) and rank. Non-normalized was reported by median and interquartile rank (IQR).

3.7.2 Inferential statistics:

Firstly, bivariate analysis was performed to test an association between residential environmental variables and respiratory symptoms (yes/no). For categorical data, chi-square test was performed to find those associations. If chi-square was not meet the assumption, fisher's exact test was reported. For continuous data, independent t-test was analyzed to find a difference between independent variable on each symptom. If data was skewed, Man-Whitney U test was performed.

Secondly, residential environmental variables which had p-value less than 0.2 in bivariate analysis were selected to include into multivariate analysis.

Lastly, multivariate analysis was performed by binary logistic regression adjusting general characteristic of children (age 6 – 10 years). Adjusted odd ratio (AOR) was reported. In the models, each respiratory symptom was considered as

a dependent variable. For independent variables, selected residential environment variables in the second step were included into each model.

3.8 Ethical Consideration

This study was reviewed and approved for research involving human by the Ethics Review Committee of Chulalongkorn University (COA No. 085/2561).

CHAPTER IV

RESULTS

This study aimed to estimate the prevalence of respiratory and asthma symptoms and to investigate its association with residential environments among primary school children in inner Bangkok, Thailand. The data analysis was divided into 3 parts as the following:

Part I: Prevalence of respiratory and asthma symptoms in primary school children at Din Dang district, Bangkok, Thailand

Part II: Association between children's characteristics and respiratory and asthma symptoms

Part III: Association between residential environments and respiratory and asthma symptoms

4.1 Prevalence of respiratory and asthma symptoms in primary school children at Din Dang district, Bangkok Thailand

A total of 658 primary school children age 6 - 10 years old was participants in this study. As shown in Table 5, the highest prevalence of respiratory symptoms and asthma symptom in the past 12 months was running nose without cold symptom (52.7%), followed by phlegm (43.3%). The prevalence of allergy (doctor diagnosis) was 21.1% mostly for allergic rhinitis (69.8%) type. The prevalence of asthma (doctor diagnosis) was 1.8% mostly for allergic asthma (58.3%), followed by Cough-Induced asthma (50.0%).

Table 5 Prevalence of respiratory and asthma symptoms in primary school children at Din Dang district, Bangkok, Thailand (n = 658)

Symptoms	Yes: n (%)		No: n (%)	
Respiratory symptoms in the past 12 months				
Wheezing or whistling in the chest	75	(11.4)	583	(88.6)
Dry cough at night	214	(32.5)	444	(67.5)
Phlegm	285	(43.3)	373	(56.7)
Shortness of breath	60	(9.1)	598	(90.9)
Running nose without cold	347	(52.7)	311	(47.3)
Allergy (doctor diagnosis)	139	(21.1)	519	(78.9)
Types of allergies				
Skin allergy	26	(18.7)	113	(81.3)
Dust allergy	58	(41.7)	81	(58.3)
Insect sting allergy	14	(10.1)	125	(89.9)
Pet allergies	14	(10.1)	125	(89.9)
Eye allergy	11	(7.9)	128	(92.1)
Allergic rhinitis	97	(69.8)	42	(30.2)
Mold allergy	7	(5.0)	132	(95.0)
Cockroach allergy	2	(1.4)	137	(98.6)
Asthma (doctor diagnosis)	12	(1.8)	646	(98.2)
Types of asthma				
Allergic asthma	7	(58.3)	5	(41.7)
Exercise-Induced asthma	1	(8.3)	11	(91.7)
Cough-Induced asthma	6	(50.0)	6	(50.0)
Nocturnal asthma	2	(16.7)	10	(83.3)

4.2 Association between children's characteristics and respiratory and asthma symptoms

The participants both male (50.2%) and female (49.8%) were included in this study. Table 6 shows the median age (interquartile rang; IQR) were 8 (2) years. The median height for both male and female children were 122 (10.0) cm. Median weight at birth was 3 (0.3) kg and weight at present was 26 (7.0) kg. Most of children (64.6%) had exercise regularly. Only 2.3% had family history of asthma.

4.2.1 Association between children's characteristics and respiratory and asthma symptoms (1 month)

Table 6 shows an association between children's characteristics and respiratory and asthma symptoms during the past 1 month. In bivariate analysis, the results indicated that height of children was associated with dry cough at night (p=0.026). Median (IQR) of height among children with dry cough at night (120 (10)) was less than children without dry cough (123 (10)). Weight of children at birth and at present were associated with shortness of breath symptom (p<0.05). Children's weight at present with shortness of breath symptom (median (IQR): 29.4 (10)) was higher than children without the symptom (median (IQR): 26 (7)). Age and present weight of children with and without wheezing or whistling in the chest symptom was equally.

Table 6 Children's characteristics and respiratory and asthma symptoms
(1 month) (n=658)

Children Characteristics	Total (n=658)	Wheezing or whistling in the chest (n = 58)			Dry cough at night (n = 176)			Phlegm (n=251)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Age (years); Median (IQR)	8 (2.0)	8 (2.0)	8 (2.0)	0.151^a	8 (2.0)	8 (2.0)	0.435^a	8 (2.0)	8 (2.0)	0.724^a
Gender										
Male	330 (50.2)	32 (9.7)	298 (90.3)	0.423^b	93 (28.2)	237 (71.8)	0.405^b	121 (36.7)	209 (63.3)	0.433^b
Female	328 (49.8)	26 (7.9)	302 (92.1)		83 (25.3)	245 (74.7)		130 (39.6)	198 (60.4)	
Height (cm); Median (IQR)	122 (10.0)	123 (10.0)	122 (10.0)	0.947^a	120 (10.0)	123 (10.0)	0.026^a	123 (10.0)	121 (10.0)	0.560^a
Weight (kg);										
Present (kg); Median (IQR)	26 (7.0)	26 (7.3)	26 (7.0)	0.172^a	26 (8.0)	26 (7.0)	0.227^a	26 (7.0)	26 (7.0)	0.847^a
At birth (kg); Median (IQR)	3 (0.3)	3 (0.1)	3 (0.3)	0.505^a	3 (0.3)	3 (0.3)	0.912^a	3 (0.3)	3 (0.3)	1.000^a
Family history of asthma	15 (2.3)									
Yes	15 (2.3)	1 (6.7)	14 (93.3)	1.000^c	4 (26.7)	11 (73.3)	1.000^c	9 (60.0)	6 (40.0)	0.078^b
No	643 (97.7)	57 (8.9)	586 (91.1)		172 (26.7)	471 (73.3)		242 (37.6)	401 (62.4)	
Exercise										
Yes	319 (64.6)	34 (10.7)	285 (89.3)	0.242^b	80 (25.1)	239 (74.9)	0.265^b	133 (41.7)	186 (58.3)	0.062^b
No	175 (35.4)	13 (7.4)	162 (92.6)		52 (29.7)	123 (70.3)		58 (33.1)	117 (66.9)	

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 6 Children's characteristics and respiratory and asthma symptoms (1 month) (n=658) (Continued)

Children Characteristics	Total (n=658)	Shortness of breath (n=45)			Running nose without cold (n=312)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Age (years); Median (IQR)	8 (2.0)	8 (2.0)	8 (2.0)	0.527^a	8 (2.0)	8 (2.0)	0.693^a
Gender							
Male	330 (50.2)	21 (6.4)	309 (93.6)	0.628^b	156 (47.3)	174 (52.7)	0.941^b
Female	328 (49.8)	24 (7.3)	304 (92.7)		156 (47.6)	172 (52.4)	
Height (cm); Median (IQR)	122 (10.0)	126 (12.0)	122 (10.0)	0.248^a	122 (10.0)	122 (10.0)	0.879^a
Weight (kg);							
Present (kg); Median (IQR)	26 (7.0)	29.4 (10.0)	26 (7.0)	0.024^a	26 (7.0)	26 (7.3)	0.882^a
At birth (kg); Median (IQR)	3 (0.3)	3 (0.4)	3 (0.3)	0.012^a	3 (0.3)	3 (0.3)	0.760^a
Family history of asthma	15 (2.3)						
Yes	15 (2.3)	2 (13.3)	13 (86.7)	0.274^c	8 (53.3)	7 (46.7)	0.642^b
No	643 (97.7)	43 (6.7)	600 (93.3)		304 (47.3)	339 (52.7)	
Exercise							
Yes	319 (64.6)	20 (6.3)	299 (93.7)	0.800^b	157 (49.2)	162 (50.8)	0.533^b
No	175 (35.4)	12 (6.9)	163 (93.1)		81 (46.3)	94 (53.7)	

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

4.2.2 Association between children's characteristics and respiratory and asthma symptoms (12 months)

Analysis of table 7 shows an association between children's characteristics and respiratory and asthma symptoms in the past 12 months. In bivariate analysis, the results indicated that height of children was associated with dry cough at night (p=0.008). Median (IQR) of height among children with dry cough at night (120 (10)) was less than children without dry cough (124 (10)). The weight at birth of children was associated with shortness of breath symptom (p=0.003). Children's weight at birth with shortness of breath symptom (median (IQR): 3 (0.4)) was similar to children without the symptom (median (IQR): 3 (0.3)).

Age and present weight of children with and without dry cough at night symptom were equally. Family history of asthma of children with phlegm (10 (66.7%)) and running nose without cold (11 (73.3%)) symptoms were higher than children without these symptoms (5 (33.3%), 4 (26.7%)).

Table 7 Children's characteristics and respiratory and asthma symptoms (12 months) (n=658)

Children Characteristics	Total (n=658)	Wheezing or whistling in the chest (n = 75)			Dry cough at night (n = 214)			Phlegm (n=285)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Age (years); Median (IQR)	8 (2.0)	8 (2.0)	8 (2.0)	0.308[a]	8 (2.0)	8 (2.0)	0.129[a]	8 (2.0)	8 (2.0)	0.277[a]
Gender										
Male	330 (50.2)	43 (13.0)	287 (87.0)	0.186[b]	113 (34.2)	217 (65.8)	0.345[b]	135 (40.9)	195 (59.1)	0.212[b]
Female	328 (49.8)	32 (9.8)	296 (90.2)		101 (30.8)	227 (69.2)		150 (45.7)	178 (54.3)	
Height (cm); Median (IQR)	122 (10.0)	123 (10.0)	122 (10.0)	0.815[a]	120 (10.0)	124 (10.0)	0.008[a]	122 (10.0)	122 (10.0)	0.743[a]
Weight (kg);										
Present (kg); Median (IQR)	26 (7.0)	26 (7.0)	26 (7.0)	0.757[a]	26 (8.0)	26 (7.4)	0.164[a]	26 (7.0)	26 (7.0)	0.742[a]
At birth (kg); Median (IQR)	3 (0.3)	3 (0.2)	3 (0.3)	0.330[a]	3 (0.3)	3 (0.3)	0.892[a]	3 (0.3)	3 (0.2)	0.435[a]
Family history of asthma										
Yes	15 (2.3)	2 (13.3)	13 (86.7)	0.685[c]	6 (40.0)	9 (60.0)	0.580[c]	10 (66.7)	5 (33.3)	0.065[b]
No	643 (97.7)	73 (11.4)	570 (88.6)		208 (32.3)	435 (67.7)		275 (42.8)	368 (57.2)	
Exercise										
Yes	319 (64.6)	38 (11.9)	281 (88.1)	0.726[b]	93 (29.2)	226 (70.8)	0.090[b]	130 (40.8)	189 (59.2)	0.152[b]
No	175 (35.4)	19 (10.9)	156 (89.1)		64 (36.6)	111 (63.4)		83 (47.4)	92 (52.6)	

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 7 Children's characteristics and respiratory and asthma symptoms (12 months) (n=658) (Continued)

Children Characteristics	Total (n=658)	Shortness of breath (n=60)			Running nose without cold (n=347)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Age (years); Median (IQR)	8 (2.0)	8 (2.0)	8 (2.0)	0.232^a	8 (2.0)	8 (2.0)	0.725^a
Gender							
Male	330 (50.2)	30 (9.1)	300 (90.9)	0.980^b	166 (50.3)	164 (49.7)	0.210^b
Female	328 (49.8)	30 (9.1)	298 (90.9)		181 (55.2)	147 (44.8)	
Height (cm); Median (IQR)	122 (10.0)	120 (10.0)	122 (10.0)	0.648^a	123 (10.0)	121 (10.0)	0.835^a
Weight (kg);							
Present (kg); Median (IQR)	26 (7.0)	26 (8.4)	26 (7.0)	0.328^a	26 (7.0)	26 (7.0)	0.737^a
At birth (kg); Median (IQR)	3 (0.3)	3 (0.4)	3 (0.3)	0.003^a	3 (0.3)	3 (0.2)	0.802^a
Family history of asthma	15 (2.3)						
Yes	15 (2.3)	2 (13.3)	13 (86.7)	0.639^c	11 (73.3)	4 (26.7)	0.106^b
No	643 (97.7)	58 (9.0)	585 (91.0)		336 (52.3)	307 (47.7)	
Exercise							
Yes	319 (64.6)	26 (8.2)	293 (91.8)	0.776^b	163 (51.1)	156 (48.9)	0.244^b
No	175 (35.4)	13 (7.4)	162 (92.6)		99 (56.6)	76 (43.4)	

Note. ^{a} Mann-Whitney U test, ^{b} Pearson Chi-Square test, ^{c} Fisher X'act test

4.3 Association between residential environment factors and respiratory and asthma symptoms

4.3.1 Area at residence and spending time

Table 8 shows about area at residence and spending time of children that children stayed at residence on weekend more than school day. Most of children (53.0%) stayed at their home around 24 hours during weekend whereas 76.0% of children stayed at residence around 13-14 hours during school day. Majority of children (69.5%) spent most of their time in bedroom more than other rooms.

Table 8 Area and spending time of children at residence (n=658)

Factors	n (%)	
Room/area at residence (spending a lot of time)		
Child's bedroom	457	(69.5)
Living room	122	(18.5)
Kitchen	36	(5.5)
Outside the house	43	(6.5)
Spending time at residence		
Monday to Friday		
< 13 Hrs.	50	(7.6)
13 - 14 Hrs.	500	(76.0)
> 14 Hrs.	108	(16.4)
Weekend (Saturday and Sunday)		
< 12 Hrs.	127	(19.3)
12 - 15 Hrs.	79	(12.0)
16 - 20 Hrs.	103	(15.7)
21 - 24 Hrs.	349	(53.0)

4.3.2 Association between residential environment factors and respiratory and asthma symptoms (1 month)

Analysis of table 9 – 12 shows an association between residential environment factors and respiratory symptoms including asthma symptoms during 1 month.

Table 9 shows an association between residential characteristics, environment near children's residence (such as type of residence, age of residence, residence's owner, and places near residence) and respiratory symptoms.

In bivariate analysis, the results show significant association ($p<0.05$) which indicated that owner of residence was significantly associated with phlegm symptom ($p=0.047$). Owner of residence both owner and tenant among children with phlegm symptom (68 (45.0%), 183 (36.1%)) were less than children without symptom (83 (55.0%), 324 (63.9%)). Having garment/clothing shop near residence was significantly associated with shortness of breath symptom ($p=0.029$). Having garment/clothing shop near residence among children with shortness of breath symptom (17 (10.6%)) was less than children without symptom (143 (89.4%)).

However, there were no association between type and owner of residence and wheezing or whistling in the chest symptom of children ($p>0.05$). Type and owner of residence among children with wheezing or whistling in the chest symptom (8 (7.3%), (8 (5.3%)) were less than children without symptom (101 (92.7%), 143 (94.7%)). There was no association between having furniture shop near residence and dry cough at night symptom ($p>0.05$). Having furniture shop near residence among children with dry cough at night symptom (14 (35.9%)) was

less than children without symptom (25 (64.1%)). And also there was no association between age of residence and shortness of breath symptom ($p>0.05$). Median (IQR) of age's residence among children with shortness of breath symptom (30 (20.0)) was higher than children without symptom (30 (10.0)).

As shown in tables 10 and 11 were an association between environment at children's residence such as family member, smoke (such as cigarette smoke, charcoal smoke from cooking stove, incense smoke), wall dampness, home renovation, and insecticide used and respiratory symptoms.

Table 10 shows significant association ($p<0.05$) that children who having smoking people in family were significantly associated with phlegm and running nose without cold symptoms ($p=0.025$, 0.041). Having smoking people in family among children with phlegm symptom (133 (42.6%)) was less than children without symptom (179 (57.4%)) while among children with running nose symptom (161 (51.6%)) was higher than children without symptom (151 (48.4%)). Children who usually lived in smoking area were significantly associated with dry cough at night symptom ($p=0.030$). Among children with dry cough at night symptom (31 (36.5%)) were less than children without symptom (54 (63.5%)). Presenting of wall dampness at residence was significantly associated with phlegm and running nose without cold symptoms ($p<0.001$, =0.004). Presenting of wall dampness at residence among children with both symptoms (82 (50.3%), 93 (57.1%)) were higher than children without symptoms (81 (49.7%), 70 (42.9%)), respectively. Having home renovation was significantly associated with phlegm and running nose without cold symptoms ($p=0035$, 0.005). Having home renovation among children with phlegm symptom

(65 (45.8%)) was less than children without symptom (77 (54.2%)) while among children with running nose without cold symptom (82 (57.7%)) was higher than children without symptom (60 (42.3%)). And family member was significantly associated with shortness of breath symptoms (p=0.037). Family member among children with and without shortness of breath symptoms was equally (3 (2.0)).

However, there was no association (p>0.05) between children who living in smoking area and phlegm symptom. Living in smoking area among children with phlegm symptom (38 (44.7%)) was less than children without symptom (47 (55.3%)).

There was no association between presenting of wall dampness at residence and wheezing or whistling in the chest symptom. Presenting of wall dampness among children with wheezing symptom (19 (11.7%)) was less than children without symptom (144 (88.3%)). And having home renovation was no associated with dry cough at night symptom. Having home renovation among children with dry cough at night symptom (45 (31.7%)) was less than children without symptom (97 (68.3%)).

Table 11 shows significant association (p<0.05) that presenting of vectors, pets, cigarette smoke, and charcoal smoke (cooking stove) were significantly associated with phlegm symptom (p=0.001, 0.021, 0.001, 0.017). Presenting of vectors, pets, and cigarette smoke among children with phlegm symptom (176 (42.8%), 133 (42.8%), 93 (47.9%)) were less than children without phlegm symptom (235 (57.2%), 178 (57.2%), 101 (52.1%)), respectively while presenting of charcoal smoke (cooking stove) among children with and without phlegm symptom (42

(50.0%)) was equally. Moreover, presenting of flowers with pollen, vectors, and cigarette smoke were significantly associated with running nose without cold symptom (p=0.032, 0.002, 0.010). Presenting of those among children with running nose without cold symptom (69 (56.1%), 214 (52.1%), 107 (55.2%)) were higher than children without symptom (54 (43.9%), 197 (47.9%), 87 (44.8%)), respectively.

However, there was no association (p>0.05) between presenting of vectors and other symptoms; wheezing in the chest, dry cough at night, and shortness of breath symptoms. Presenting of vectors among children with these symptoms (41 (10.0%), 119 (29.0%), 34 (8.3%)) were less than children without symptoms (370 (90.0%), 292 (71.0%), 377 (91.7%)), respectively. Having pets was no associated with dry cough at night, shortness of breath, and running nose without cold symptoms (p>0.05). Having pets among children with dry cough at night, and shortness of breath symptoms (93 (29.9%), 26 (8.4%)) were less than children without these symptoms (218 (70.1%), 285 (91.6%)), respectively while among children with running nose without cold symptom (158 (50.8%)) were higher than children without symptom (153 (49.2%)). Presenting of cigarette smoke was no associated with dry cough at night symptom (p>0.05) which was among children with this symptom (61 (31.4%)) less than children without symptom (133 (68.6%)). Presenting of charcoal smoke (cooking stove) was no associated with wheezing or whistling in the chest and running nose without cold symptoms (p>0.05). Presenting of charcoal smoke (cooking stove) among children with wheezing symptom (11 (13.1%)) was less than children without symptom (73 (86.9%)) while among children with running nose

without cold symptom (48 (57.1%)) was higher than children without symptom (36 (42.9%)).

Table 12 shows association between environment in children's bedroom such as using cooling devices (air conditioner, fan, misting fans), numbers of window, curtain, carpet, bringing pets into bedroom, doll, and wall dampness near bedroom and respiratory symptoms.

The results from bivariate analysis show that there was significant association ($p<0.05$) between one environmental factor and many symptoms. Using fan was significantly associated with phlegm and running nose without cold symptoms ($p=0.004, 0.028$). Using fan among children with these symptoms (210 (41.1%), 254 (49.7%)) was less than children without symptoms (301 (58.9%), 257 (50.3%)), respectively. Having curtain in bedroom was significantly associated with shortness of breath and running nose without cold symptoms ($p=0.040, 0.021$). Having curtain among children with shortness of breath symptom (33 (8.5%)) was less than children without this symptom (354 (91.5%)) while among children with running nose without cold symptom (198 (51.2%)) was higher than children without this symptom (189 (48.8%)). Bringing pets into bedroom was significantly associated with shortness of breath symptom ($p=0.015$). Bringing pets into bedroom among children with shortness of breath symptom (36 (6.0%)) was less than children without this symptom (562 (94.0%)). Having doll was significantly associated with all symptoms except wheezing or whistling in the chest symptom (p=0.037, <0.001, 0.004, <0.001). Having doll among children with dry cough at night (125 (29.4%)), phlegm (183 (43.1%)), and shortness of breath (38 (8.9%)) symptoms were less than

children without these symptoms (300 (70.6%), 242 (56.9%), 387 (91.1%)), respectively while among children with running nose without cold symptom (232 (54.6%)) was higher than children without this symptom (193 (45.4%)). Presenting of wall dampness near children's residence was significantly associated with phlegm, shortness of breath, and running nose without cold symptoms ($p<0.001$, =0.047, 0.003). Presenting of wall dampness among children with phlegm (29 (72.5%)) and running nose without cold (28 (70.0%)) symptoms were higher than children without these symptoms (11 (27.5%), 12 (30.0%)), respectively while among children with shortness of breath symptom (6 (15.0%)) were less than children without this symptom (34 (85.0%)).

However, there was no association ($p>0.05$) between using fan and dry cough at night symptom. Using fan among children with dry cough at night symptom (144 (28.2%)) was less than children without this symptom (367 (71.8%)). Bringing pets into bedroom was no associated with dry cough at night, and phlegm symptom. Bringing pets into bedroom among children with dry cough at night (154 (25.8%)), and phlegm (222 (37.1%)) symptoms were less than children without this symptom (444 (74.2%), 376 (62.9%)). Presenting of wall dampness near children's bedroom was no associated with wheezing or whistling in the chest, and dry cough at night symptoms. Presenting of wall dampness among children with these symptoms (51 (8.3%), 15 (37.5%)) were less than children without symptoms (567 (91.7%), 25 (62.5%)), respectively.

Table 9 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658)

Residential environment	Total (n=658) n (%)	Wheezing or whistling in the chest (n = 58) Yes: n (%)	No: n (%)	p-value	Dry cough at night (n = 176) Yes: n (%)	No: n (%)	p-value	Phlegm (n=251) Yes: n (%)	No: (%)	p-value
Type of residence										
Single family house	109 (16.6)	8 (7.3)	101 (92.7)	0.143^b	24 (22.0)	85 (78.0)	0.295^b	46 (42.2)	63 (57.8)	0.489^b
Townhouse	85 (12.9)	13 (15.3)	72 (84.7)		28 (32.9)	57 (67.1)		34 (40.0)	51 (60.0)	
Flat/ Apartment/ Condominium	414 (62.9)	32 (7.7)	382 (92.3)		108 (26.1)	306 (73.9)		149 (36.0)	265 (64.0)	
Community (slum)	50 (7.6)	5 (10.0)	45 (90.0)		16 (32.0)	34 (68.0)		22 (44.0)	28 (56.0)	
Age of residence (year); Median (IQR)	30 (10.0)	30 (16.0)	30 (10.0)	0.347^a	30 (10.0)	30 (10.0)	0.785^a	30 (15.0)	30 (10.0)	0.716^a
Owner of residence										
Owner	151 (22.9)	8 (5.3)	143 (94.7)	0.082^b	36 (23.8)	115 (76.2)	0.358^b	68 (45.0)	83 (55.0)	0.047^b
Tenant	507 (77.1)	50 (9.9)	457 (90.1)		140 (27.6)	367 (72.4)		183 (36.1)	324 (63.9)	
Place near residence										
Furniture shop	39 (5.9)	5 (12.8)	34 (87.2)	0.376^c	14 (35.9)	25 (64.1)	0.183^b	15 (38.5)	24 (61.5)	0.967^b
Garment/ clothing	160 (24.3)	16 (10.0)	144 (90.0)	0.543^b	38 (23.8)	122 (76.3)	0.325^b	63 (39.4)	97 (60.6)	0.713^b
Garage/ Car care	64 (9.7)	4 (6.3)	60 (93.8)	0.446^b	13 (20.3)	51 (79.7)	0.221^b	29 (45.3)	35 (54.7)	0.214^b
Petrol station	37 (5.6)	1 (2.7)	36 (97.3)	0.240^c	10 (27.0)	27 (73.0)	0.968^b	15 (40.5)	22 (59.5)	0.758^b
Fresh market and restaurant (cooking smoke)	15 (2.3)	0 (0.0)	15 (100.0)	0.385^c	3 (20.0)	12 (80.0)	0.770^c	6 (40.0)	9 (60.0)	0.881^b

Note. ^{a} Mann -Whitney U test, ^{b} Pearson Chi-Square test, ^{c} Fisher X'act test

Table 9 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658) (Continued)

Residential environment	Total (n=658)		Shortness of breath (n=45)			Running nose without cold (n=312)		
	n (%)		Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Type of residence								
Single family house	109	(16.6)	5 (4.6)	104 (95.4)	0.610[b]	56 (51.4)	53 (48.6)	0.760[b]
Townhouse	85	(12.9)	8 (9.4)	77 (90.6)		38 (44.7)	47 (55.3)	
Flat/ Apartment/ Condominium	414	(62.9)	29 (7.0)	385 (93.0)		196 (47.3)	218 (52.7)	
Community (slum)	50	(7.6)	3 (6.0)	47 (94.0)		22 (44.0)	28 (56.0)	
Age of residence (year); Median (IQR)	30	(10.0)	30 (20.0)	30 (10.0)	0.091[a]	30 (15.0)	30 (10.0)	0.409[a]
Owner of residence								
Owner	151	(22.9)	10 (6.6)	141 (93.4)	0.904[b]	78 (51.7)	73 (48.3)	0.235[b]
Tenant	507	(77.1)	35 (6.9)	472 (93.1)		234 (46.2)	273 (53.8)	
Place near residence								
Furniture shop	39	(5.9)	4 (10.3)	35 (89.7)	0.331[c]	21 (53.8)	18 (46.2)	0.407[b]
Garment/ clothing	160	(24.3)	17 (10.6)	143 (89.4)	0.029[b]	79 (49.4)	81 (50.6)	0.568[b]
Garage/ Car care	64	(9.7)	5 (7.8)	59 (92.2)	0.793[c]	33 (51.6)	31 (48.4)	0.484[b]
Petrol station	37	(5.6)	4 (10.8)	33 (89.2)	0.309[c]	15 (40.5)	22 (59.5)	0.389[b]
Fresh market and restaurant (cooking smoke)	15	(2.3)	0 (0.0)	15 (100.0)	0.615[c]	6 (40.0)	9 (60.0)	0.561[b]

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 10 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658)

Residential environment	Total (n=658)		Wheezing or whistling in the chest (n = 58)			Dry cough at night (n = 176)			Phlegm (n=251)		
	n (%)		Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Family member; Median (IQR)	3	(1.0)	3 (1.0)	3 (2.0)	0.313^a	3 (2.0)	3 (1.0)	0.495^a	3 (2.0)	3 (1.0)	0.635^a
Have smoking people in family											
Yes	312	(47.4)	26 (8.3)	286 (91.7)	0.679^b	91 (29.2)	221 (70.8)	0.183^b	133 (42.6)	179 (57.4)	0.025^b
No	346	(52.6)	32 (9.2)	314 (90.8)		85 (24.6)	261 (75.4)		118 (34.1)	228 (65.9)	
Child usually lives in smoking area											
Yes	85	(12.9)	6 (7.1)	79 (92.9)	0.541^b	31 (36.5)	54 (63.5)	0.030^b	38 (44.7)	47 (55.3)	0.182^b
No	573	(87.1)	52 (9.1)	521 (90.9)		145 (25.3)	428 (74.7)		213 (37.2)	360 (62.8)	
Using stove for cooking in residence											
Yes	106	(16.1)	10 (9.4)	96 (90.6)	0.806^b	23 (21.7)	83 (78.3)	0.200^b	37 (34.9)	69 (65.1)	0.453^b
No	552	(83.9)	48 (8.7)	504 (91.3)		153 (27.7)	399 (72.3)		214 (38.8)	338 (61.2)	
Wall dampness/ Water leakage											
Yes	163	(24.8)	19 (11.7)	144 (88.3)	0.140^b	48 (29.4)	115 (70.6)	0.369^b	82 (50.3)	81 (49.7)	$<0.001^b$
No	495	(75.2)	39 (7.9)	456 (92.1)		128 (25.9)	367 (74.1)		169 (34.1)	326 (65.9)	
Home renovation											
Yes	142	(21.6)	11 (7.7)	131 (92.3)	0.612^b	45 (31.7)	97 (68.3)	0.133^b	65 (45.8)	77 (54.2)	0.035^b
No	516	(78.4)	47 (9.1)	469 (90.9)		131 (25.4)	385 (74.6)		186 (36.0)	330 (64.0)	
Insecticide used											
Yes	494	(75.1)	47 (9.5)	447 (90.5)	0.272^b	132 (26.7)	362 (73.3)	0.978^b	191 (38.7)	303 (61.3)	0.635^b
No	164	(24.9)	11 (6.7)	153 (93.3)		44 (26.8)	120 (73.2)		60 (36.6)	104 (63.4)	
Mosquito controlled	331	(67.0)	30 (9.1)	301 (90.9)	0.821^b	80 (24.2)	251 (75.8)	0.133^b	118 (35.6)	213 (64.4)	0.185^b
Ant, cockroach, termite controlled	208	(42.1)	22 (10.6)	186 (89.4)	0.278^b	68 (32.7)	140 (67.3)	0.019^b	92 (44.2)	116 (55.8)	0.029^b

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 10 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658) (Continued)

Residential environment	Total (n=658) n (%)	Shortness of breath (n=45) Yes: n (%)	No: n (%)	p-value	Running nose without cold (n=312) Yes: n (%)	No: n (%)	p-value
Family member; Median (IQR)	3 (1.0)	3 (2.0)	3 (2.0)	0.037[a]	3 (2.0)	3 (1.0)	0.664[a]
Have smoking people in family							
Yes	312 (47.4)	20 (6.4)	292 (93.6)	0.679[b]	161 (51.6)	151 (48.4)	0.041[b]
No	346 (52.6)	25 (7.2)	321 (92.8)		151 (43.6)	195 (56.4)	
Child usually lives in smoking area							
Yes	85 (12.9)	6 (7.1)	79 (92.9)	0.931[b]	44 (51.8)	41 (48.2)	0.390[b]
No	573 (87.1)	39 (6.8)	534 (93.2)		268 (46.8)	305 (53.2)	
Using stove for cooking in residence							
Yes	106 (16.1)	7 (6.6)	99 (93.4)	0.917[b]	49 (46.2)	57 (53.8)	0.789[b]
No	552 (83.9)	38 (6.9)	514 (93.1)		263 (47.6)	289 (52.4)	
Wall dampness/ Water leakage							
Yes	163 (24.8)	14 (8.6)	149 (91.4)	0.307[b]	93 (57.1)	70 (42.9)	0.004[b]
No	495 (75.2)	31 (6.3)	464 (93.7)		219 (44.2)	276 (55.8)	
Home renovation							
Yes	142 (21.6)	11 (7.7)	131 (92.3)	0.628[b]	82 (57.7)	60 (42.3)	0.005[b]
No	516 (78.4)	34 (6.6)	482 (93.4)		230 (44.6)	286 (55.4)	
Insecticide used							
Yes	494 (75.1)	32 (6.5)	462 (93.5)	0.524[b]	238 (48.2)	256 (51.8)	0.497[b]
No	164 (24.9)	13 (7.9)	151 (92.1)		74 (45.1)	90 (54.9)	
Mosquito controlled	331 (67.0)	18 (5.4)	313 (94.6)	0.152[b]	152 (45.9)	179 (54.1)	0.440[b]
Ant, cockroach, termite controlled	208 (42.1)	17 (8.2)	191 (91.8)	0.357[c]	111 (53.4)	97 (46.6)	0.038[c]

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 11 Residential environment factors and respiratory and asthma symptoms
(1 month) (n = 658)

Residential environment	Total (n=658)		Wheezing or whistling in the chest (n = 58)				Dry cough at night (n = 176)			
	n (%)		Yes: n (%)	No: n (%)		p-value	Yes: n (%)		No: n (%)	p-value
Environment at children's residence										
Flowers with pollen										
Yes	123	(18.7)	11 (8.9)	112	(91.1)	0.956^{b}	29 (23.6)	94	(76.4)	0.378^{b}
No	535	(81.3)	47 (8.8)	488	(91.2)		147 (27.5)	388	(72.5)	
Vectors (cockroach, rat, etc.)										
Yes	411	(62.5)	41 (10.0)	370	(90.0)	0.175^{b}	119 (29.0)	292	(71.0)	0.099^{b}
No	247	(37.5)	17 (6.9)	230	(93.1)		57 (76.9)	190	(23.1)	
Pets (dog, cat, bird, etc.)										
Yes	311	(47.3)	31 (10.0)	280	(90.0)	0.323^{b}	93 (29.9)	218	(70.1)	0.083^{b}
No	347	(52.7)	27 (7.8)	320	(92.2)		83 (23.9)	264	(76.1)	
Cigarette smoke										
Yes	194	(29.5)	21 (10.8)	173	(89.2)	0.240^{b}	61 (31.4)	133	(68.6)	0.078^{b}
No	464	(70.5)	37 (8.0)	427	(92.0)		115 (24.8)	349	(75.2)	
Charcoal smoke (Cooking stove)										
Yes	84	(12.8)	11 (13.1)	73	(86.9)	0.138^{b}	23 (27.4)	61	(72.6)	0.888^{b}
No	574	(87.2)	47 (8.2)	527	(91.8)		153 (26.7)	421	(73.3)	
Incense smoke										
Yes	140	(21.3)	10 (7.1)	130	(92.9)	0.432^{b}	31 (22.1)	109	(77.9)	0.165^{b}
No	518	(78.7)	48 (9.3)	470	(90.7)		145 (28.0)	373	(72.0)	
Child usually lives in charcoal smoke area										
Yes	41	(6.2)	6 (14.6)	35	(85.4)	0.162^{c}	7 (17.1)	34	(82.9)	0.148^{b}
No	617	(93.8)	52 (8.4)	565	(91.6)		169 (27.4)	448	(72.6)	
Child usually lives in incense smoke area										
Yes	24	(3.6)	5 (20.8)	19	(79.2)	0.052^{c}	6 (25.0)	18	(75.0)	0.844^{b}
No	634	(96.4)	53 (8.4)	581	(91.6)		170 (26.8)	464	(73.2)	

Note. ^{b} Pearson Chi-Square test, ^{c} Fisher X'act test

Table 11 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658) (Continued)

Residential environment	Total (n=658) n (%)		Phlegm (n=251) Yes: n (%)		No: n (%)		p-value	Shortness of breath (n=45) Yes: n (%)		No: n (%)		p-value
Environment at children's residence												
Flowers with pollen												
Yes	123	(18.7)	53	(43.1)	70	(56.9)	0.211[b]	11	(91.1)	112	(8.9)	0.305[b]
No	535	(81.3)	198	(37.0)	337	(63.0)		34	(6.4)	501	(93.6)	
Vectors (cockroach, rat, etc.)												
Yes	411	(62.5)	176	(42.8)	235	(57.2)	0.001[b]	34	(8.3)	377	(91.7)	0.060[b]
No	247	(37.5)	75	(30.4)	172	(69.6)		11	(4.5)	236	(95.5)	
Pets (dog, cat, bird, etc.)												
Yes	311	(47.3)	133	(42.8)	178	(57.2)	0.021[b]	26	(8.4)	285	(91.6)	0.143[b]
No	347	(52.7)	118	(34.0)	229	(66.0)		19	(5.5)	328	(94.5)	
Cigarette smoke												
Yes	194	(29.5)	93	(47.9)	101	(52.1)	0.001[b]	17	(8.8)	177	(91.2)	0.206[b]
No	464	(70.5)	158	(34.1)	306	(65.9)		28	(6.0)	436	(94.0)	
Charcoal smoke (Cooking stove)												
Yes	84	(12.8)	42	(50.0)	42	(50.0)	0.017[b]	6	(7.1)	78	(92.9)	0.906[b]
No	574	(87.2)	209	(36.4)	365	(63.6)		39	(6.8)	535	(93.2)	
Incense smoke												
Yes	140	(21.3)	61	(43.6)	79	(56.4)	0.136[b]	7	(5.0)	133	(95.0)	0.331[b]
No	518	(78.7)	190	(36.7)	328	(63.3)		38	(7.3)	480	(92.7)	
Child usually lives in charcoal smoke area												
Yes	41	(6.2)	19	(46.3)	22	(53.7)	0.265[b]	5	(12.2)	36	(87.8)	0.189[c]
No	617	(93.8)	232	(37.6)	385	(62.4)		40	(6.5)	577	(93.5)	
Child usually lives in incense smoke area												
Yes	24	(3.6)	12	(50.0)	12	(50.0)	0.223[b]	4	(16.7)	20	(83.3)	0.074[c]
No	634	(96.4)	239	(37.7)	395	(62.3)		41	(6.5)	593	(93.5)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 11 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658) (Continued)

Residential environment	Total (n=658) n (%)		Running nose without cold (n=312)			
			Yes: n (%)		No: n (%)	p-value
Environment at children's residence						
Flowers with pollen						
Yes	123	(18.7)	69	(56.1)	54 (43.9)	0.032^{b}
No	535	(81.3)	243	(45.4)	292 (54.6)	
Vectors (cockroach, rat, etc.)						
Yes	411	(62.5)	214	(52.1)	197 (47.9)	0.002^{b}
No	247	(37.5)	98	(39.7)	149 (60.3)	
Pets (dog, cat, bird, etc.)						
Yes	311	(47.3)	158	(50.8)	153 (49.2)	0.099^{b}
No	347	(52.7)	154	(44.4)	193 (55.6)	
Cigarette smoke						
Yes	194	(29.5)	107	(55.2)	87 (44.8)	0.010^{b}
No	464	(70.5)	205	(44.2)	259 (55.8)	
Charcoal smoke (Cooking stove)						
Yes	84	(12.8)	48	(57.1)	36 (42.9)	0.056^{b}
No	574	(87.2)	264	(46.0)	310 (54.0)	
Incense smoke						
Yes	140	(21.3)	70	(50.0)	70 (50.0)	0.490^{b}
No	518	(78.7)	242	(46.7)	276 (53.3)	
Child usually lives in charcoal smoke area						
Yes	41	(6.2)	19	(46.3)	22 (53.7)	0.887^{b}
No	617	(93.8)	293	(47.5)	324 (52.5)	
Child usually lives in incense smoke area						
Yes	24	(3.6)	14	(58.3)	10 (41.7)	0.275^{b}
No	634	(96.4)	298	(47.0)	336 (53.0)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 12 Residential environment factors and respiratory and asthma symptoms
(1 month) (n = 658)

Environment in children's bedroom	Total (n=658)		Wheezing or whistling in the chest (n = 58)			Dry cough at night (n = 176)		
	n	(%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Using cooling devices								
Air conditioner								
Yes	275	(41.8)	21 (7.6)	254 (92.4)	0.366[b]	68 (24.7)	207 (75.3)	0.321[b]
No	383	(58.2)	37 (9.7)	346 (90.3)		108 (28.2)	275 (71.8)	
Fan								
Yes	511	(77.7)	48 (9.4)	463 (90.6)	0.329[b]	144 (28.2)	367 (71.8)	0.122[b]
No	147	(22.3)	10 (6.8)	137 (93.2)		32 (21.8)	115 (78.2)	
Misting fans								
Yes	622	(94.5)	2 (5.6)	34 (94.4)	0.761[c]	9 (25.0)	27 (75.0)	0.807[b]
No	36	(5.5)	56 (9.0)	566 (91.0)		167 (26.8)	455 (73.2)	
Number of window usually used								
No	278	(42.2)	19 (6.8)	259 (93.2)	0.271[b]	78 (28.1)	200 (71.9)	0.310[b]
1 - 2	247	(37.5)	24 (9.7)	223 (90.3)		58 (23.5)	189 (76.5)	
> 2	133	(20.2)	15 (11.3)	118 (88.7)		40 (30.1)	93 (69.9)	
Have curtain								
Yes	387	(58.8)	35 (9.0)	352 (91.0)	0.804[b]	109 (28.2)	278 (71.8)	0.326[b]
No	271	(41.2)	23 (9.0)	248 (91.5)		67 (24.7)	204 (75.3)	
Have carpet								
Yes	59	(9.0)	6 (10.2)	53 (89.8)	0.700[b]	16 (27.1)	43 (72.9)	0.946[b]
No	599	(91.0)	52 (8.7)	547 (91.3)		160 (26.7)	439 (73.3)	
Bringing pets into bedroom								
Never	598	(90.9)	52 (8.7)	546 (91.3)	0.734[b]	154 (25.8)	444 (74.2)	0.069[b]
Sometimes	60	(9.1)	6 (10.0)	54 (90.0)		22 (36.7)	38 (63.3)	
Have dolls								
Yes	425	(64.6)	41 (9.6)	384 (90.4)	0.309[b]	125 (29.4)	300 (70.6)	0.037[b]
No	233	(35.4)	17 (7.3)	216 (92.7)		51 (21.9)	182 (78.1)	
Number of dolls								
≤ 5	332	(50.5)	28 (8.4)	304 (91.6)	0.109[b]	92 (27.7)	240 (72.3)	0.146[b]
> 5	93	(14.1)	13 (14.0)	80 (86.0)		33 (35.5)	60 (64.5)	
Put the dolls on the bed								
Yes	180	(42.4)	21 (11.7)	159 (88.3)	0.227[b]	56 (31.1)	124 (68.9)	0.510[b]
No	245	(57.6)	20 (8.2)	225 (91.8)		69 (28.2)	176 (71.8)	
Wall dampness near child's bedroom								
Yes	40	(6.1)	51 (8.3)	567 (91.7)	0.075[c]	15 (37.5)	25 (62.5)	0.113[b]
No	618	(93.9)	7 (17.5)	33 (82.5)		161 (26.1)	457 (73.9)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 12 Residential environment factors and respiratory and asthma symptoms (1 month) (n = 658) (Continued)

Environment in children's bedroom	Total (n=658)		Phlegm (n=251)			Shortness of breath (n=45)		
	n	(%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Using cooling devices								
Air conditioner								
Yes	275	(41.8)	112 (40.7)	163 (59.3)	0.248[b]	20 (7.3)	255 (92.7)	0.709[b]
No	383	(58.2)	139 (36.3)	244 (63.7)		25 (6.5)	358 (93.5)	
Fan								
Yes	511	(77.7)	210 (41.1)	301 (58.9)	0.004[b]	37 (7.2)	474 (92.8)	0.446[b]
No	147	(22.3)	41 (27.9)	106 (72.1)		8 (5.4)	139 (94.6)	
Misting fans								
Yes	622	(94.5)	18 (50.0)	18 (50.0)	0.132[b]	3 (8.3)	33 (91.7)	0.730[c]
No	36	(5.5)	233 (37.5)	389 (62.5)		42 (6.8)	580 (93.2)	
Number of window usually used								
No	278	(42.2)	97 (34.9)	181 (65.1)	0.180[b]	19 (6.8)	259 (93.2)	0.466[b]
1 - 2	247	(37.5)	95 (38.5)	152 (61.5)		14 (5.7)	233 (94.3)	
> 2	133	(20.2)	59 (44.4)	74 (55.6)		12 (9.0)	121 (91.0)	
Have curtain								
Yes	387	(58.8)	150 (38.8)	237 (61.2)	0.699[b]	33 (8.5)	354 (91.5)	0.040[b]
No	271	(41.2)	101 (37.3)	170 (62.7)		12 (4.4)	259 (95.6)	
Have carpet								
Yes	59	(9.0)	21 (35.6)	38 (64.4)	0.672[b]	8 (13.6)	51 (86.4)	0.051[c]
No	599	(91.0)	230 (38.4)	369 (61.6)		37 (6.2)	562 (93.8)	
Bringing pets into bedroom								
Never	598	(90.9)	222 (37.1)	376 (62.9)	0.088[b]	36 (6.0)	562 (94.0)	0.015[c]
Sometimes	60	(9.1)	29 (48.3)	31 (51.7)		9 (15.0)	51 (85.0)	
Have dolls								
Yes	425	(64.6)	183 (43.1)	242 (56.9)	<0.001[b]	38 (8.9)	387 (91.1)	0.004[b]
No	233	(35.4)	68 (29.2)	165 (70.8)		7 (3.0)	226 (97.0)	
Number of dolls								
≤ 5	332	(50.5)	130 (39.2)	202 (60.8)	0.002[b]	26 (7.8)	306 (92.2)	0.130[b]
> 5	93	(14.1)	53 (57.0)	40 (43.0)		12 (12.9)	81 (87.1)	
Put the dolls on the bed								
Yes	180	(42.4)	82 (45.6)	98 (54.4)	0.373[b]	22 (12.2)	158 (87.8)	0.042[b]
No	245	(57.6)	101 (41.2)	144 (58.8)		16 (6.5)	229 (93.5)	
Wall dampness near child's bedroom								
Yes	40	(6.1)	29 (72.5)	11 (27.5)	<0.001[b]	6 (15.0)	34 (85.0)	0.047[c]
No	618	(93.9)	222 (35.9)	396 (64.1)		39 (6.3)	579 (93.7)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 12 Residential environment factors and respiratory and asthma symptoms
(1 month) (n = 658) (Continued)

Environment in children's bedroom	Total (n=658)		Running nose without cold (n=312)				
	n	(%)	Yes: n (%)		No: n (%)		p-value
Using cooling devices							
Air conditioner							
Yes	275	(41.8)	136	(49.5)	139	(50.5)	0.375[b]
No	383	(58.2)	176	(46.0)	207	(54.0)	
Fan							
Yes	511	(77.7)	254	(49.7)	257	(50.3)	0.028[b]
No	147	(22.3)	58	(39.5)	89	(60.5)	
Misting fans							
Yes	622	(94.5)	19	(52.8)	17	(47.2)	0.508[b]
No	36	(5.5)	293	(47.1)	329	(52.9)	
Number of window usually used							
No	278	(42.2)	120	(43.2)	158	(56.8)	0.172[b]
1 - 2	247	(37.5)	124	(50.2)	123	(49.8)	
> 2	133	(20.2)	68	(51.1)	65	(48.9)	
Have curtain							
Yes	387	(58.8)	198	(51.2)	189	(48.8)	0.021[b]
No	271	(41.2)	114	(42.1)	157	(57.9)	
Have carpet							
Yes	59	(9.0)	32	(54.2)	27	(45.8)	0.271[b]
No	599	(91.0)	280	(46.7)	319	(53.3)	
Bringing pets into bedroom							
Never	598	(90.9)	280	(46.8)	318	(53.2)	0.336[b]
Sometimes	60	(9.1)	32	(53.3)	28	(46.7)	
Have dolls							
Yes	425	(64.6)	232	(54.6)	193	(45.4)	<0.001[b]
No	233	(35.4)	80	(34.3)	153	(65.7)	
Number of dolls							
≤ 5	332	(50.5)	174	(52.4)	158	(47.6)	0.088[b]
> 5	93	(14.1)	58	(62.4)	35	(37.6)	
Put the dolls on the bed							
Yes	180	(42.4)	97	(53.9)	83	(46.1)	0.804[b]
No	245	(57.6)	135	(55.1)	110	(44.9)	
Wall dampness near child's bedroom							
Yes	40	(6.1)	28	(70.0)	12	(30.0)	0.003[b]
No	618	(93.9)	284	(46.0)	334	(54.0)	

Note. [b] Pearson Chi-Square test

The bivariate analysis was used in first step for screening variables, and then the variables which p-value less than 0.2 were selected to include to multivariate logistic regression model. Analysis in table 13 – 17 show final model results for each dependent variable.

Table 13 shows a binary logistic regression analysis between residential environment factors and wheezing or whistling in the chest symptom (1 month). The results found that children who living in tenant house were increased 2.419-fold odds of having wheezing or whistling in the chest symptom (AOR = 2.419, 95%CI 1.073-5.452, p= 0.033) compared to children living in their own residence.

However, living in community (slum) area, presenting of wall dampness in residence and near children's bedroom, presenting of vectors, charcoal smoke, and living in charcoal smoke area were possible to be risk factors (AOR>1) of having wheezing or whistling in the chest symptom among children but statistical significant was not achieved.

Table 14 shows a binary logistic regression analysis between residential environment factors and dry cough at night symptom (1 month). The results found that having doll was increased 1.506-fold odds of having dry cough at night symptom (AOR = 1.506, 95%CI 1.001-2.266, p=0.049) compared to children without doll.

However, having furniture shop near residence, living in smoking area, having home renovation, presenting of vectors, having pets and bringing into bedroom, presenting of cigarette smoke, using fan in children's bedroom, and presenting of wall dampness near children's bedroom were possible to be risk

factors (AOR>1) of having dry cough at night symptom among children but statistical significant was not achieved.

Table 15 shows a binary logistic regression analysis between residential environment factors and phlegm symptom (1 month). The results found that having dolls was increased 1.576-fold odds of having phlegm symptom (AOR = 1.576, 95%CI 1.069-2.323, p=0.022) compared to children without doll. Presenting of wall dampness near children's bedroom was increased 3.662-fold odds of having phlegm (AOR = 3.662, 95%CI 1.622-8.266, p= 0.002) compared to without wall dampness near children's bedroom.

However, having smoking people in family, presenting of wall dampness in residence, having home renovation, presenting of vectors, pets, cigarette smoke, charcoal smoke from cooking stove, using fan in children's bedroom, having more than 2 windows in bedroom, and bringing pets into bedroom were possible to be risk factors (AOR>1) of having phlegm symptom among children but statistical significant was not achieved.

Table 16 shows a binary logistic regression analysis between residential environment factors and shortness of breath symptom (1 month). The results found that having garment/clothing shop near residence was increased 2.041-fold odds of having shortness of breath symptom compared to children who have no garment/clothing shop near residence (AOR = 2.041, 95%CI 1.044-3.992, p=0.037). Having dolls was increased 2.895-fold odds of having shortness of breath symptom compared to without doll (AOR = 2.895, 95%CI 1.199-6.991, p=0.018).

However, presenting of vectors, living in charcoal smoke area, having curtain in bedroom, bringing pets into bedroom, and presenting of wall dampness near children's bedroom were possible to be risk factors (AOR>1) of having phlegm symptom among children but statistical significant was not achieved.

Table 17 shows a binary logistic regression analysis between residential environment factors and running nose without cold symptom (1 month). The results found that having doll was increased 2.138-fold odds of having running nose without cold symptom (AOR = 2.138, 95%CI 1.478-3.094, p<0.001) compared to children without doll.

However, having smoking people in family, presenting of wall dampness in residence and near children's bedroom, having home renovation, having flowers with pollen, presenting of vectors, cigarette smoke, charcoal smoke from cooking stove, using fan in children's bedroom, having windows and curtain in children's bedroom were possible to be risk factors (AOR>1) of having phlegm symptom among children but statistical significant was not achieved.

Table 13 Binary logistic regression model association between residential
environment factors and wheezing symptom (asthma) (1 month)

Factors	Wheezing or whistling in the chest (n = 58)		
	AOR	95% CI	p-value
Type of residence			
Single family house	Ref.		
Townhouse	2.499	0.950, 6.576	0.064
Flat/ Apartment/ Condominium	0.975	0.417, 2.277	0.953
Community (slum)	1.134	0.335, 3.835	0.839
Owner of residence			
Owner	Ref.		
Tenant	2.419	1.073, 5.452	0.033
Environment at children's residence			
Wall dampness/ water leakage			
No	Ref.		
Yes	1.160	0.573, 2.351	0.680
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.391	0.744, 2.600	0.302
Charcoal smoke (Cooking stove)			
No	Ref.		
Yes	1.304	0.602, 2.826	0.501
Child usually lives in charcoal smoke area			
No	Ref.		
Yes	1.108	0.397, 3.097	0.845
Child usually lives in incense smoke area			
No	Ref.		
Yes	2.920	0.974, 8.752	0.056
Environment in children's bedroom			
Wall dampness near child's bedroom			
No	Ref.		
Yes	1.933	0.676, 5.525	0.219

Table 14 Binary logistic regression model association between residential environment factors and dry cough at night symptom (1 month)

Factors	Dry cough at night (n = 176)		
	AOR	95% CI	p-value
Place near residence			
Furniture shop			
No	Ref.		
Yes	1.418	0.702, 2.867	0.330
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	0.942	0.625, 1.419	0.774
Child usually lives in smoking area			
No	Ref.		
Yes	1.444	0.817, 2.554	0.206
Home renovation			
No	Ref.		
Yes	1.165	0.756, 1.796	0.488
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.155	0.756, 1.764	0.505
Pets (dog, cat, bird, etc.)			
No	Ref.		
Yes	1.105	0.734, 1.663	0.633
Cigarette smoke			
No	Ref.		
Yes	1.408	0.890 2.226	0.144
Incense smoke			
No	Ref.		
Yes	0.591	0.359, 0.972	0.038
Child usually lives in charcoal smoke area			
No	Ref.		
Yes	0.554	0.231, 1.330	0.186
Environment in children's bedroom			
Using cooling devices			
Fan			
No	Ref.		
Yes	1.261	0.793, 2.006	0.327
Bringing pets into bedroom			
Never	Ref.		
Sometimes	1.382	0.750, 2.548	0.299
Have dolls			
No	Ref.		
Yes	1.506	1.001, 2.266	0.049
Wall dampness near child's bedroom			
No	Ref.		
Yes	1.485	0.736, 2.994	0.269

Table 15 Binary logistic regression model association between residential environment factors and phlegm symptom (1 month)

Factors	Phlegm (n=251)		
	AOR	95% CI	p-value
Owner of residence			
Owner	Ref.		
Tenant	0.753	0.508, 1.118	0.160
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	1.148	0.788, 1.672	0.473
Child usually lives in smoking area			
No	Ref.		
Yes	0.901	0.518, 1.569	0.713
Wall dampness/ water leakage			
No	Ref.		
Yes	1.203	0.786, 1.842	0.394
Home renovation			
No	Ref.		
Yes	1.104	0.729, 1.672	0.641
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.162	0.785, 1.721	0.452
Pets (dog, cat, bird, etc.)			
No	Ref.		
Yes	1.048	0.714, 1.537	0.812
Cigarette smoke			
No	Ref.		
Yes	1.485	0.963, 2.290	0.074
Charcoal smoke (Cooking stove)			
No	Ref.		
Yes	1.257	0.734, 2.154	0.405
Incense smoke			
No	Ref.		
Yes	0.970	0.617, 1.526	0.896

Table 15 Binary logistic regression model association between residential environment factors and phlegm symptom (1 month) (n = 251) (continued)

Factors	Phlegm (n=251)		
	AOR	95% CI	p-value
Environment in children's bedroom			
Using cooling devices			
Fan			
No	Ref.		
Yes	1.454	0.939, 2.253	0.093
Misting fans			
No	Ref.		
Yes	1.753	0.858, 3.579	0.123
Number of window usually used			
No	Ref.		
1 - 2	0.904	0.611, 1.337	0.613
> 2	1.146	0.728, 1.804	0.557
Bringing pets into bedroom			
Never	Ref.		
Sometimes	1.270	0.699, 2.309	0.432
Have dolls			
No	Ref.		
Yes	1.576	1.069, 2.323	0.022
Wall dampness near child's bedroom			
No	Ref.		
Yes	3.662	1.622, 8.266	0.002

Table 16 Binary logistic regression model association between residential environment factors and shortness of breath symptom (1 month)

Factors	Shortness of breath (n=45)		
	AOR	95% CI	p-value
Age of residence (year); Median (IQR)			
Place near residence			
Garment/ clothing			
No	Ref.		
Yes	2.041	1.044, 3.992	0.037
Environment at children's residence			
Family member; Median (IQR)	0.803	0.646, 0.999	0.049
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.364	0.615, 3.024	0.445
Pets (dog, cat, bird, etc.)			
No	Ref.		
Yes	0.962	0.453, 2.043	0.920
Child usually lives in charcoal smoke area			
No	Ref.		
Yes	1.221	0.403, 3.702	0.724
Child usually lives in incense smoke area			
No	Ref.		
Yes	3.116	0.883, 10.995	0.077
Environment in children's bedroom			
Have curtain			
No	Ref.		
Yes	1.609	0.783, 3.307	0.196
Have carpet			
No	Ref.		
Yes	1.861	0.773, 4.479	0.166
Bringing pets into bedroom			
Never	Ref.		
Sometimes	2.272	0.893, 5.777	0.085
Have dolls			
No	Ref.		
Yes	2.895	1.199, 6.991	0.018
Wall dampness near child's bedroom			
No	Ref.		
Yes	1.688	0.588, 4.849	0.331

Table 17 Binary logistic regression model association between residential environment factors and running nose without cold symptom (1 month)

Factors	Running nose without cold (n=312)		
	AOR	95% CI	p-value
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	1.145	0.811, 1.617	0.442
Water leakage or wall dampness			
No	Ref.		
Yes	1.146	0.754, 1.741	0.524
Home renovation			
No	Ref.		
Yes	1.315	0.879, 1.968	0.182
Flowers with pollen			
No	Ref.		
Yes	1.219	0.799, 1.861	0.359
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.275	0.876, 1.855	0.204
Pets (dog, cat, bird, etc.)			
No	Ref.		
Yes	0.948	0.667 1.349	0.768
Cigarette smoke			
No	Ref.		
Yes	1.202	0.811, 1.782	0.360
Charcoal smoke (Cooking stove)			
No	Ref.		
Yes	1.265	0.759, 2.109	0.367
Environment in children's bedroom			
Using cooling devices			
Fan			
No	Ref.		
Yes	1.156	0.770, 1.734	0.485
Number of window usually used			
No	Ref.		
1 - 2	1.085	0.745, 1.579	0.671
> 2	1.000	0.637, 1.568	0.998
Have curtain			
No	Ref.		
Yes	1.226	0.875, 1.717	0.236
Have dolls			
No	Ref.		
Yes	2.138	1.478, 3.094	<0.001
Wall dampness near child's bedroom			
No	Ref.		
Yes	2.001	0.910, 4.400	0.084

4.3.3 Association between residential environment factors and respiratory and asthma symptoms (12 months)

Analysis of table 18 – 21 shows an association between residential environment factors and respiratory symptoms including asthma symptoms in the past 12 months.

Table 18 shows an association between residential characteristics, environment near children's residence (such as type of residence, age of residence, residence's owner, and place near residence) and respiratory and asthma symptoms.

In bivariate analysis, the results show significant association ($p<0.05$) which indicated that owner of residence was significantly associated with wheezing or whistling in the chest (asthma) symptom ($p=0.035$). Owner of residence both owner and tenant among children with wheezing symptom (10 6.6%), 65 (12.8%)) were less than children without symptom (141 (93.4%), 442 (87.2%)). Having garment/clothing shop near residence was significantly associated with shortness of breath ($p=0.008$). Having garment/clothing shop near residence among children with shortness of breath symptom (23 (14.4%)) was less than children without this symptom (137 (85.6%)). And having fresh market/ restaurant (cooking smoke) near residence was significantly associated with running nose without cold symptom ($p=0.041$). Having fresh market/ restaurant (cooking smoke) among children with running nose without cold symptom (4 (26.7%)) was less than children without this symptom (11 (73.3%)).

However, there was no association ($p>0.05$) between age of residence and two symptoms which were dry cough at night and phlegm symptom of children. Age of residence among children with and without those symptoms (30 (12.0), 30 (10.0)) was equally. There was no association between having garage/ car care near residence and wheezing or whistling in the chest (asthma) symptom of children. Having garage/ car care near residence among children with wheezing or whistling in the chest symptom (4 (6.3%)) was less than children with symptom (60 (93.8%)). There was no association between having furniture shop near residence and shortness of breath symptom. Having furniture shop near residence among children with shortness of breath symptom (6 (15.4%)) was less than children without symptom (33 (84.6%)).

Analysis of table 19 and 20 shows an association between environment at children's residence (such as family member, smoke (e.g. cigarette smoke, charcoal smoke from cooking stove, incense smoke), wall dampness, home renovation, and insecticide used) and respiratory and asthma symptoms.

Table 19 shows significant association ($p<0.05$) which indicated that having smoking people in family was significantly associated with dry cough at night, and running nose without cold symptoms ($p=0.024, 0.004$). Having smoking people in family among children with dry cough at night symptom (115 (36.9%)) was less than children without symptom (197 (63.1%)) while among children with running nose without cold symptom (183 (58.7%)) were higher than children without cold symptom (129 (41.3%)). Living in smoking area was significantly associated with dry cough at night symptom ($p=0.005$). Living in smoking area among children with dry

cough at night symptom (39 (45.9%)) was less than children without symptom (46 (54.1%)). Presenting of wall dampness in house was significantly associated with wheezing or whistling in the chest (asthma), phlegm, and shortness of breath symptoms (p=0.007, 0.024, 0.004). Presenting of wall dampness in residence among children with wheezing (asthma) (28 (17.2%), and shortness of breath (24 (14.7%)) symptoms were less than children without those symptoms (135 (82.8%), 139 (85.3%)), respectively while among children with phlegm symptom (83 (50.9%)) were higher than children without phlegm symptom (80 (49.1%)). Having home renovation was significantly associated with dry cough at night, phlegm, and running nose without cold symptoms (p=0.029, 0.028, 0.021). Having home renovation among children with phlegm (73 (51.42%), and running nose without cold (87 (61.3%)) symptoms were higher than children without those symptoms (69 (48.6%), 55 (38.7%)), respectively while among children with dry cough at night symptom (57 (40.1%)) were less than children without this symptom (85 (59.9%)).

However, there was no association (p>0.05) between having smoking people in family and phlegm symptoms. Having smoking people in family among children with phlegm symptom (147 (47.1%)) was less than children without this symptom (165 (52.9%)). Living in smoking area was no associated with phlegm, and running nose without cold symptoms of children. Living in smoking area among children with phlegm (44 (51.8%)), and running nose without cold (52 (61.2%)) symptoms were higher than children without those symptoms (41 (48.2%), 33 (38.8%)), respectively. Presenting of wall dampness in residence was no associated with dry cough at night, and running nose without cold symptoms of

children. Presenting of wall dampness in residence among children with dry cough at night symptom (62 (38.0%)) was less than children without this symptom (101 (62.0%)) while among children with running nose without cold symptom (94 (57.7%)) were higher than children without this symptom (69 (42.3%)). And also home renovation was no associated with shortness of breath symptom of children. Home renovation among children with shortness of breath symptom (18 (12.7%)) was less than children without this symptom (124 (87.3%)).

Table 20 shows significant association ($p<0.05$) which indicated that presenting of vectors was significantly associated with dry cough at night, phlegm, and running nose without cold symptoms ($p=0.005$, 0.006, 0.009). Presenting of vectors among children with dry cough at night (150 (36.5%)), and phlegm (195 (47.4%)) symptoms were less than children without these symptoms (261 (63.5%), 216 (52.6%)), respectively while among children with running nose without cold symptom (233 (56.7%)) were higher than children without this symptom (178 (43.3%)). Presenting of cigarette smoke was significantly associated with dry cough at night, and running nose without cold symptoms ($p=0.047$, 0.002). Presenting of cigarette smoke among children with dry cough at night (74 (38.1%)) was less than children without this symptom (120 (61.9%)) while among children with running nose without cold symptom (120 (61.9%)) were higher than children without this symptom (74 (38.1%)).

However, flowers with pollen at residence was no associated with phlegm, shortness of breath, and running nose without cold symptoms ($p>0.05$). Flowers with pollen at residence among children with phlegm (60 (48.8%)), and

shortness of breath (16 (13.0%)) were less than children without these symptoms (63 (51.2%), 107 (87.0%)), respectively while among children with running nose without cold symptom (72 (58.5%)) were higher than children without this symptom (51 (41.5%)). Presenting of vectors was no associated with wheezing or whistling in the chest (asthma), and shortness of breath symptoms (p>0.05). Presenting of vectors among children with wheezing (asthma) (52 (12.7%)), and shortness of breath (43 (10.5%)) symptoms were less than children without these symptoms (359 (87.3%), 368 (89.5%)), respectively. Having pets at residence was no associated with phlegm symptom (p>0.05). Having pets at residence among children with phlegm symptom (144 (46.3%)) was less than children without this symptom (187 (53.7%)).

Table 21 shows significant association (p<0.05) which indicated that using fan in children's bedroom was significantly associated with phlegm, and shortness of breath symptoms (p=0.017, 0.037). Using fan in children's bedroom among children with phlegm (234 (45.8%)), and shortness of breath (53 (10.4%)) symptoms were less than children without these symptoms (277 (54.2%), 458 (89.6%)), respectively. Having window usually used in children's bedroom was significantly associated with phlegm, and running nose without cold symptoms (p=0.001, <0.001). Having window in children's bedroom among children with phlegm (184 (48.4%)) was less than children without symptom (196 (51.6%)) while among children with running nose without cold symptom (222 (58.4%)) were higher than children without these symptoms (158 (41.8%)). Having doll was significantly associated with almost symptoms except wheezing or whistling in the chest

(asthma) symptom ($p<0.001$, <0.001, =0.004, <0.001). Having doll among children with dry cough at night (163 (38.4%)), and shortness of breath (49 (11.5%)) were less than children without these symptoms (262 (61.6%), 376 (88.5%)), respectively while having doll among children with phlegm (218 (51.3%)), and running nose without cold (258 (60.7%)) symptoms were higher than children without these symptoms (207 (48.7%), 167 (39.3%)), respectively. Presenting of wall dampness near children's bedroom was significantly associated with all symptoms ($p=0.017$, 0.037, =0.004, <0.001, 0.010). Presenting of wall dampness near children's bedroom among children with wheezing (asthma) (10 (25.0%)), dry cough at night (19 (47.5%)), and shortness of breath (11 (27.5%)) were less than children without these symptoms (30 (75.0%), 21 (52.5%), 29 (72.5%)), respectively while among children with phlegm (26 (65.0%)), and running nose without cold (29 (72.5%)) symptoms were higher than children without these symptoms (14 (35.0%), 11 (27.5%)), respectively.

However, there was no association ($p>0.05$) between using fan and wheezing or whistling in the chest (asthma) symptom. Using fan among children with wheezing (asthma) symptom (176 (34.4%)) was less than children without this symptom (335 (65.6%)). Using air conditioner was no associated with phlegm symptom. Using air conditioner among children with phlegm symptom (130 (47.3%)) was less than children without this symptom (145 (52.7%)). Having window in children's bedroom was no associated with wheezing or whistling in the chest, and dry cough at night symptom. Having window in children's bedroom among children with wheezing (50 (13.2%)), and dry cough at night (129 (33.9%))

symptoms were less than children without these symptoms (330 (86.8%), 251 (66.1%)), respectively. Having curtain in children's bedroom was no associated with shortness of breath and running nose without cold symptoms. Having curtain in children's bedroom among children with shortness of breath (41 (10.6%)) was less than children without this symptom (346 (89.4%)) while among children with running nose without cold symptom (213 (55.0%)) was higher than children without this symptom (174 (45.0%)). And bringing pets into bedroom was no associated with dry cough at night symptom. Bringing pets into bedroom among children with dry cough at night symptom (190 (31.8 %)) was less than children without this symptom (408 (68.2%)).

Table 18 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658)

Residential environment	Total (n=658)	Wheezing or whistling in the chest (asthma) (n = 75)			Dry cough at night (n = 214)			Phlegm (n=285)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Type of residence										
Single family house	109 (16.6)	12 (11.0)	97 (89.0)	0.282[b]	27 (24.8)	82 (75.2)	0.214[b]	44 (40.4)	65 (59.6)	0.686[b]
Townhouse	85 (12.9)	15 (17.6)	70 (82.4)		29 (34.1)	56 (65.9)		35 (41.2)	50 (58.8)	
Flat/ Apartment/ Condominium	414 (62.9)	43 (10.4)	371 (89.6)		138 (33.3)	276 (66.7)		181 (43.7)	233 (56.3)	
Community (slum)	50 (7.6)	5 (10.0)	45 (90.0)		20 (40.0)	30 (60.0)		25 (50.0)	25 (50.0)	
Age of residence (year); Median (IQR)	30 (10.0)	30 (10.0)	30 (10.0)	0.242[a]	30 (10.0)	30 (10.0)	0.162[a]	30 (12.0)	30 (10.0)	0.179[a]
Owner of residence										
Owner	151 (22.9)	10 (6.6)	141 (93.4)	0.035[b]	44 (29.1)	107 (70.9)	0.312[b]	69 (45.7)	82 (54.3)	0.501[b]
Tenant	507 (77.1)	65 (12.8)	442 (87.2)		170 (33.5)	337 (66.5)		216 (42.6)	291 (57.4)	
Place near residence										
Furniture shop	39 (5.9)	6 (15.4)	33 (84.6)	0.433[c]	15 (38.5)	24 (61.5)	0.414[b]	18 (46.2)	21 (53.8)	0.712[b]
Garment/ clothing	160 (24.3)	17 (10.6)	143 (89.4)	0.724[b]	56 (35.0)	104 (65.0)	0.442[b]	68 (42.5)	92 (57.5)	0.811[b]
Garage/ Car care	64 (9.7)	4 (6.3)	60 (93.8)	0.173[b]	20 (31.3)	44 (68.8)	0.819[b]	29 (45.3)	35 (54.7)	0.734[b]
Petrol station	37 (5.6)	3 (8.1)	34 (91.9)	0.789[c]	11 (29.7)	26 (70.3)	0.709[b]	17 (45.9)	20 (54.1)	0.739[b]
Fresh market and restaurant (cooking smoke)	15 (2.3)	0 (0.0)	15 (100.0)	0.398[c]	3 (80.0)	12 (20.0)	0.407[c]	5 (33.3)	10 (66.7)	0.430[b]

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 18 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658) (Continued)

Residential environment	Total (n=658)	Shortness of breath (n=60)			Running nose without cold (n=347)		
	n (%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Type of residence							
Single family house	109 (16.6)	6 (5.5)	103 (94.5)	0.507^b	54 (49.5)	55 (50.5)	0.785^b
Townhouse	85 (12.9)	8 (9.4)	77 (90.6)		46 (54.1)	39 (45.9)	
Flat/ Apartment/	414 (62.9)						
Condominium		42 (10.1)	372 (89.9)		218 (52.7)	196 (47.3)	
Community (slum)	50 (7.6)	4 (8.0)	46 (92.0)		29 (58.0)	21 (42.0)	
Age of residence (year); Median (IQR)	30 (10.0)	30 (12.0)	30 (10.0)	0.560^a	30 (15.0)	30 (10.0)	0.352^a
Owner of residence							
Owner	151 (22.9)	12 (7.9)	139 (92.1)	0.569^b	81 (53.6)	70 (46.4)	0.799^b
Tenant	507 (77.1)	48 (9.5)	459 (90.5)		266 (52.5)	241 (47.5)	
Place near residence							
Furniture shop	39 (5.9)	6 (15.4)	33 (84.6)	0.155^c	22 (56.4)	17 (43.6)	0.636^b
Garment/ clothing	160 (24.3)	23 (14.4)	137 (85.6)	0.008^b	85 (53.1)	75 (46.9)	0.910^b
Garage/ Car care	64 (9.7)	5 (7.8)	59 (92.2)	0.702^b	34 (53.1)	30 (46.9)	0.948^b
Petrol station	37 (5.6)	4 (10.8)	33 (89.2)	0.766^c	17 (45.9)	20 (54.1)	0.394^b
Fresh market and restaurant (cooking smoke)	15 (2.3)	0 (0.0)	15 (100.0)	0.384^c	4 (26.7)	11 (73.3)	0.041^b

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test, [c] Fisher X'act test

96

Table 19 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658)

Residential environment	Total (n=658) n (%)	Wheezing or whistling in the chest (asthma) (n = 75) Yes: n (%)	No: n (%)	p-value	Dry cough at night (n = 214) Yes: n (%)	No: n (%)	p-value	Phlegm (n=285) Yes: n (%)	No: n (%)	p-value
Family member; Median (IQR)	3 (1.0)	3 (2.0)	3 (1.0)	0.456^a	3 (2.0)	3 (1.0)	0.150^a	3 (2.0)	3 (1.0)	0.543^a
Have smoking people in family										
Yes	312 (47.4)	36 (11.5)	276 (88.5)	0.914^b	115 (36.9)	197 (63.1)	0.024^b	147 (47.1)	165 (52.9)	0.062^b
No	346 (52.6)	39 (11.3)	307 (88.7)		99 (28.6)	247 (71.4)		138 (39.9)	208 (60.1)	
Child usually lives in smoking area										
Yes	85 (12.9)	11 (12.9)	74 (87.1)	0.631^b	39 (45.9)	46 (54.1)	0.005^b	44 (51.8)	41 (48.2)	0.092^b
No	573 (87.1)	64 (11.2)	509 (88.8)		175 (30.5)	398 (69.5)		241 (42.1)	332 (57.9)	
Using stove for cooking in residence										
Yes	106 16.1	11 (10.4)	95 (89.6)	0.718^b	37 (34.9)	69 (65.1)	0.567^b	44 (41.5)	62 (58.5)	0.682^b
No	552 83.9	64 (11.6)	488 (88.4)		177 (32.1)	375 (67.9)		241 (43.7)	311 (56.3)	
Wall dampness/ Water leakage										
Yes	163 (24.8)	28 (17.2)	135 (82.8)	0.007^b	62 (38.0)	101 (62.0)	0.083^b	83 (50.9)	80 (49.1)	0.024^b
No	495 (75.2)	47 (9.5)	448 (90.5)		152 (30.7)	343 (69.3)		202 (40.8)	293 (59.2)	
Home renovation										
Yes	142 (21.6)	14 (9.9)	128 (90.1)	0.515^b	57 (40.1)	85 (59.9)	0.029^b	73 (51.4)	69 (48.6)	0.028^b
No	516 (78.4)	61 (11.8)	455 (88.2)		157 (30.4)	359 (69.6)		212 (41.1)	304 (58.9)	
Insecticide used										
Yes	494 (75.1)	57 (11.5)	437 (88.5)	0.844^b	157 (31.8)	337 (68.2)	0.481^b	213 (43.1)	281 (56.9)	0.860^b
No	164 (24.9)	18 (11.0)	146 (89.0)		57 (34.8)	107 (65.2)		72 (43.9)	92 (56.1)	
Mosquito controlled	331 (67.0)	36 (10.9)	295 (89.1)	0.511^b	96 (29.0)	235 (71.0)	0.059^b	130 (39.3)	201 (60.7)	0.014^b
Ant, cockroach, termite controlled	208 (42.1)	27 (13.0)	181 (87.0)	0.392^b	78 (37.5)	130 (62.5)	0.020^a	102 (49.0)	106 (51.0)	0.023^b

Note. ^{a} Mann-Whitney U test, ^{b} Pearson Chi-Square test

Table 19 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658) (Continued)

Residential environment	Total (n=658) n (%)	Shortness of breath (n=60) Yes: n (%)	No: n (%)	p-value	Running nose without cold (n=347) Yes: n (%)	No: n (%)	p-value
Family member; Median (IQR)	3 (1.0)	3 (2.0)	3 (2.0)	0.187[a]	3 (2.0)	3 (1.0)	0.456[a]
Have smoking people in family							
Yes	312 (47.4)	28 (9.0)	284 (91.0)	0.903[b]	183 (58.7)	129 (41.3)	0.004[b]
No	346 (52.6)	32 (9.2)	314 (90.8)		164 (47.4)	182 (52.6)	
Child usually lives in smoking area							
Yes	85 (12.9)	10 (11.8)	75 (88.2)	0.364[b]	52 (61.2)	33 (38.8)	0.095[b]
No	573 (87.1)	50 (8.7)	523 (91.3)		295 (51.5)	278 (48.5)	
Using stove for cooking in residence							
Yes	106 16.1	10 (9.4)	96 (90.6)	0.902[b]	58 (54.7)	48 (45.3)	0.656[b]
No	552 83.9	50 (9.1)	502 (90.9)		289 (52.4)	263 (47.6)	
Wall dampness/ Water leakage							
Yes	163 (24.8)	24 (14.7)	139 (85.3)	0.004[b]	94 (57.7)	69 (42.3)	0.146[b]
No	495 (75.2)	36 (7.3)	459 (92.7)		253 (51.1)	242 (48.9)	
Home renovation							
Yes	142 (21.6)	18 (12.7)	124 (87.3)	0.096[b]	87 (61.3)	55 (38.7)	0.021[b]
No	516 (78.4)	42 (8.1)	474 (91.9)		260 (50.4)	256 (49.6)	
Insecticide used							
Yes	494 (75.1)	39 (7.9)	455 (92.1)	0.058[b]	262 (53.0)	232 (47.0)	0.788[b]
No	164 (24.9)	21 (12.8)	143 (87.2)		85 (51.8)	79 (48.2)	
Mosquito controlled	331 (67.0)	24 (7.3)	307 (92.7)	0.449[b]	166 (50.2)	165 (49.8)	0.067[b]
Ant, cockroach, termite controlled	208 (42.1)	18 (8.7)	190 (91.3)	0.594[b]	120 (57.7)	88 (42.3)	0.077[b]

Note. [a] Mann -Whitney U test, [b] Pearson Chi-Square test

Table 20 Residential environment factors and respiratory and asthma symptoms
(12 months) (n = 658)

Residential environment	Total (n=658)		Wheezing or whistling in the chest (asthma) (n = 75)				Dry cough at night (n = 214)			
	n (%)		Yes: n (%)		No: n (%)	p-value	Yes: n (%)		No: n (%)	p-value
Environment at children's residence										
Flowers with pollen										
Yes	123	(18.7)	15	(12.2)	108 (87.8)	0.758^b	42 (34.1)		81 (65.9)	0.670^b
No	535	(81.3)	60	(11.2)	475 (88.8)		172 (32.1)		363 (67.9)	
Vectors (cockroach, rat, etc.)										
Yes	411	(62.5)	52	(12.7)	359 (87.3)	0.192^b	150 (36.5)		261 (63.5)	0.005^b
No	247	(37.5)	23	(9.3)	224 (90.7)		64 (25.9)		183 (74.1)	
Pets (dog, cat, bird, etc.)										
Yes	311	(47.3)	38	(12.2)	273 (87.8)	0.531^b	108 (34.7)		203 (65.3)	0.253^b
No	347	(52.7)	37	(10.7)	310 (89.3)		106 (30.5)		241 (69.5)	
Cigarette smoke										
Yes	194	(29.5)	21	(10.8)	173 (89.2)	0.765^b	74 (38.1)		120 (61.9)	0.047^b
No	464	(70.5)	54	(11.6)	410 (88.4)		140 (30.2)		324 (69.8)	
Charcoal smoke (Cooking stove)										
Yes	84	(12.8)	7	(8.3)	77 (91.7)	0.344^b	26 (31.0)		58 (69.0)	0.742^b
No	574	(87.2)	68	(11.8)	506 (88.2)		188 (32.8)		386 (67.2)	
Incense smoke										
Yes	140	(21.3)	13	(9.3)	127 (90.7)	0.375^b	42 (30.0)		98 (70.0)	0.473^b
No	518	(78.7)	62	(12.0)	456 (88.0)		172 (33.2)		346 (66.8)	
Child usually lives in charcoal smoke area										
Yes	41	(6.2)	4	(9.8)	37 (90.2)	1.000^c	12 (29.3)		29 (70.7)	0.646^b
No	617	(93.8)	71	(11.5)	546 (88.5)		202 (32.7)		415 (67.3)	
Child usually lives in incense smoke area										
Yes	24	(3.6)	5	(20.8)	19 (79.2)	0.178^c	10 (41.7)		14 (58.3)	0.330^b
No	634	(96.4)	70	(11.0)	564 (89.0)		204 (67.8)		430 (32.2)	

Note. ^{b} Pearson Chi-Square test, ^{c} Fisher X'act test

Table 20 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658) (Continued)

Residential environment	Total (n=658) n (%)		Phlegm (n=285) Yes: n (%)		No: n (%)		p-value	Shortness of breath (n=60) Yes: n (%)		No: n (%)		p-value
Environment at children's residence												
Flowers with pollen												
Yes	123	(18.7)	60	(48.8)	63	(51.2)	0.175^{b}	16	(13.0)	107	(87.0)	0.097^{b}
No	535	(81.3)	225	(57.9)	310	(42.1)		44	(8.2)	491	(91.8)	
Vectors (cockroach, rat, etc.)												
Yes	411	(62.5)	195	(47.4)	216	(52.6)	0.006^{b}	43	(10.5)	368	(89.5)	0.122^{b}
No	247	(37.5)	90	(36.4)	157	(63.6)		17	(6.9)	230	(93.1)	
Pets (dog, cat, bird, etc.)												
Yes	311	(47.3)	144	(46.3)	167	(53.7)	0.143^{b}	30	(9.6)	281	(90.4)	0.656^{b}
No	347	(52.7)	141	(40.6)	206	(59.4)		30	(8.6)	317	(91.4)	
Cigarette smoke												
Yes	194	(29.5)	90	(46.4)	104	(53.6)	0.303^{b}	20	(10.3)	174	(89.7)	0.493^{b}
No	464	(70.5)	195	(42.0)	269	(58.0)		40	(8.6)	424	(91.4)	
Charcoal smoke (Cooking stove)												
Yes	84	(12.8)	33	(39.3)	51	(60.7)	0.425^{b}	6	(7.1)	78	(92.9)	0.501^{b}
No	574	(87.2)	252	(43.9)	322	(56.1)		54	(9.4)	520	(90.6)	
Incense smoke												
Yes	140	(21.3)	58	(41.4)	82	(58.6)	0.612^{b}	15	(10.7)	125	(89.3)	0.460^{b}
No	518	(78.7)	227	(43.8)	291	(56.2)		45	(8.7)	473	(91.3)	
Child usually lives in charcoal smoke area												
Yes	41	(6.2)	16	(39.0)	25	(61.0)	0.567^{b}	6	(14.6)	35	(85.4)	0.254^{c}
No	617	(93.8)	269	(43.6)	348	(56.4)		54	(8.8)	563	(91.2)	
Child usually lives in incense smoke area												
Yes	24	(3.6)	13	(54.2)	11	(45.8)	0.274^{b}	5	(20.8)	19	(79.2)	0.058^{c}
No	634	(96.4)	272	(42.9)	362	(57.1)		55	(8.7)	579	(91.3)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 20 Residential environment factors and respiratory and asthma symptoms

(12 months) (n = 658) (Continued)

Residential environment	Total (n=658)		Running nose without cold (n=347)				
	n (%)		Yes: n (%)		No: n (%)		p-value
Environment at children's residence							
Flowers with pollen							
Yes	123	(18.7)	72	(58.5)	51	(41.5)	0.153[b]
No	535	(81.3)	275	(51.4)	260	(48.6)	
Vectors (cockroach, rat, etc.)							
Yes	411	(62.5)	233	(56.7)	178	(43.3)	0.009[b]
No	247	(37.5)	114	(46.2)	133	(53.8)	
Pets (dog, cat, bird, etc.)							
Yes	311	(47.3)	169	(54.3)	142	(45.7)	0.435[b]
No	347	(52.7)	178	(51.3)	169	(48.7)	
Cigarette smoke							
Yes	194	(29.5)	120	(61.9)	74	(38.1)	0.002[b]
No	464	(70.5)	227	(48.9)	237	(51.1)	
Charcoal smoke (Cooking stove)							
Yes	84	(12.8)	44	(52.4)	40	(47.6)	0.944[b]
No	574	(87.2)	303	(52.8)	271	(47.2)	
Incense smoke							
Yes	140	(21.3)	72	(51.4)	68	(48.6)	0.727[b]
No	518	(78.7)	275	(53.1)	243	(46.9)	
Child usually lives in charcoal smoke area							
Yes	41	(6.2)	21	(51.2)	20	(48.8)	0.841[b]
No	617	(93.8)	326	(52.8)	291	(47.2)	
Child usually lives in incense smoke area							
Yes	24	(3.6)	17	(70.8)	7	(29.2)	0.070[b]
No	634	(96.4)	330	(52.1)	304	(47.9)	

Note. [b] Pearson Chi-Square test

Table 21 Residential environment factors and respiratory and asthma symptoms
(12 months) (n = 658)

Environment in children's bedroom	Total (n=658)		Wheezing or whistling in the chest (asthma) (n = 75)			Dry cough at night (n = 214)		
	n	(%)	Yes: n (%)	No: n (%)	p-value	Yes: n (%)	No: n (%)	p-value
Using cooling devices								
Air conditioner								
Yes	275	(41.8)	27 (9.8)	248 (90.2)	0.280[b]	88 (32.0)	187 (68.0)	0.808[b]
No	383	(58.2)	48 (12.5)	335 (87.5)		126 (32.9)	257 (67.1)	
Fan								
Yes	511	(77.7)	62 (12.1)	449 (87.9)	0.269[b]	176 (34.4)	335 (65.6)	0.050[b]
No	147	(22.3)	13 (8.8)	134 (91.2)		38 (25.9)	109 (74.1)	
Misting fans								
Yes	622	(94.5)	3 (8.3)	33 (91.7)	0.787[c]	9 (25.0)	27 (75.0)	0.322[b]
No	36	(5.5)	72 (11.6)	550 (88.4)				
Number of window usually used								
No	278	(42.2)	25 (9.0)	253 (91.0)	0.079[b]	85 (30.6)	193 (69.4)	0.084[b]
1 - 2	247	(37.5)	28 (11.3)	219 (88.7)		75 (30.4)	172 (69.6)	
> 2	133	(20.2)	22 (16.5)	111 (83.5)		54 (40.6)	79 (59.4)	
Have curtain								
Yes	387	(58.8)	45 (11.6)	342 (88.4)	0.825[b]	136 (35.1)	251 (64.9)	0.087[b]
No	271	(41.2)	30 (11.1)	241 (88.9)		78 (28.8)	193 (71.2)	
Have carpet								
Yes	59	(9.0)	9 (15.3)	50 (84.7)	0.329[b]	15 (25.4)	44 (74.6)	0.222[b]
No	599	(91.0)	66 (11.0)	533 (89.0)		199 (33.2)	400 (66.8)	
Bringing pets into bedroom								
Never	598	(90.9)	70 (11.7)	528 (88.3)	0.433[b]	190 (31.8)	408 (68.2)	0.195[b]
Sometimes	60	(9.1)	5 (8.3)	55 (91.7)		24 (40.0)	36 (60.0)	
Have dolls								
Yes	425	(64.6)	53 (12.5)	372 (87.5)	0.242[b]	163 (38.4)	262 (61.6)	<0.001[b]
No	233	(35.4)	22 (9.4)	211 (90.6)		51 (21.9)	182 (78.1)	
Number of dolls								
≤ 5	332	(50.5)	39 (11.7)	293 (88.3)	0.394[b]	125 (37.7)	207 (62.3)	0.574[b]
> 5	93	(14.1)	14 (15.1)	79 (84.9)		38 (40.9)	55 (59.1)	
Put the dolls on the bed								
Yes	180	(42.4)	25 (13.9)	155 (86.1)	0.448[b]	75 (41.7)	105 (58.3)	0.229[b]
No	245	(57.6)	28 (11.4)	217 (88.6)		88 (35.9)	157 (64.1)	
Wall dampness near child's bedroom								
Yes	40	(6.1)	10 (25.0)	30 (75.0)	0.017[c]	19 (47.5)	21 (52.5)	0.037[b]
No	618	(93.9)	65 (10.5)	553 (89.5)		195 (31.6)	423 (68.4)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 21 Residential environment factors and respiratory and asthma symptoms (12 months) (n = 658) (Continued)

Environment in children's bedroom	Total (n=658) n (%)	Phlegm (n=285) Yes: n (%)	No: n (%)	p-value	Shortness of breath (n=60) Yes: n (%)	No: n (%)	p-value
Using cooling devices							
Air conditioner							
Yes	275 (41.8)	130 (47.3)	145 (52.7)	0.082[b]	24 (8.7)	251 (91.3)	0.768[b]
No	383 (58.2)	155 (40.5)	228 (59.5)		36 (9.4)	347 (90.6)	
Fan							
Yes	511 (77.7)	234 (45.8)	277 (54.2)	0.017[b]	53 (10.4)	458 (89.6)	0.037[b]
No	147 (22.3)	51 (34.7)	96 (65.3)		7 (4.8)	140 (95.2)	
Misting fans							
Yes	622 (94.5)	17 (47.2)	19 (52.8)	0.626[b]	3 (8.3)	33 (91.7)	1.000[c]
No	36 (5.5)	268 (43.1)	354 (56.9)		57 (9.2)	565 (90.8)	
Number of window usually used							
No	278 (42.2)	101 (36.3)	177 (63.7)	0.001[b]	28 (10.1)	250 (89.9)	0.444[b]
1 - 2	247 (37.5)	109 (44.1)	138 (55.9)		18 (7.3)	229 (92.7)	
> 2	133 (20.2)	75 (56.4)	58 (43.6)		14 (10.5)	119 (89.5)	
Have curtain							
Yes	387 (58.8)	174 (45.0)	213 (55.0)	0.308[b]	41 (10.6)	346 (89.4)	0.116[b]
No	271 (41.2)	111 (41.0)	160 (59.0)		19 (7.0)	252 (93.0)	
Have carpet							
Yes	59 (9.0)	23 (39.0)	36 (61.0)	0.482[b]	7 (11.9)	52 (88.1)	0.443[b]
No	599 (91.0)	262 (43.7)	337 (56.3)		53 (8.8)	546 (91.2)	
Bringing pets into bedroom							
Never	598 (90.9)	257 (43.0)	341 (57.0)	0.582[b]	52 (8.7)	546 (91.3)	0.234[b]
Sometimes	60 (9.1)	28 (46.7)	32 (53.3)		8 (13.3)	52 (86.7)	
Have dolls							
Yes	425 (64.6)	218 (51.3)	207 (48.7)	0.000[b]	49 (11.5)	376 (88.5)	0.004[b]
No	233 (35.4)	67 (28.8)	166 (71.2)		11 (4.7)	222 (95.3)	
Number of dolls							
≤ 5	332 (50.5)	159 (47.9)	173 (52.1)	0.008[b]	34 (10.2)	298 (89.8)	0.116[b]
> 5	93 (14.1)	59 (63.4)	34 (36.6)		15 (16.1)	78 (83.9)	
Put the dolls on the bed							
Yes	180 (42.4)	101 (56.1)	79 (43.9)	0.089[b]	24 (13.3)	156 (86.7)	0.318[b]
No	245 (57.6)	117 (47.8)	128 (52.2)		25 -10.2	220 (89.8)	
Wall dampness near child's bedroom							
Yes	40 (6.1)	26 (65.0)	14 (35.0)	0.004[b]	11 (27.5)	29 (72.5)	<0.001[c]
No	618 (93.9)	259 (41.9)	359 (58.1)		49 (7.9)	569 (92.1)	

Note. [b] Pearson Chi-Square test, [c] Fisher X'act test

Table 21 Residential environment factors and respiratory and asthma symptoms
(12 months) (n = 658) (Continued)

Environment in children's bedroom	Total (n=658)		Running nose without cold (n=347)			
	n	(%)	Yes: n (%)		No: n (%)	p-value
Using cooling devices						
Air conditioner						
Yes	275	(41.8)	155	(56.4)	120 (43.6)	0.114[b]
No	383	(58.2)	192	(50.1)	191 (49.9)	
Fan						
Yes	511	(77.7)	279	(54.6)	232 (45.4)	0.074[b]
No	147	(22.3)	68	(46.3)	79 (53.7)	
Misting fans						
Yes	622	(94.5)	22	(61.1)	14 (38.9)	0.301[b]
No	36	(5.5)	325	(52.3)	297 (47.7)	
Number of window usually used						
No	278	(42.2)	125	(45.0)	153 (55.0)	<0.001[b]
1 - 2	247	(37.5)	134	(54.3)	113 (45.7)	
> 2	133	(20.2)	88	(66.2)	45 (33.8)	
Have curtain						
Yes	387	(58.8)	213	(55.0)	174 (45.0)	0.157[b]
No	271	(41.2)	134	(49.4)	137 (50.6)	
Have carpet						
Yes	59	(9.0)	33	(55.9)	26 (44.1)	0.606[b]
No	599	(91.0)	314	(52.4)	285 (47.6)	
Bringing pets into bedroom						
Never	598	(90.9)	315	(52.7)	283 (47.3)	0.922[b]
Sometimes	60	(9.1)	32	(53.3)	28 (46.7)	
Have dolls						
Yes	425	(64.6)	258	(60.7)	167 (39.3)	<0.001[b]
No	233	(35.4)	89	(38.2)	144 (61.8)	
Number of dolls						
≤ 5	332	(50.5)	196	(59.0)	136 (41.0)	0.183[b]
> 5	93	(14.1)	62	(66.7)	31 (33.3)	
Put the dolls on the bed						
Yes	180	(42.4)	118	(65.6)	62 (34.4)	0.079[b]
No	245	(57.6)	140	(57.1)	105 (42.9)	
Wall dampness near child's bedroom						
Yes	40	(6.1)	29	(72.5)	11 (27.5)	0.010[b]
No	618	(93.9)	318	(51.5)	300 (48.5)	

Note. [b] Pearson Chi-Square test

The bivariate analysis was used in first step for screening variables, and then the variables which p-value less than 0.2 were selected to include to multivariate logistic regression model. Analysis in table 22 – 26 show final model results for each dependent variable.

Table 22 shows a binary logistic regression analysis between residential environment factors and wheezing or whistling in the chest (asthma) symptom (12 months). The results found that children who living in tenant residence, was increased 2.362-fold odds of having wheezing or whistling in the chest (asthma) symptoms (AOR = 2.362, 95%CI 1.156-4.828, *p*=0.018) compared to children who living in their own residence. Having more than 2 windows in children's bedroom was increased 2.104-fold odds of having wheezing or whistling in the chest (asthma) symptoms compared to children without window in bedroom (AOR = 2.104, 95%CI 1.115-3.967, *p*=0.022).

However, presenting of wall dampness in residence and near children's bedroom, having at least 1-2 windows, and presenting of vectors were possible to be risk factors (AOR>1) of having wheezing or whistling in the chest (asthma) symptom among children but statistical significant was not achieved.

Table 23 shows a binary logistic regression analysis between residential environment factors and dry cough at night symptom (12 months). The results found that living in smoking area was increased 1.887-fold odds of having dry cough at night symptom compared to children who did not live in smoking area (AOR = 1.887, 95%CI 1.075-3.309, *p*=0.027). Having doll was increased 2.610-fold odds of having dry cough at night symptom (AOR = 2.610, 95%CI 1.720-3.959, *p*<0.001) compared to children without doll.

However, age of residence, having smoking people in family, presenting of wall dampness near children's bedroom, having home renovation, presenting of vectors, cigarette smoke, using fan in children's bedroom, having more than 2 windows, having curtain, and bringing pets into bedroom were possible to be risk factors (AOR>1) of having dry cough at night symptom among children but statistical significant was not achieved.

Table 24 shows a binary logistic regression analysis between residential environment factors and phlegm symptom (12 months). The results found that having more than 2 windows in children's bedroom was increased 1.853-fold odds of having phlegm symptom (AOR = 1.853, 95%CI 1.180-2.909, p=0.007) compared to children without windows in bedroom. Having doll was increased 2.375-fold odds of having phlegm symptom (AOR = 2.375, 95%CI 1.618-3.488, p<0.001) compared to children without doll.

However, age of residence, having smoking people in family, living in smoking area, having home renovation, having flowers with pollen, presenting of vectors, using cooling devices (air conditioner and fan) in children's bedroom, and presenting wall dampness near children's bedroom were possible to be risk factors (AOR>1) of having phlegm symptom among children but statistical significant was not achieved.

Table 25 shows a binary logistic regression analysis between residential environment factors and shortness of breath symptom (12 months). The results found that having garment/clothing shop near residence was increased 1.935-fold odds of having shortness of breath symptom (AOR = 1.935, 95%CI 1.060-3.529, p=0.031) compared to children who have no garment/clothing shop near residence. Living in

incense smoke area was increased 3.767-fold odds of having shortness of breath symptom (AOR = 3.767, 95%CI 1.183-11.990, p=0.025) compared to children who did not live in incense smoke area. Having doll was increased 2.440-fold odds of having shortness of breath symptom (AOR = 2.440, 95%CI 1.164-5.114, p=0.018) compared to children without doll. Presenting of wall dampness near children's bedroom was increased 3.435-fold odds of having shortness of breath symptom (AOR = 3.435, 95%CI 1.297-9.098, p=0.013) compared to children without wall dampness near bedroom.

However, having wall dampness in residence, having home renovation, flowers with pollen, presenting of vectors, using fan, and having curtain in children's bedroom were possible to be risk factors (AOR>1) of having shortness of breath symptom among children but statistical significant was not achieved.

Table 26 shows a binary logistic regression analysis between residential environment factors and running nose without cold symptom (12 months). The results found that having more than 2 windows in children's bedroom was increased 1.914-fold odds of having running nose without cold symptom (AOR = 1.914, 95%CI 1.203-3.044, p=0.006) compared to children without window in bedroom. Having doll was increased 2.265-fold odds of having running nose without cold symptom (AOR = 2.265, 95%CI 1.558-3.291, p<0.001) compared to children without doll. Presenting of wall dampness near children's bedroom was increased 2.331-fold odds of having running nose without cold symptom (AOR = 2.331, 95%CI 1.034-5.257, p=0.041) compared to children without wall dampness near bedroom.

However, having smoking people in family, living in smoking area, having home renovation, flowers with pollen, presenting of vectors, cigarette smoke, using cooling devices (air conditioner and fan) in children's bedroom, and having at least 1-2 windows were possible to be risk factors (AOR>1) of having running nose without cold symptom among children but statistical significant was not achieved.

Table 22 Binary logistic regression model association between residential environment factors and wheezing symptom (asthma) (12 months)

Factors	Wheezing or whistling in the chest (asthma) (n = 75)		
	AOR	95% CI	p - value
Owner of residence			
Owner	Ref.		
Tenant	2.362	1.156, 4.828	0.018
Place near residence			
Garage/ Car care			
No	Ref.		
Yes	0.433	0.148, 1.267	0.127
Environment at children's residence			
Wall dampness/ water leakage			
No	Ref.		
Yes	1.487	0.812, 2.723	0.198
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.193	0.695, 2.049	0.521
Child usually lives in incense smoke area			
No	Ref.		
Yes	1.937	0.665, 5.642	0.226
Environment in children's bedroom			
Number of window usually used			
No	Ref.		
1 - 2	1.375	0.767, 2.462	0.285
> 2	2.104	1.115, 3.967	0.022
Wall dampness near child's bedroom			
No	Ref.		
Yes	2.338	0.946, 5.779	0.066

Table 23 Binary logistic regression model association between residential environment factors and dry cough at night symptom (12 months)

Factors	Dry cough at night (n = 214)		
	AOR	95% CI	p - value
Age of residence (year);Median (IQR)	1.011	0.996, 1.026	0.144
Family member (Median -IQR)	1.068	0.971, 1.174	0.174
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	1.070	0.719, 1.591	0.739
Child usually lives in smoking area			
No	Ref.		
Yes	1.887	1.075, 3.309	0.027
Wall dampness/ water leakage			
No	Ref.		
Yes	0.856	0.543, 1.349	0.502
Home renovation			
No	Ref.		
Yes	1.032	0.673, 1.583	0.886
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.394	0.943, 2.060	0.096
Cigarette smoke			
No	Ref.		
Yes	1.050	0.688, 1.602	0.821
Environment in children's bedroom			
Using cooling devices			
Air conditioner			
No	Ref.		
Yes	0.794	0.543, 1.159	0.232
Fan			
No	Ref.		
Yes	1.104	0.701, 1.739	0.668
Number of window usually used			
No	Ref.		
1 - 2	0.821	0.541, 1.245	0.352
> 2	1.195	0.747, 1.912	0.458
Have curtain			
No	Ref.		
Yes	1.337	0.912, 1.959	0.136
Brings pets into bedroom			
Never	Ref.		
Sometimes	1.116	0.620, 2.009	0.715
Have dolls			
No	Ref.		
Yes	2.610	1.720, 3.959	<0.001
Wall dampness near child's bedroom			
No	Ref.		
Yes	1.721	0.797, 3.715	0.167

Table 24 Binary logistic regression model association between residential environment factors and phlegm symptom (12 months)

Factors	Phlegm (n=285)		
	AOR	95% CI	p-value
Age of residence (year);Median (IQR)	1.013	0.999, 1.027	0.065
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	1.161	0.809, 1.664	0.418
Child usually lives in smoking area			
No	Ref.		
Yes	1.428	0.838, 2.432	0.190
Wall dampness/ water leakage			
No	Ref.		
Yes	0.993	0.644, 1.531	0.975
Home renovation			
No	Ref.		
Yes	1.065	0.707, 1.605	0.762
Flowers with pollen			
No	Ref.		
Yes	1.086	0.707, 1.669	0.706
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.274	0.874, 1.857	0.208
Environment in children's bedroom			
Using cooling devices			
Air conditioner			
No	Ref.		
Yes	1.203	0.853, 1.696	0.291
Fan			
No	Ref.		
Yes	1.215	0.798, 1.852	0.364
Number of window usually used			
No	Ref.		
1 - 2	1.183	0.805, 1.738	0.391
> 2	1.853	1.180, 2.909	0.007
Have dolls			
No	Ref.		
Yes	2.375	1.618, 3.488	<0.001
Wall dampness near child's bedroom			
No	Ref.		
Yes	2.139	0.987, 4.636	0.054

Table 25 Binary logistic regression model association between residential environment factors and shortness of breath symptom (12 months)

Factors	Shortness of breath (n=60)		
	AOR	95% CI	p-value
Place near residence			
Furniture shop			
No	Ref.		
Yes	1.486	0.551, 4.005	0.434
Garment/ clothing			
No	Ref.		
Yes	1.935	1.060, 3.529	0.031
Environment at children's residence			
Family member; Median (IQR)	0.888	0.752, 1.049	0.162
Wall dampness/ water leakage			
No	Ref.		
Yes	1.093	0.525, 2.275	0.811
Home renovation			
No	Ref.		
Yes	1.254	0.657, 2.393	0.492
Insecticide used			
No	Ref.		
Yes	0.453	0.242, 0.849	0.013
Flowers with pollen			
No	Ref.		
Yes	1.532	0.776, 3.021	0.219
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.085	0.573, 2.054	0.803
Child usually lives in incense smoke area			
No	Ref.		
Yes	3.767	1.183, 11.990	0.025
Environment in children's bedroom			
Using cooling devices in child's bedroom			
Fan			
No	Ref.		
Yes	1.811	0.768, 4.272	0.175
Have curtain			
No	Ref.		
Yes	1.309	0.704, 2.433	0.394
Have dolls			
No	Ref.		
Yes	2.440	1.164, 5.114	0.018
Wall dampness near child's bedroom			
No	Ref.		
Yes	3.435	1.297, 9.098	0.013

Table 26 Binary logistic regression model association between residential environment factors and running nose without cold symptom (12 months)

Factors	Running nose without cold (n=347)		
	AOR	95% CI	p-value
Place near residence			
Fresh market and restaurant (cooking smoke)			
No	Ref.		
Yes	0.294	0.088, 0.988	0.048
Environment at children's residence			
Have smoking people in family			
No	Ref.		
Yes	1.384	0.958, 2.000	0.083
Child usually lives in smoking area			
No	Ref.		
Yes	1.021	0.581, 1.792	0.943
Wall dampness/ water leakage			
No	Ref.		
Yes	0.808	0.524, 1.246	0.335
Home renovation			
No	Ref.		
Yes	1.188	0.782, 1.803	0.420
Flowers with pollen			
No	Ref.		
Yes	1.018	0.662, 1.565	0.937
Vectors (cockroach, rat, etc.)			
No	Ref.		
Yes	1.174	0.821, 1.679	0.381
Cigarette smoke			
No	Ref.		
Yes	1.340	0.894, 2.008	0.157
Child usually lives in incense smoke area			
No	Ref.		
Yes	1.908	0.712, 5.109	0.199

Table 26 Binary logistic regression model association between residential environment factors and running nose without cold symptom (12 months) (continued)

Factors	Running nose without cold (n=347)		
	AOR	95% CI	p-value
Environment in children's bedroom			
Using cooling devices			
Air conditioner			
No	Ref.		
Yes	1.185	0.83, 1.690	0.350
Fan			
No	Ref.		
Yes	1.010	0.667, 1.530	0.962
Number of window usually used			
No	Ref.		
1 - 2	1.160	0.794, 1.695	0.443
> 2	1.914	1.203, 3.044	0.006
Have curtain			
No	Ref.		
Yes	0.948	0.665, 1.351	0.766
Have dolls			
No	Ref.		
Yes	2.265	1.558, 3.291	0.000
Wall dampness near child's bedroom			
No	Ref.		
Yes	2.331	1.034, 5.257	0.041

CHAPTER V

DISCUSSION

This study was evaluated an association between residential environments and respiratory and asthma symptoms among primary school children in urban area where is located in the highest air pollution concentration in Bangkok, Thailand. We found that around 1 in 4 of primary school children in this area reported respiratory and asthma symptoms in the past 12 months.

5.1 prevalence of respiratory and asthma symptoms

In our study, the most reported symptom was running nose without cold and the less reported symptom was shortness of breath. We found that around 11% of children were reported having wheezing symptom which was lower than other studies in urban areas. For example, wheezing symptom was found 21.7% among children in Shanghai whereas rapid urbanization and modernization in China which was high indoor air pollution from commonly used many household equipment and man-made materials in the residences due to high-rise multi-story apartment buildings and high population density (58), and wheezing symptoms was found rank between 12.7% – 17.7% among children in Delhi whereas commercial areas like slums with high density of population and had high concentration of air pollution from transport vehicles in India (59). Furthermore, our study found dry cough at night (32.5%) and phlegm (43.3%) were higher than the study by Mathew et al. (2015) which reported night cough/ phlegm rank between 26.9% - 29.0% in Delhi children (59).

5.2 Children's characteristic

The participants were 658 primary school children both male (50.2%) and female (49.8%) which was almost equally. There was no difference median age, median height, and median weight (at birth/ at present) of them. Most of them had exercise (64.6%) from school activities for example, football (31.5%), swimming (29.5%), badminton (10.3%), etc.

The results found that there was 1.8% asthma (doctor diagnosis) and 2.3% having family history of asthma. Among those having family history of asthma, there was the highest for running nose without cold symptom (73.3%), followed by phlegm symptom (66.7%), and dry cough at night (40.0%), respectively. All symptoms in this study were tend to be asthma symptoms which recommend by the Global Initiative for Asthma (GINA) (3) although only wheezing or whistling in the chest was also recommended by the World Allergy Organization (49). In this study reported 13.3% asthma symptom (wheezing or whistling in the chest). Although, many studies found the association between children's characteristic(60) (e.g. age, gender, and genetic) and asthma, the statistical significant was not achieved in our study which was inconsistent with those studies. For example the study by Dhenuka et al (2014) found that the increasing incidence of asthma among children in younger age higher than older age (61). For gender, the studies by Chen et al (2003) said that incidence of asthma hospitalization was substantially higher for young boys than girls, and Yao (2015) also said that boys had a greater risk of asthma-like disease and current wheeze than girls (60). Furthermore, the study by Liu et al (2009) found a significant association that a genetic had a tendency to develop asthma in children (35). Then,

we selected these factors for adjusting factors and included to final model to find association on each symptom.

5.3 Residential environment

Children stayed at residence on weekend more than school day. This study reported that most of children (53.0%) stayed at their home around 24 hours during weekend while they stayed around 13-14 hours during school day. And majority of children (69.5%) spent most of their time in bedroom more than other rooms.

5.3.1 Association between residential characteristic, environment near residence and respiratory and asthma symptoms

Most of children in this study lived in flat/ apartment/ condominium (62.9%) and the average age of residence was more than 30 years which was consistent with our observation that most of buildings in this area were old and high density of both buildings and people. Furthermore, the results found that age of residence was possible to be risk factors (AOR>1) of having dry cough at night and phlegm symptoms in the past 12 months while living in community (slum) was possible to be risk factors (AOR>1) of having wheezing symptom during 1 month. Although, there was nearly 30.0% of them living in single family (16.6%) and townhouse (12.9%) but they also lived among the same environments such as places near their residence which can cause respiratory effect, whether garment/clothing shop (24.3%), garage/car care (9.7%), furniture shop (5.9%), or fresh market/ restaurant (cooking smoke) (2.4%). Especially garment/clothing shop was positively associated with shortness of breath symptom both during 1 month and

in the past 12 months while having furniture shop near residence was possible to be risk factors (AOR>1) of having dry cough at night symptom. Cotton dust from garment/clothing shop and wood dust from furniture shop can be trigger on respiratory tract in human which many studies found the association between those dust and respiratory symptoms including asthma among worker in those factories while had no study among children.

For example the study by Silpasuwan et al (2016) among home-based garment workers found that significant respiratory tract signs and symptoms were associated with lung function capacity (OR = 52.15, 95%CI 6.49-419.60) (62). Moreover, Chumchai et al (2015) also found the significant association between garment dust exposure and respiratory symptoms among worker ($p<0.001$) (63). In addition, the study reviewed by Wiggans et al (2016) supported about association between furniture shop and respiratory symptoms that their reviewed found many studies said among furniture workers was significantly associated with increasing risk of respiratory symptoms and asthma. (64). If children lived in the same area with had high concentration of those dust especially in their residence, for long term exposure they may get effect like those workers because children's body still not strong like adult.

Moreover, our finding showed that most of participants were tenant (77.1%) more than owner residence (22.9%) which was positively associated with wheezing or whistling in the chest symptom. A possible reason for this finding may rely on the fact that owner will take care of their house better than tenant.

5.3.2 Association between residential environment at residence and respiratory and asthma symptoms

Exposures to poor quality of indoor air are the most important concern for causes of respiratory diseases and asthma among children (2, 65). This study found that children living in cigarette smoke area were significantly associated with dry cough at night and living in incense smoke area were significantly associated shortness of breath. These findings are consistent with many studies. For example, the study by Salo et al (2004) found the strongest associations (OR>1, 95%CI) between smoking (cigarette smoke) in home and respiratory symptoms; cough and phlegm without colds among children (42). Furthermore, the study by Chen et al (2011) found that exposures to tobacco smoke can be possible and increasing risk of asthma when children expose to them since early life (11). And also the study by Pirastu et al (2009) found that exposures to tobacco smoke can increase both prevalence for current wheeze and current asthma (13). Smoking area at residence in our study may be from both smoking people in family or next door people while incense area focused only in residence. Therefore, our result showed that having smoking people in family was not found the association but it was possible to be risk factors (AOR>1) of having dry cough at night, phlegm, and running nose without cold symptoms. More than 7,000 chemicals were found in tobacco or cigarette smoke which are chemically active and trigger profound potentially fatal changes in the body (66). Those dangerous chemicals in cigarette smoke are tar, carbon monoxide, hydrogen cyanide, oxidizing chemicals, metals, radioactive compounds which are known effect to human health. And people can get them into body by inhale.

For incense smoke, the study by Wang et al (2011) found the association between frequency of incense burning at home and increasing risk of current asthma and exercise wheeze especially in genetically susceptible children (67). Incense was used in house especially for Buddhist family; they usually used it when praying to Buddha. Although, incense stick was mostly made from natural materials such as bamboo, and wood but some chemical materials were added for oxidizer and binding of stick when it was flamed and changed to smoke and ash, they contains many particles, gas products such as CO, CO_2, NO_2, SO_2, and many organic compounds such as benzene, toluene, xylenes, aldehydes, and polycyclic aromatic hydrocarbons (PAHs) which those mixtures can affect to respiratory system in human (68, 69).

Although other environments including presenting of vectors, having home renovation, charcoal smoke (from cooking stove), and flowers with pollen were not statistical significance with respiratory and asthma symptoms which is inconsistent with other studies.

Many vectors are known as risk factors of allergic symptoms, respiratory symptoms including asthma symptoms especially cockroach which is indicated that vectors of indoor are dirt and decay in house (70) and it is the most key allergen in household especially inner-city house. Some worst asthma cases were found that those cases who had both exposures to high concentrations of cockroach allergens in house and allergic tendency to make reactions to cockroach allergens (53). The study by Chen et al (2011) found that among children who expose to cockroaches since early in life was associated with asthma (OR=2.16; 95% CI, 1.15-4.07) (11), and Kim et al (2005) (52) as well. In addition, the reviewed studies by Do et

al (2016) also showed the significant association on linkage of cockroach's allergen-induced asthma (53) from many studies.

Furthermore, the study by Dong et al (2014) found that the having renovation in house in the past two years was significantly associated with respiratory symptoms and asthma among children which can increase prevalence of those symptoms (71). When doing home renovation, many substances can be produce during home's construction such as chemicals from painting, dust from material (e.g. roof, cement, etc.) that many of them can either cause allergies and respiratory symptoms (72).

In addition the study by Erbas et al (2013) found the association between exposures to pollen and asthma (AOR>1) that appearance of asthma in children can be increasing by persistently exposure to pollen during infancy (56).

Moreover, Charcoal smoke which was produced when incomplete burning of carbon-containing materials to a mixture of particles and chemicals form. The mixture of those in smoke such as carbon monoxide (CO), carbon dioxide (CO_2) and particulate matter (PM or soot) which dangerous for human when exposures (73). As a result in the study by Bautista et al (2009) found increasing the risk of respiratory infection in young children when exposure to charcoal smoke (74), and Salo et al (2004) found the strongest associations (OR>1, 95%CI) between coal burning for cooking in home and wheezing among children (42).

5.3.3 Association between children's bedroom environment and respiratory and asthma symptoms

This study found that dampness of wall near children's bedroom was associated with respiratory and asthma symptoms which is consistent with the studies by Chen et al (2011) (11), Nguyen et al (2010) (12), and Wang et al (2014) (54). Dampness can cause of mold growing that mold is known as respiratory allergen (75) to respiratory and asthma symptoms.

Children who have dolls in bedroom were shown the most at risk of respiratory and asthma symptoms in this study. There were most of them (64.6%) having dolls and nearly half (42.4%) of this group put doll on their bed. Especially soft dolls which made from clothing/fur materials which can be the place of dust accumulation (76).

The result found that the more number of windows usually opened was increased risk of respiratory and asthma symptoms than less numbers of window. Since this study was conducted in high pollution area of Bangkok having windows which usually opened them that may be possible to increase a contamination of outdoor air pollution. Those sources are from emissions of vehicles both on-road and off-road in urban areas (Leung, 2015) (77). In addition, findings of the study by Kim et al. (1997) showed relationships between the Indoor/ Outdoor in Korean urban areas which confirmed the importance of ambient air in determining the quality of indoor air (78). And for long term of less cleaning room can be high concentration of dust accumulate in the room.

Although other environments including using cooling devices (air conditioner/ fan), having at least 1-2 windows, having curtain, and bringing pets into bedroom were not statistical significance with respiratory and asthma symptoms which is inconsistent with other studies (10, 11). The results found that they were possible to be risk factors (AOR>1) of having respiratory and asthma symptoms among children. And another possible reason may rely on fact that people who had asthma or respiratory disease, they usually sensitive to cold temperature than other people. When using air conditioner, the temperature may cool and affect to their respiratory system. While using fan may spread many trigger substances in the air than without using fan. Moreover, curtain can be the place of dust accumulation such as dust mite, particles including vectors. As the result found may relevant to the practice of cleaning.
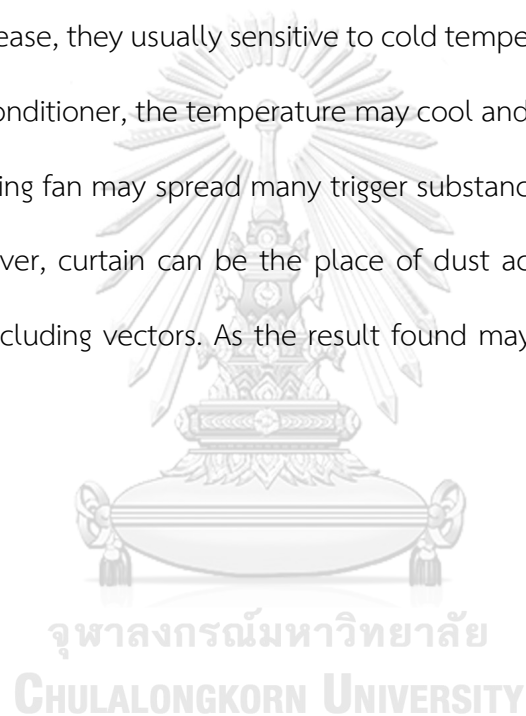
CHAPTER VI

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

This study was cross-sectional study to estimate the prevalence of respiratory and asthma symptoms and to investigate its association with residential environments among primary school children in Din Daeng district, Bangkok, Thailand between April and May, 2018. And this is the first study which focused on those relationships among children in this area. The questionnaire was used to collect the data in this study by self-reported questionnaire from children's parents or children's family. There were 658 primary school children included in this study. The statistical analysis used which were descriptive statistics, bivariate analysis (Mann – Whitney U test, Pearson Chi-square-test, and Fisher X'act test), and binary logistic regression model; to find association between dependent variables (respiratory and asthma symptoms) and independent variables (residential environments) which were divided into 3 parts; near residence, at residence, and in children's bedroom.

In conclusion, around 1 in 4 of primary school children in this area reported respiratory and asthma symptoms in the past 12 months. The most reported symptom was running nose without cold and the less reported symptoms was shortness of breath. Residential environments including tenant status, garment/clothing shop near residence, cigarette smoke, incense smoke, doll, window, and wall dampness were positive significantly associated with respiratory and asthma symptoms. However, other environments including using cooling

devices (air conditioner/ fan), having at least 1-2 windows, having curtain, and bringing pets into bedroom were not statistical significance with respiratory and asthma symptoms which is inconsistent with other studies. And those were also possible to be risk factors (AOR>1) of having the symptoms among children.

In conclusion, associations between residential environment factors and respiratory and asthma symptoms were summarized into table 27 and table 28. The symbol "+ +" was presented a significant positive association between residential factors and the symptoms while the symbol "+" showed possible positive associations but without statistical significant.
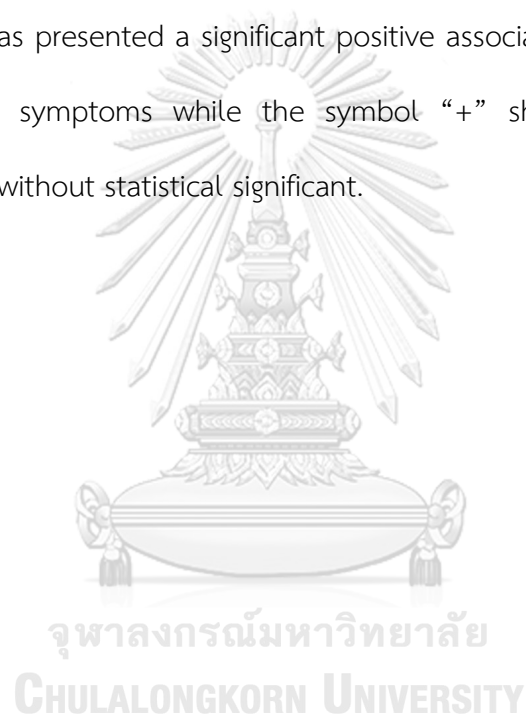
Table 27 Summary final results association between residential environment factors and respiratory and asthma symptoms (1 month)

Factors	Wheezing or whistling in the chest	Dry cough at night	Phlegm	Shortness of breath	Running nose without cold
Residential characteristics and environments near residence					
Type of residence					
Community (slum)	+				
Owner of residence					
Tenant	+ +				
Place near residence					
Furniture shop		+			
Garment/ clothing				+ +	
Residential environment at residence					
Cigarette smoke		+	+		+
Have smoking people in family			+		+
Living in smoking area		+			
Vectors (cockroach, rat, etc.)	+	+	+	+	+
Home renovation		+	+		+
Wall dampness/water leakage in residence	+		+		+
Charcoal smoke (from cooking stove)	+		+		+
Ling in charcoal smoke area	+			+	
Flowers with pollen					+
Pets (dog, cat, bird, etc.)		+	+		
Environment in children's bedroom					
Using cooling devices					
Fan		+	+		+
Have window usually used					
≤2					+
>2			+		+
Have curtain				+	+
Have doll		+ +	+ +	+ +	+ +
Bringing pets into bedroom/ sleep over		+	+	+	
Wall dampness near child's bedroom	+	+	+ +	+	+

Note. + = Possible to be risk factor but statistical significant was not achieved. (AOR>1; p>0.05)

  + + = Risk factor of respiratory and asthma symptoms. (AOR>1; $p<0.05$)

Table 28 Summary final results association between residential environment factors and respiratory and asthma symptoms (12 months)

Factors	Wheezing or whistling in the chest	Dry cough at night	Phlegm	Shortness of breath	Running nose without cold
Residential characteristics and environments near residence					
Age of residence (year)		+	+		
Owner of residence					
Tenant	+ +				
Place near residence					
Garment/ clothing				+ +	
Residential environment at residence					
Cigarette smoke		+			+
Have smoking people in family		+	+		+
Living in smoking area		+ +	+		+
Vectors (cockroach, rat, etc.)	+	+	+	+	+
Home renovation		+	+	+	+
Wall dampness/water leakage in residence	+			+	
Flowers with pollen			+	+	+
Living in incense smoke area				+ +	
Environment in children's bedroom					
Using cooling devices					
Air conditioner			+		+
Fan		+	+	+	+
Have window usually used					
≤2	+		+		+
>2	+ +	+	+ +		+ +
Have curtain		+		+	
Have doll		+ +	+ +	+ +	+ +
Bringing pets into bedroom/ sleep over		+			
Wall dampness near child's bedroom	+	+	+	+ +	+ +

Note.   +   = Possible to be risk factor but statistical significant was not achieved. (AOR>1; p>0.05)

        + +   = Risk factor of respiratory and asthma symptoms. (AOR>1; $p<0.05$)

6.2 Recommendation

According to the results in this study indicated that residential environment factors were found as possible risk factors in relation to respiratory and asthma symptoms. Therefore, the recommendations to reduce and prevent its effect to children health are as following:

(1) Parents should pay more attention about improving environment at residence especially in children's bedroom as appropriate for children health;

- moving out risk factors and increasing frequency of cleaning even curtain, doll, wall, or floor, including reducing number of dolls and do not put them on the bed, and do not bring pets into bedroom,

- cleaning the room after closed the window for reducing the concentration of dust or particulate matter that can spread into the room during opened the window,

- reducing dampness and flowers with pollen at residence,

- For home renovation; should choose the healthy product and avoiding children from renovation area until finish and less particulate matter.

(3) Preventing and avoiding children from smoke area even cigarette smoke, charcoal smoke, or incense smoke.

(4) Policymaker should do as following:

- To determine the policy for controlling the standard of rental residence especially on sanitation issue, the standard of garment/ clothing business which close to residence by integrating between governments and involved organization,

- To provide guideline and given knowledge to people in this area about preventing indoor/ outdoor air pollution and improvement the residential environment for children health.

(5) Further study should consider to use hospital base records for respiratory and asthma disease diagnosis including collecting of indoor air quality at residence and in children's bedroom would be benefit to confirm association between indoor air quality and the symptoms.

6.3 Limitation

6.3.1 This study cannot be generalizability because only 2 primary schools in Din Daneng district under control by Bangkok Metropolitan Administration were selected.

6.3.2 This study used only self-reported questionnaire which data were reported by participants themselves which may lead to information bias especially about happening of symptoms such as wheezing sound.

6.3.3 Since respiratory symptoms in this study were considered both short (1 month) and long term (12 months), this may lead to recall bias for long term symptoms.

6.3.4 This study did not exclude Respiratory Syncytial Virus disease (RSV), did not collect the data of weather, and have no question in detail about allergic rhinitis which may be confounding factor of respiratory symptoms.

REFERENCES

1. World Health Organization. The cost of a polluted environment: 1.7 million child deaths a year, says WHO 2017 [updated 6 March2017. Available from: http://www.who.int/mediacentre/news/releases/2017/pollution-child-death/en/.

2. World Health Organization. Asthma 2017 [updated April 2017; cited 2017. Available from: http://www.who.int/mediacentre/factsheets/fs307/en/.

3. The Global Initiative for Asthma (GINA). Pocket Guide for Asthma Management and Prevention (for Adult and Children Older than 5 Years) Updated 2018 2018 [cited 2018. Available from: http://ginasthma.org/gina-reports/.

4. Sanguansak Thanaviratananich S-HC. Burden of respiratory disease in Thailand: Results from the APBORD observational study. Medicine (Baltimore). 2016;2016 Jul; 95(28): e4090.

5. D'Amato G, Vitale C, Molino A, Stanziola A, Sanduzzi A, Vatrella A, et al. Asthma-related deaths. Multidiscip Respir Med. 2016;11:37.

6. Health Information Unit SaPD. Public Health Statistics A.D.2016: Health Information Unit, Strategy and Planning Division, Ministry of Public Health, Thailand; 2017 September 2017.

7. The Global Asthma Network. The Global asthma Report 2014, 2014, [Available from: http://www.globalasthmareport.org/resources/Global_Asthma_Report_2014.pdf.

8. Maipang P. Effectiveness of Pediatric Easy Asthma Clinic at Lomsak Hospital: Journal of Department of Medical Survices; 2015 [Available from: http://www.dms.moph.go.th/dmsweb/dmsweb_v2_2/content/org/webpageJDMS_30/demo/data/2559/2559-03/2559-03-10-6.pdf.

9. Cincinelli A, Martellini T. Indoor Air Quality and Health. Int J Environ Res Public Health. 2017;14(11).

10. Brunekreef B, Von Mutius E, Wong G, Odhiambo J, Garcia-Marcos L, Foliaki S, et al. Exposure to cats and dogs, and symptoms of asthma, rhinoconjunctivitis, and eczema. Epidemiology. 2012;23(5):742-50.

11. Chen YC, Tsai CH, Lee YL. Early-life indoor environmental exposures increase the risk of childhood asthma. Int J Hyg Environ Health. 2011;215(1):19-25.

12. Nguyen T1 LM, Gomez M, Reddy A, Pandya K, Medvesky M. The national asthma surveyeNew York State: association of the home environment with current asthma status. 2010.

13. Pirastu R, Bellu C, Greco P, Pelosi U, Pistelli R, Accetta G, et al. Indoor exposure to environmental tobacco smoke and dampness: respiratory symptoms in Sardinian children--DRIAS study. Environ Res. 2009;109(1):59-65.

14. Matsui EC, Hansel NN, McCormack MC, Rusher R, Breysse PN, Diette GB. Asthma in the inner city and the indoor environment. Immunol Allergy Clin North Am. 2008;28(3):665-86, x.

15. Kumar R, Nagar JK, Goel N, Kumar P, Kushwah AS, Gaur SN. Indoor air pollution and asthma in children at Delhi, India. Pneumonol Alergol Pol. 2015;83(4):275-82.

16. Health MoP. Public Health Statistics A.D. 2016: Ministry of Public Health; 2017 September, 2017.

17. Ministry of Public Health. Monthly report illness and death people on severe of lung infection 2016 [cited 2016. Available from: http://www.boe.moph.go.th/files/report/20160118_51640252.pdf.

18. Bruce N, Perez-Padilla R, Albalak R. Indoor air pollution in developing countries: a major environmental and public health challenge. Bull World Health Organ. 2000;78(9):1078-92.

19. World Health Organization. Chronic respiratory diseases 2017 [cited 2017. Available from: http://www.who.int/respiratory/en/.

20. National Heart LaBI. Asthma n.d [cited 2017. Available from: https://www.nhlbi.nih.gov/health-topics/asthma.

21. Disease GBD, Injury I, Prevalence C. Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388(10053):1545-602.

22. Lai CK, Beasley R, Crane J, Foliaki S, Shah J, Weiland S, et al. Global variation in the prevalence and severity of asthma symptoms: phase three of the

International Study of Asthma and Allergies in Childhood (ISAAC). Thorax. 2009;64(6):476-83.

23. To T, Stanojevic S, Moores G, Gershon AS, Bateman ED, Cruz AA, et al. Global asthma prevalence in adults: findings from the cross-sectional world health survey. BMC Public Health. 2012;12:204.

24. Chakravarthy S, Singh RB, Swaminathan S, Venkatesan P. Prevalence of asthma in urban and rural children in Tamil Nadu. Natl Med J India. 2002;15(5):260-3.

25. Lum EY, Sharpe HM, Nilsson C, Andrews EM, Tsuyuki RT, Mayers I, et al. Urban and rural differences in the management of asthma amongst primary care physicians in Alberta. Can J Clin Pharmacol. 2007;14(3):e275-82.

26. Sole D, Cassol VE, Sillva AR, Teche SP, Rizzato TM, Bandim LC, et al. Prevalence of symptoms of asthma, rhinitis, and atopic eczema among adolescents living in urban and rural areas in different regions of Brazil. Allergol Immunopath. 2007;35(6):248-53.

27. Ma Y, Zhao J, Han ZR, Chen YZ, Leung TF, Wong GWK. Very Low Prevalence of Asthma and Allergies in Schoolchildren From Rural Beijing, China. Pediatr Pulm. 2009;44(8):793-9.

28. Malik HU, Kumar K, Frieri M. Minimal difference in the prevalence of asthma in the urban and rural environment. Clin Med Insights Pediatr. 2012;6:33-9.

29. Wichai A, Suwat B. Health Survey in Thai Population by Physical Examination 2008: Health Information System Development Office; 2008 [cited 2008. Available from: http://www.hiso.or.th/hiso/picture/reportHealth/report/report6_8.pdf.

30. Burke W, Fesinmeyer M, Reed K, Hampson L, C. C. Family history as a predictor of asthma risk. American Journal of Preventive Medicine. 2003;24(2):9.

31. Wjst M, Dold S, Reitmeier P, Wulff A, Nicolai T, E. vM. [Does breast feeding prevent asthma and allergies? Results of the Munich asthma and allergy study]. 1992;140(10):6.

32. Salam MT, Li YF, Langholz B, Gilliland FD, Children's Health S. Early-life environmental risk factors for asthma: findings from the Children's Health Study. Environ Health Perspect. 2004;112(6):760-5.

33. Bener A, al-Jawadi TQ, Simsek M, al-Nassar KE. Heredity of asthma in Saudi population. Eur J Epidemiol. 1992;8(5):733-6.

34. Postma DS. Gender differences in asthma development and progression. Gend Med. 2007;4 Suppl B:S133-46.

35. Liu TB, Valdez R, Yoon PW, Crocker D, Moonesinghe R, Khoury MJ. The association between family history of asthma and the prevalence of asthma among US adults: National Health and Nutrition Examination Survey, 1999-2004. Genet Med. 2009;11(5):323-8.

36. Hofhuis W, de Jongste JC, Merkus PJ. Adverse health effects of prenatal and postnatal tobacco smoke exposure on children. Arch Dis Child. 2003;88(12):1086-90.

37. Williams LK, Ownby DR, Maliarik MJ, Johnson CC. The role of endotoxin and its receptors in allergic disease. Ann Allergy Asthma Immunol. 2005;94(3):323-32.

38. Gern JE. Viral respiratory infection and the link to asthma. Pediatr Infect Dis J. 2008;27(10 Suppl):S97-103.

39. Saglani S. Viral infections and the development of asthma in children. Ther Adv Infect Dis. 2013;1(4):139-50.

40. Wadonda-Kabondo N, Sterne JA, Golding J, Kennedy CT, Archer CB, Dunnill MG, et al. Association of parental eczema, hayfever, and asthma with atopic dermatitis in infancy: birth cohort study. Arch Dis Child. 2004;89(10):917-21.

41. Keet CA, Keller JP, Peng RD. Long-term Coarse PM Exposure is Associated with Asthma Among Children in Medicaid. Am J Respir Crit Care Med. 2017.

42. Salo PM, Xia J, Johnson CA, Li Y, Kissling GE, Avol EL, et al. Respiratory symptoms in relation to residential coal burning and environmental tobacco smoke among early adolescents in Wuhan, China: a cross-sectional study. Environ Health. 2004;3(1):14.

43. Fitzpatrick S, Joks R, Silverberg JI. Obesity is associated with increased asthma severity and exacerbations, and increased serum immunoglobulin E in inner-city adults. Clin Exp Allergy. 2012;42(5):747-59.

44. Alvarez Zallo N, Guillen Grima F, Aguinaga-Ontoso I, Hermoso-de-Mendoza-Canton J, Marin Fernandez B, Serrano-Monzo I, et al. [Study of prevalence and

association between asthma symptoms and obesity in the pediatric population of Pamplona]. Nutr Hosp. 2014;30(3):519-25.

45. Feitosa CA, Santos DN, Barreto do Carmo MB, Santos LM, Teles CA, Rodrigues LC, et al. Behavior problems and prevalence of asthma symptoms among Brazilian children. J Psychosom Res. 2011;71(3):160-5.

46. Michael A. Kaliner, Richard F. Lockey, Jennifer E. Fergeson, Richard F. Lockey. Acute Asthma 2015 [updated July 2015; cited 2004. Available from: http://www.worldallergy.org/professional/allergic_diseases_center/asthma/.

47. Qu YL, Liu J, Zhang LX, Wu CM, Chu AJ, Wen BL, et al. Asthma and the risk of lung cancer: a meta-analysis. Oncotarget. 2017;8(7):11614-20.

48. Trakultivakorn M, Sangsupawanich P, Vichyanond P. Time trends of the prevalence of asthma, rhinitis and eczema in Thai children-ISAAC (International Study of Asthma and Allergies in Childhood) Phase Three. J Asthma. 2007;44(8):609-11.

49. Pearce N, Ait-Khaled N, Beasley R, Mallol J, Keil U, Mitchell E, et al. Worldwide trends in the prevalence of asthma symptoms: phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). Thorax. 2007;62(9):758-66.

50. U.S. EPA. What is Particle Pollution? n.d [cited 2017. Available from: https://www.epa.gov/pmcourse/what-particle-pollution.

51. World Health Organization. WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide: Global update 2005 (Summary of risk assessment)2006.

52. J. L. Kim LE, Y. Mi,, M. Johansson GS, Norbck D. Current asthma and respiratory symptoms among pupils in relation to dietary factors and allergens in the school environment. 2005.

53. Do DC, Zhao Y, Gao P. Cockroach allergen exposure and risk of asthma. Allergy. 2016;71(4):463-74.

54. Wang J, Li B, Yu W, Yang Q, Wang H, Huang D, et al. Rhinitis symptoms and asthma among parents of preschool children in relation to the home environment in Chongqing, China. PLoS One. 2014;9(4):e94731.

55. Annesi-Maesano I, Moreau D, Caillaud D, Lavaud F, Le Moullec Y, Taytard A, et al. Residential proximity fine particles related to allergic sensitisation and asthma in primary school children. Respir Med. 2007;101(8):1721-9.

56. Erbas B1 LA, Lodge CJ, Matheson MC, Hosking CS, Hill DJ, Vicendese D, Allen KJ, Abramson MJ, Dharmage SC. Persistent pollen exposure during infancy is associated with increased risk of subsequent childhood asthma and hayfever. 2013.

57. Ronna C. Turner, Carlson L. Indexes of Item-Objective Congruence for Multidimensional Items. International Journal of Testing. 1977;3.

58. Wei Liu, Chen Huang, Yu Hu, Zhijun Zou, Zhuohui Zhao, Jan Sundell. Association of building characteristics, residential heating and ventilation with asthmatic symptoms of preschool children in Shanghai: A cross-sectional study. SAGE Journals. 2014;23(2):14.

59. Mathew, J., Goyal, R., Taneja, K.K. Air pollution and respiratory health of school children in industrial, commercial and residential areas of Delhi. 2014;8(4):7.

60. Yao J, Zhou Y, Wang J, Wu H, Liu H, Shi Y, et al. Relationship between obesity and sex, and prevalence of asthma-like disease and current wheeze in Han children in Nanjing, China. J Int Med Res. 2015;43(1):139-46.

61. Radhakrishnan DK, Dell SD, Guttmann A, Shariff SZ, Liu K, To T. Trends in the age of diagnosis of childhood asthma. J Allergy Clin Immunol. 2014;134(5):1057-62 e5.

62. Silpasuwan P, Prayomyong S, Sujitrat D, Suwan-Ampai P. Cotton Dust Exposure and Resulting Respiratory Disorders Among Home-Based Garment Workers. Workplace Health Saf. 2016;64(3):95-102.

63. Chumchai P, Silapasuwan P, Wiwatwongkasem C, Arphorn S, Suwan-Ampai P. Prevalence and risk factors of respiratory symptoms among home-based garment workers in Bangkok, Thailand. Asia Pac J Public Health. 2015;27(4):461-8.

64. Wiggans RE, Evans G, Fishwick D, Barber CM. Asthma in furniture and wood processing workers: a systematic review. Occup Med (Lond). 2015;66(3):193-201.

65. World Health Organization. Global Health Observatory (GHO) data: Top 10 causes of death, 2015 [cited 2015. Available from: http://www.who.int/gho/mortality_burden_disease/causes_death/top_10/en/.

66. State of Victoria. Smoking - effects on your body: State of Victoria; 2018 [cited 2018. Available from: https://www.betterhealth.vic.gov.au/health/healthyliving/smoking-effects-on-your-body.

67. Wang IJ, Tsai CH, Chen CH, Tung KY, Lee YL. Glutathione S-transferase, incense burning and asthma in children. Eur Respir J. 2011;37(6):1371-7.

68. Torben Eggert, Ole Christian Hansen. Survey and emission of chemical substances from incense. 2004.

69. Wang B, Lee SC, Ho KF, Kang YM. Characteristics of emissions of air pollutants from burning of incense in temples, Hong Kong. Sci Total Environ. 2004;377(1):52-60.

70. Partners Asthma Center. BREATH OF FRESH AIR: FEATURE ARTICLES Chapter 13: Roaches and Asthma: Lessons to be Learned 2010 [cited 2010. Available from: http://www.asthma.partners.org/NewFiles/BoFAChapter13.html.

71. Dong GH, Qian ZM, Wang J, Trevathan E, Liu MM, Wang D, et al. Home renovation, family history of atopy, and respiratory symptoms and asthma among children living in China. Am J Public Health. 2014;104(10):1920-7.

72. Claire Gagné Could Your House Be Causing Allergies and Asthma? Allergic Living magazine. 2010 June 30 2010.

73. New York State Department of Health. Exposure to Smoke from Fires: New York State Department of Health,; 2016 [updated October 2016; cited 2016. Available from: https://www.health.ny.gov/environmental/outdoors/air/smoke_from_fire.htm.

74. Bautista LE, Correa A, Baumgartner J, Breysse P, Matanoski GM. Indoor charcoal smoke and acute respiratory infections in young children in the Dominican Republic. Am J Epidemiol. 2009;169(5):572-80.

75. Centers for Disease Control and Prevention (CDC). Facts about Mold and Dampness 2017 [updated September 5, 2017; cited 2017 September 5]. Available from: https://www.cdc.gov/mold/dampness_facts.htm.

76. Talreja. Stuffed Toys – A Trigger Of Allergies and Asthma: The Allergy Group; 2015 [cited 2015. Stuffed toys collect plenty of dust and germs while they are being

carried everywhere by your kids. These toys could hence be a source of infection and allergies for your child. Here are some tips on how to sanitize your kid's stuffed toys.]. Available from: https://theallergygroup.com/Blog/ArticleID/44/Stuffed-Toys-%E2%80%93-A-Trigger-Of-Allergies-and-Asthma.

77. Chuen-yu Chan. Outdoor-indoor air pollution in urban environment: challenges and opportunity. Environmental Science Journals,. 2015.

78. S. O., Kim, Y. S., Perry, R. Indoor air quality in homes, offices and restaurants in Korean urban areas—indoor/outdoor relationships. Atmospheric Environment. 1997;31(4):15.

APPENDIX

APPENDIX A

ETHICAL APPROVAL

AF 01-12

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย
254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330
โทรศัพท์/โทรสาร: 0-2218-3202 E-mail: eccu@chula.ac.th

COA No. 085/2561

ใบรับรองโครงการวิจัย

โครงการวิจัยที่ 048.1/61	:	ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดิน หายใจและโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ใน พื้นที่เขตดินแดง กรุงเทพมหานคร ประเทศไทย
ผู้วิจัยหลัก	:	นางสาวนวรัตน์ อภิชัยนันท์
หน่วยงาน	:	วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย
ได้พิจารณา โดยใช้หลัก ของ The International Conference on Harmonization – Good Clinical Practice
(ICH-GCP) อนุมัติให้ดำเนินการศึกษาวิจัยเรื่องดังกล่าวได้

ลงนาม..

(รองศาสตราจารย์ นายแพทย์ปรีดา ทัศนประดิษฐ)
ประธาน

ลงนาม..

(ผู้ช่วยศาสตราจารย์ ดร.นันทรี ชัยชนะวงศาโรจน์)
กรรมการและเลขานุการ

วันที่รับรอง : 9 เมษายน 2561   **วันหมดอายุ** : 8 เมษายน 2562

เอกสารที่คณะกรรมการรับรอง

1) โครงการวิจัย
2) ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยและใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย
3) ผู้วิจัย
4) แบบสอบถาม

เลขที่โครงการวิจัย 048.1/61

วันที่รับรอง - 9 เม.ย. 2561

วันหมดอายุ - 8 เม.ย. 2562

เงื่อนไข

1. ข้าพเจ้ารับทราบว่าเป็นการผิดจริยธรรม หากดำเนินการเก็บข้อมูลการวิจัยก่อนได้รับการอนุมัติจากคณะกรรมการพิจารณาจริยธรรมการวิจัยฯ
2. หากใบรับรองโครงการวิจัยหมดอายุ การดำเนินการวิจัยต้องยุติ เมื่อต้องการต่ออายุต้องขออนุมัติใหม่ล่วงหน้าไม่ต่ำกว่า 1 เดือน พร้อมส่งรายงาน ความก้าวหน้าการวิจัย
3. ต้องดำเนินการวิจัยตามที่ระบุไว้ในโครงการวิจัยอย่างเคร่งครัด
4. ใช้เอกสารข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย ใบยินยอมของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย และเอกสารเชิญเข้า ร่วมวิจัย (ถ้ามี) **เฉพาะที่ประทับตราคณะกรรมการเท่านั้น**
5. หากเกิดเหตุการณ์ไม่พึงประสงค์ร้ายแรงในสถานที่เก็บข้อมูลที่ขออนุมัติจากคณะกรรมการ ต้องรายงานคณะกรรมการภายใน 5 วันทำการ
6. หากมีการเปลี่ยนแปลงการดำเนินการวิจัย ให้ส่งคณะกรรมการพิจารณารับรองก่อนดำเนินการ
7. โครงการวิจัยไม่เกิน 1 ปี ส่งแบบรายงานสิ้นสุดโครงการวิจัย (AF 03-12) และบทคัดย่อผลการวิจัยภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น สำหรับ โครงการวิจัยที่เป็นวิทยานิพนธ์ให้ส่งบทคัดย่อผลการวิจัย ภายใน 30 วัน เมื่อโครงการวิจัยเสร็จสิ้น

APPENDIX B

Participants Information Sheet of Questionnaire

AF 04-07

ข้อมูลสำหรับกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ชื่อโครงการวิจัย ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจและ
โรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ในเขตพื้นที่ชั้นในของ
กรุงเทพมหานคร ประเทศไทย

ชื่อผู้วิจัย นางสาวนวรัตน์ อภิชัยนันท์ ตำแหน่ง นักศึกษาระดับมหาบัณฑิต

สถานที่ติดต่อผู้วิจัย 45/5 ซอยกรุงเทพนนท์ 3 แยก 2 ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี

โทรศัพท์มือถือ 06 2640 4442   E-mail : nawarat.t@anamai.mail.go.th

1. ขอเรียนเชิญท่านเข้าร่วมในการวิจัย ก่อนที่ท่านจะตัดสินใจเข้าร่วมในการวิจัย มีความจำเป็น
ที่ท่านควรทำความเข้าใจว่างานวิจัยนี้ทำเพราะเหตุใด และเกี่ยวข้องกับอะไร กรุณาใช้เวลาในการอ่านข้อมูล
ต่อไปนี้อย่างละเอียดรอบคอบ และสอบถามข้อมูลเพิ่มเติมหรือข้อมูลที่ไม่ชัดเจนได้ตลอดเวลา

2. โครงการนี้เกี่ยวข้องกับการวิจัย สิ่งแวดล้อมทั้งภายในและภายนอกบ้าน หรือที่อยู่อาศัยของ
เด็กนักเรียนระดับประถมศึกษาชั้นปีที่ 1 – 3 ว่ามีความเกี่ยวข้องกับการเกิดอาการของโรคระบบทางเดิน
หายใจหรือโรคหืดในเด็กหรือไม่

3. รายละเอียดของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

● ลักษณะของกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย   เกณฑ์การคัดเข้า และเกณฑ์
การคัดออก

-กลุ่มประชากร ได้แก่ เด็กนักเรียนระดับประถมศึกษาชั้นปีที่ 1 – 3 ของโรงเรียนในสังกัด
กรุงเทพมหานคร ในพื้นที่เขตดินแดง จำนวน 3 แห่ง ได้แก่

1) โรงเรียนสามเสนนอก

2) โรงเรียนวิชากร

3) โรงเรียนวิชูทิศ

- เกณฑ์การคัดเข้า ดังนี้

1) เด็กนักเรียนมีอายุระหว่าง 6 – 9 ปี

2) เด็กนักเรียนที่กำลังเรียนอยู่ระดับประถมศึกษาชั้นปีที่ 1   –   3 ในโรงเรียน
3 แห่ง ที่คัดเลือกเป็นพื้นที่เป้าหมายในการวิจัยครั้งนี้

3) บ้านที่เด็กนักเรียนอาศัยอยู่ปัจจุบันอยู่ในพื้นที่เขตดินแดง และเด็กอาศัยอยู่ที่บ้าน
หลังนี้ไม่น้อยกว่า 1 ปี ก่อนการเก็บข้อมูลวิจัยครั้งนี้

4) เด็กนักเรียน และผู้ปกครองยินดีที่จะเข้าร่วมการวิจัยหรือให้ข้อมูลในแบบสอบถาม

- เกณฑ์การคัดออก ดังนี้

1) เด็กนักเรียนที่เพิ่งรับการผ่าตัด หรือรักษาเกี่ยวกับอาการที่เกี่ยวข้องกับระบบ
ทางเดินหายใจ ได้แก่ ไซนัส หรือโพรงจมูก

2) เด็กนักเรียนที่มีโรคประจำตัว ได้แก่ ไซนัส หรือกรดไหลย้อน

048.1/61

วันที่รับรอง   – 9 เม.ย. 2561

วันหมดอายุ   – 8 เม.ย. 2562

AF 04-07

- ในการศึกษาครั้งนี้มีจำนวนเด็กนักเรียนที่เข้าร่วมการศึกษาทั้งสิ้น 1,807 คน
- วิธีการได้มาซึ่งกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัยครั้งนี้ เป็นการคัดเลือก
กลุ่มประชากรเด็กวัยเรียนทั้งหมด ที่กำลังเรียนอยู่ในโรงเรียนสามเสนนอก โรงเรียนวิชากร และโรงเรียน
วิชูทิศ และมีที่อยู่อาศัยตั้งอยู่ในพื้นที่เขตดินแดงซึ่งมีค่ามลพิษทางอากาศสูงที่สุดในกรุงเทพมหานคร
ตามผลการตรวจวัดค่ามลพิษทางอากาศของกรมควบคุมมลพิษ

4. กระบวนการการวิจัยที่กระทำต่อกลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

การวิจัยนี้ เก็บข้อมูลโดยใช้แบบสอบถาม ซึ่งจะดำเนินการกับกลุ่มเป้าหมายระหว่างวันที่
26 มีนาคม -31 พฤษภาคม พ.ศ. 2561 โดยมีขั้นตอนในการกระจายแบบสอบถาม และเก็บคืน
แบบสอบถาม ดังนี้

*ขั้นตอนที่ 1 ผู้วิจัยขออนุญาตผู้อำนวยการ โรงเรียนเพื่อขอเข้าไปทำการวิจัย จากนั้นจะประสานครู
ประจำชั้นเรียนทั้งหมดที่เกี่ยวข้องเพื่อทำความเข้าใจเกี่ยวกับวัตถุประสงค์การวิจัย ตลอดจนการดำเนินการ
เก็บข้อมูล*

*ขั้นตอนที่ 2 ผู้วิจัยและผู้ช่วยวิจัยจะเป็นผู้แจกแบบสอบถาม พร้อมอธิบายสรุปสาระสำคัญ
โครงการวิจัย วัตถุประสงค์การวิจัย เกณฑ์การคัดเข้า-คัดออกกลุ่มตัวอย่าง และ การตอบคำถามตาม
แบบสอบถามการวิจัย ซึ่งมีจำนวนทั้งสิ้น 64 ข้อ ใช้เวลาทำแบบสอบถามโดยประมาณ 25 นาที ให้กับ
ผู้ปกครองของเด็กนักเรียนกลุ่มเป้าหมายในการวิจัยนี้ เพื่อให้ข้อมูลเกี่ยวกับเด็ก และสิ่งแวดล้อม
ในที่อยู่อาศัยของเด็ก โดยดำเนินการผ่านช่องทางการประชุมผู้ปกครอง ซึ่งจะดำเนินการแล้วเสร็จ
ในวันดังกล่าว แต่ทั้งนี้ หากผู้ปกครองท่านใดที่ไม่สะดวกดำเนินการในวันนั้น และประสงค์เข้าร่วม
การวิจัย สามารถนำแบบสอบถามกลับไปทำที่บ้านได้ ไม่เกิน 2 สัปดาห์ และนำส่งคืนให้ครูประจำชั้น
ซึ่งผู้วิจัยจะจัดทำกล่องเก็บคืนแบบสอบถามวาง ไว้ที่ป้อมยาม และมาทำการเก็บคืนแบบสอบถามต่อไป
แต่อย่างไรก็ดี ผู้ปกครองที่ผ่านการคัดกรองแล้วเท่านั้น จึงนำแบบสอบถามกลับไปทำที่บ้านได้*

*ผู้ปกครองทำแบบคัดกรอง (แบบประเมินก่อนทำแบบสอบถาม) เพื่อคัดเข้าและคัดออกกลุ่ม
ตัวอย่างตามวัตถุประสงค์การวิจัย ก่อนดำเนินการให้ข้อมูลตอบแบบสอบถามการวิจัย โดยหากพบว่าไม่
ตรงตามวัตถุประสงค์การวิจัย ผู้ปกครอง ไม่ต้องทำแบบสอบถามดังกล่าวต่อไป*

*ขั้นตอนที่ 3 ผู้มีส่วนร่วมในการวิจัยลงนามในเอกสารแสดงความยินยอมเข้าร่วมการวิจัย ก่อนทำ
แบบสอบถามการวิจัย*

ขั้นตอนที่ 4 *ผู้วิจัยและผู้ช่วยวิจัยเก็บคืนแบบสอบถาม พร้อมตรวจสอบความถูกต้อง ครบถ้วนของ
แบบสอบถาม*

นอกจากนี้ ข้อคำถามในแบบสอบถามการวิจัยครั้งนี้ ไม่มีการระบุชื่อบุคคล ทั้งเด็กนักเรียน
และผู้ปกครอง ซึ่งข้อมูลดังกล่าวจะใช้เพื่อการวิจัยครั้งนี้เท่านั้น

5. กระบวนการให้ข้อมูลแก่กลุ่มประชากรหรือผู้มีส่วนร่วมในการวิจัย

ผู้วิจัยจะชี้แจงวัตถุประสงค์ของโครงการวิจัย และอธิบายการตอบแบบสอบถามให้กับ
ครูประจำชั้น ซึ่งจะเป็นผู้กระจายแบบสอบถามไปยังผู้ปกครองของเด็ก อีกทั้ง ผู้วิจัยได้จัดทำข้อมูลเกี่ยวกับ

AF 04-07

โครงการวิจัย และคำอธิบายการตอบคำถามแนบไปพร้อมกับแบบสอบถาม หากผู้ตอบแบบสอบถาม
มีข้อสงสัยใดระหว่างการตอบแบบสอบถามดังกล่าว สามารถติดต่อสอบถามได้จากผู้วิจัยได้โดยตรง
ผ่านข้อมูลการติดต่อที่ระบุไว้ในแบบสอบถาม

      6. การให้ข้อมูลตามแบบสอบถามการวิจัยนี้ ไม่มีการระบุชื่อบุคคลในแบบสอบถาม จึงไม่มี
ความเสี่ยงหรืออันตรายใดต่อผู้ตอบแบบสอบถามหรือให้ข้อมูล แต่ทั้งนี้ การวิจัยครั้งนี้ ขึ้นอยู่กับความ
สมัครใจหรือยินดีเข้าร่วมในงานวิจัยเท่านั้น

      7. *การวิจัยครั้งนี้ อาจไม่มีประโยชน์โดยตรงต่อผู้ให้ข้อมูลแต่จะมีประโยชน์ต่อส่วนรวมใน
ระดับโรงเรียน ซึ่งผู้วิจัยจะจัดส่งข้อมูลผลการวิเคราะห์ข้อมูล หรือผลการศึกษาให้กับโรงเรียนเพื่อทราบ
สถานการณ์ความชุกของโรคระบบทางเดินหายใจ และโรคหืดในโรงเรียนที่ศึกษา ซึ่งสามารถใช้ในการ
วางแผนเพื่อการดูแลสุขภาพเด็กในโรงเรียนได้ต่อไป*

      8. การเข้าร่วมในการวิจัยของท่านเป็นไปโดย**สมัครใจ** และสามารถ**ปฏิเสธ**ที่จะเข้าร่วมหรือ
ถอนตัวจากการวิจัยได้ทุกขณะ โดยไม่ต้องให้เหตุผลและไม่สูญเสียประโยชน์ที่พึงได้รับ

      9. หากท่านมีข้อสงสัยให้สอบถามเพิ่มเติมได้โดยสามารถติดต่อผู้วิจัยได้ตลอดเวลา และหาก
ผู้วิจัยมีข้อมูลเพิ่มเติมที่เป็นประโยชน์หรือโทษเกี่ยวกับการวิจัย ผู้วิจัยจะแจ้งให้ท่านทราบอย่างรวดเร็ว

      10. ข้อมูลที่เกี่ยวข้องกับท่านจะเก็บเป็นความ**ลับ** หากมีการเสนอผลการวิจัยจะเสนอเป็นภาพรวม
ข้อมูลใดที่สามารถระบุถึงตัวท่านได้จะไม่ปรากฏในรายงาน

      11.ผู้เข้าร่วมการวิจัยและผู้มีส่วนร่วมวิจัยครั้งนี้ซึ่งเป็นผู้ปกครองของเด็กนักเรียน จะได้รับอาหารว่าง
เครื่องดื่ม และของที่ระลึก ในราคารวมกัน ไม่เกิน 50 บาท ในการตอบแบบสอบถามการวิจัย

      12. "หากท่านไม่ได้รับการปฏิบัติตามข้อมูลดังกล่าวสามารถร้องเรียนได้ที่ คณะกรรมการ
พิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2
ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์/โทรสาร 0-2218-3202 E-mail: eccu@chula.ac.th"

048.1/61
- 9 เม.ย. 2561

วันหมดอายุ.............- 8 เม.ย. 2562............

APPENDIX C

Consent form of questionnaire

AF05-07

หนังสือแสดงความยินยอมเข้าร่วมการวิจัย

ทำที่..

วันที่............เดือน...................พ.ศ. ....

เลขที่ ประชากรตัวอย่างหรือผู้มีส่วนร่วมในการวิจัย........................

ข้าพเจ้า ซึ่งได้ลงนามท้ายหนังสือนี้ ขอแสดงความยินยอมเข้าร่วมโครงการวิจัย เรื่อง ความสัมพันธ์ระหว่าง สิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจและโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้น ที่อาศัยอยู่ในเขตพื้นที่ชั้นในของกรุงเทพมหานคร ประเทศไทย โดยผู้วิจัยชื่อ   นางสาวนวรัตน์ อภิชัยนันท์ ที่อยู่ 45/5 ซอยกรุงเทพนนท์ 3 แยก 2 ตำบลบางเขน อำเภอเมืองนนทบุรี จังหวัดนนทบุรี โทรศัพท์ (มือถือ) 06 2640 4442

ข้าพเจ้า **ได้รับทราบ**รายละเอียดเกี่ยวกับที่มาและวัตถุประสงค์ในการทำวิจัย รายละเอียดขั้นตอนต่างๆ ที่จะต้องปฏิบัติหรือได้รับการปฏิบัติ ความเสี่ยง/อันตราย และประโยชน์ซึ่งจะเกิดขึ้นจากการวิจัยเรื่องนี้ โดยได้อ่าน รายละเอียดในเอกสารชี้แจงผู้เข้าร่วมการวิจัยโดยตลอด และได้รับคำอธิบายจากผู้วิจัย **จนเข้าใจเป็นอย่างดีแล้ว**

ข้าพเจ้าจึง**สมัครใจ**เข้าร่วมใน โครงการวิจัยนี้ ตามที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย โดยข้าพเจ้า ยินยอมตอบแบบสอบถามเพื่อการวิจัยในครั้งนี้ *ซึ่งมีจำนวน 64 ข้อ ใช้เวลาโดยประมาณ 25 นาที*

ข้าพเจ้ามีสิทธิ**ถอนตัว**ออกจากการวิจัยเมื่อใดก็ได้ตามความประสงค์ โดย**ไม่ต้องแจ้งเหตุผล** ซึ่งการถอนตัว ออกจากการวิจัยนั้น จะไม่มีผลกระทบในทางใดๆ ต่อข้าพเจ้าทั้งสิ้น

ข้าพเจ้าได้รับคำรับรองว่า ผู้วิจัยจะปฏิบัติต่อข้าพเจ้าตามข้อมูลที่ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย และข้อมูลใดๆ ที่เกี่ยวข้องกับข้าพเจ้า ผู้วิจัยจะเก็บรักษาเป็นความลับ โดยจะนำเสนอข้อมูลการวิจัยเป็นภาพรวม เท่านั้น ไม่มีข้อมูลใดในการรายงานที่จะนำไปสู่การระบุตัวข้าพเจ้า

หากข้าพเจ้าไม่ได้รับการปฏิบัติตรงตามที่ได้ระบุไว้ในเอกสารชี้แจงผู้เข้าร่วมการวิจัย ข้าพเจ้าสามารถ ร้องเรียนได้ที่คณะกรรมการพิจารณาจริยธรรมการวิจัยในคน กลุ่มสหสถาบัน ชุดที่ 1 จุฬาลงกรณ์มหาวิทยาลัย 254 อาคารจามจุรี 1 ชั้น 2 ถนนพญาไท เขตปทุมวัน กรุงเทพฯ 10330 โทรศัพท์/โทรสาร 0-2218-3202

E-mail: eccu@chula.ac.th

ข้าพเจ้าได้ลงลายมือชื่อไว้เป็นสำคัญต่อหน้าพยาน ทั้งนี้ข้าพเจ้าได้รับสำเนาเอกสารชี้แจงผู้เข้าร่วมการวิจัย และสำเนาหนังสือแสดงความยินยอมไว้แล้ว

ลงชื่อ...

(นางสาวนวรัตน์ อภิชัยนันท์)

ผู้วิจัยหลัก

ลงชื่อ...

(...)

ผู้มีส่วนร่วมในการวิจัย

ลงชื่อ...

(...)

พยาน

เลขที่โครงการวิจัย   048.1/61

วันที่รับรอง   - 9 เม.ย. 2561

วันหมดอายุ   - 8 เม.ย. 2562

V.2.4/2558

APPENDIX D

Screening questionnaire Thai version

for inclusion and exclusion criteria of study population

แบบประเมินก่อนทำแบบสอบถาม

แบบประเมินส่วนนี้มีวัตถุประสงค์เพื่อคัดกรองเบื้องต้นก่อนที่ท่านจะตอบแบบสอบถาม

เรื่อง ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจ และโรคหืด

ในเด็กนักเรียนระดับประถมศึกษาตอนต้นในเขตพื้นที่ชั้นในของพื้นที่กรุงเทพมหานคร ประเทศไทย

คำชี้แจง : กรุณาระบุเครื่องหมาย ✔ หรือเติมข้อความในช่องว่างที่กำหนด

1. บุตรของท่านเป็นหวัดในช่วงเวลาที่ให้ข้อมูลในแบบสอบถามนี้หรือไม่

☐¹ ไม่เป็น   ☐² เป็น

2. บุตรของท่านเพิ่งรับการผ่าตัดโพรงจมูกเนื่องจากเป็นโรคไซนัสอักเสบ หรือโรคแทรกซ้อนที่เกี่ยวกับระบบทางเดิน
หายใจ ในช่วงเวลาที่ให้ข้อมูลในแบบสอบถามนี้หรือไม่

☐¹ ไม่มี   ☐² มี

3. บุตรของท่านมี หรือเคยมี โรคประจำตัว ได้แก่ กรดไหลย้อน ไซนัสอักเสบ และโรคแทรกซ้อนเกี่ยวกับระบบทางเดินหายใจ
หรือไม่

☐¹ ไม่มี   ☐² มี

◯¹ กรดไหลย้อน

◯² โรคไซนัสอักเสบ

◯³ โรคแทรกซ้อนเกี่ยวกับระบบทางเดินหายใจอื่นๆ ระบุ.........

4. บ้านที่เด็กอาศัยอยู่ ตั้งอยู่ในพื้นที่เขตดินแดง กรุงเทพมหานคร หรือไม่

☐¹ ไม่ใช่   ☐² ใช่ (ตอบข้อ 5)

5. เด็กอาศัยอยู่ในบ้านหลังนี้ไม่น้อยกว่า 1 ปี ใช่หรือไม่

☐¹ ไม่ใช่   ☐² ใช่

048.1/61

ฯที่รับรอง   - 9 เม.ย. 2561

วันหมดอายุ   - 8 เม.ย. 2562

--- ขอขอบพระคุณที่กรุณาตอบแบบสอบถาม ---

APPENDIX E

Questionnaire Thai version

รหัสผู้ตอบแบบสอบถาม ☐☐☐☐

วิทยาลัยวิทยาศาสตร์สาธารณสุข
จุฬาลงกรณ์มหาวิทยาลัย
COLLEGE OF PUBLIC HEALTH SCIENCES
CHULALONGKORN UNIVERSITY

แบบสอบถามเพื่อการวิจัย
เรื่อง ความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการของโรคระบบทางเดินหายใจ และโรคหืด
ในเด็กนักเรียนระดับประถมศึกษาตอนต้นในเขตพื้นที่ชั้นในของพื้นที่กรุงเทพมหานคร
วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

       แบบสอบถามฉบับนี้ มีจุดมุ่งหมายเพื่อศึกษาวิจัยหาความสัมพันธ์ระหว่างสิ่งแวดล้อมที่อยู่อาศัยกับอาการแสดง
ของโรคระบบทางเดินหายใจ และโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่ในพื้นที่กรุงเทพมหานคร
ซึ่งข้อมูลจากแบบสอบถามนี้ใช้เพื่อการวิจัยเท่านั้น โดยผลการศึกษาวิจัยครั้งนี้จะเป็นประโยชน์ในทางวิชาการและ
สามารถนำมาพัฒนาแนวทางการส่งเสริมคุณภาพชีวิตของเด็กวัยเรียนที่อาศัยอยู่ในชุมชนเมืองได้ต่อไป และการตอบ
แบบสอบถามนี้จะไม่มีผลกระทบต่อท่านแต่อย่างใด

       แบบสอบถามนี้แบ่งออกเป็น 5 ส่วน *(ใช้เวลาประมาณ 25 นาที)* ดังนี้

- ส่วนที่ 1 ข้อมูลทั่วไปเกี่ยวกับเด็กนักเรียน
- ส่วนที่ 2 ข้อมูลทั่วไปเกี่ยวกับผู้ปกครองของเด็ก
- ส่วนที่ 3 กิจกรรมของเด็ก
- ส่วนที่ 4 อาการของโรคระบบทางเดินหายใจและโรคหืดในเด็กนักเรียน
- ส่วนที่ 5 ข้อมูลเกี่ยวกับสิ่งแวดล้อมที่อยู่อาศัยของเด็ก

ข้อมูลเกี่ยวกับโครงการวิจัย:

1. กลุ่มเป้าหมายที่ศึกษา: เด็กนักเรียนระดับประถมศึกษาตอนต้น มีอายุระหว่าง 6 – 10 ปี
                    ศึกษา และพักอาศัยอยู่ใน*พื้นที่เขตดินแดง* กรุงเทพมหานคร

2. วัตถุประสงค์การวิจัย: 2.1 เพื่อหาความชุกของโรคระบบทางเดินหายใจและโรคหืดในเด็กนักเรียนระดับประถมศึกษา
                            ตอนต้นที่อาศัยอยู่ในพื้นที่*เขตดินแดง* กรุงเทพมหานคร

                         2.2 เพื่อหาความสัมพันธ์ระหว่างคุณลักษณะของเด็กที่เกี่ยวข้องกับอาการแสดงของโรค
                            ระบบทางเดินหายใจและโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้น

                         2.3 เพื่ออธิบายความสัมพันธ์ระหว่างปัจจัยด้านสิ่งแวดล้อมในที่พักอาศัยกับอาการของโรค
                            ระบบทางเดินหายใจและโรคหืดในเด็กนักเรียนระดับประถมศึกษาตอนต้นที่อาศัยอยู่
                            ในพื้นที่*เขตดินแดง* กรุงเทพมหานคร

3. ช่วงเวลาเก็บข้อมูล: ระหว่างเดือนมีนาคม – พฤษภาคม พ.ศ. 2561

> *หากท่านมีข้อสงสัยในแบบสอบถามวิจัยฉบับนี้ สามารถติดต่อสอบถามเพิ่มเติมได้ที่ 06 2640 4442*

1

ส่วนที่ 1 ข้อมูลทั่วไปเกี่ยวกับเด็กนักเรียน

    คำชี้แจง : กรุณาระบุเครื่องหมาย ✓ หรือเติมข้อความในช่องว่างที่กำหนด

ส่วนนี้ สำหรับผู้วิจัย

1. ชื่อโรงเรียน ....

Q1001	

2. อายุ (เด็กนักเรียน) ....ปี

Q1002	

3. เพศ: ☐¹ ชาย ☐² หญิง

Q1003	

4. ส่วนสูง .... ซม.

Q1004	

5. น้ำหนัก (ปัจจุบัน)........................ กก. น้ำหนัก (แรกเกิด) ....กก.

Q1005 (1)	
(2)	

6. อาคารเรียนประจำชั้นของเด็กมีทั้งหมดกี่ชั้น ระบุ ....

Q1006 (1)	

    ห้องเรียนของเด็กอยู่ชั้นใดของอาคาร ระบุ ....

Q1006 (2)	

ส่วนที่ 2 ข้อมูลทั่วไปเกี่ยวกับผู้ปกครองของเด็ก

    คำชี้แจง : กรุณาระบุเครื่องหมาย ✓ หรือเติมข้อความในช่องว่างที่กำหนด

ส่วนนี้ สำหรับผู้วิจัย

1. ท่านมีความสัมพันธ์กับเด็กอย่างไร ☐¹ มารดา ☐² บิดา

        ☐ อื่นๆ ระบุ ....

Q2001	

ส่วนที่ 3 กิจกรรมของเด็ก

    คำชี้แจง : กรุณาระบุเครื่องหมาย ✓ หรือเติมข้อความในช่องว่างที่กำหนด

ส่วนนี้ สำหรับผู้วิจัย

1. บุตรของท่านเล่นกีฬาประเภทใดบ้าง (เลือกได้มากกว่า 1 รายการ)

    ☐¹ ไม่มี (ข้ามไปตอบข้อ 3) ☐² ฟุตบอล ☐³ ว่ายน้ำ ☐⁴ แบดมินตัน

    ☐⁵ ปิงปอง ☐⁶ อื่นๆ ระบุ ....

Q3001	

2. กรณี "เล่นกีฬา" โปรดระบุระยะเวลาโดยประมาณ ต่อวัน และความถี่

    2.1 เวลาต่อวัน ☐¹ 30 นาที ☐² 1 ชม. ☐³ 2 ชม. ☐⁴ 3 ชม. ☐⁵ > 3 ชม.

    2.2 ความถี่ ☐¹ 1-2 วัน/สัปดาห์ ☐² 3-4 วัน/สัปดาห์ ☐³ ทุกวัน

Q3002	

3. บุตรของท่านมักใช้เวลาอยู่ที่บ้านช่วงเวลาใด และวันละประมาณกี่ชั่วโมง

    3.1 วันจันทร์ ถึง ศุกร์ ประมาณ (ระบุ) .... ชั่วโมง

Q3003(1)	

    3.2 วันหยุด หรือเสาร์-อาทิตย์

    ☐¹ <12 ชม. ☐² 12 - 15 ชม. ☐³ 16 - 20 ชม. ☐⁴ 21 - 24 ชม.

Q3003(2)	

4. เมื่ออยู่ที่บ้าน บุตรของท่านมักใช้เวลาส่วนใหญ่อยู่บริเวณใดของบ้านเรียงลำดับจากมากที่สุดไป
น้อยที่สุด (มากที่สุด คือ 1 รองลงมาคือ 2, 3, 4 และ 5 ตามลำดับ)

    ☐¹ ห้องนอนของเด็ก ประมาณ ....ชม.

    ☐² ห้องนั่งเล่น/ ห้องรับแขก ประมาณ ....ชม.

    ☐³ ห้องครัว ประมาณ ....ชม.

    ☐⁴ ภายนอกตัวบ้าน เช่น หน้าบ้าน สนามหญ้า ประมาณ ....ชม

    ☐⁵ อื่นๆ ระบุ ....

Q3004	

2

ส่วนที่ 4 อาการของโรคระบบทางเดินหายใจและโรคหืดในเด็กนักเรียน

คำชี้แจง : กรุณาระบุเครื่องหมาย ✓ หรือเติมข้อความในช่องว่างที่กำหนด

ส่วนนี้ สำหรับผู้วิจัย

1. บุตรของท่านเป็นโรคภูมิแพ้หรือไม่ (ได้รับการวินิจฉัยโดยแพทย์)

☐¹ ไม่เป็น (ข้ามไปตอบข้อ 3)   ☐² เป็น

| Q4001 | |

2. กรณี "เป็น" โปรดระบุชนิดของโรคภูมิแพ้ (เลือกได้มากกว่า 1 รายการ)

☐¹ ภูมิแพ้ทางผิวหนัง   ☐² ภูมิแพ้จากฝุ่น   ☐³ ภูมิแพ้จากแมลงกัดต่อย

☐⁴ ภูมิแพ้สัตว์เลี้ยง   ☐⁵ ภูมิแพ้ทางดวงตา   ☐⁶ ภูมิแพ้อากาศ

☐⁷ ภูมิแพ้จากเชื้อรา   ☐⁸ ภูมิแพ้จากแมลงสาบ   ☐⁹ ไม่ทราบ

☐¹⁰ อื่นๆ ระบุ..........................

| Q4002 | |

3. สมาชิกในครอบครัวของเด็กที่ป่วยเป็นโรคหืด (ที่ไม่ใช่ตัวเด็ก)

☐¹ ไม่มี (ข้ามไปตอบข้อ 4)   ☐² แม่

☐³ พ่อ   ☐⁴ พี่ หรือน้อง ของเด็ก   ☐⁵ ปู่ – ย่า หรือ ตา – ยาย

| Q4003 | |

4. บุตรของท่านเป็นโรคหืด (หรือโรคหลอดลมอักเสบจากภูมิแพ้) หรือไม่ (ได้รับการวินิจฉัยโดยแพทย์)

☐¹ ไม่เป็น (ข้ามไปตอบข้อ 7)   ☐² เป็น

| Q4004 | |

5. กรณี "เป็น" โปรดระบุชนิดของโรคหืด (เลือกได้มากกว่า 1 รายการ)

☐¹ โรคหืดจากภูมิแพ้   ☐² โรคหืดจากการออกกำลังกาย

☐³ โรคหืดจากการไอ   ☐⁴ โรคหืดเวลากลางคืน   ☐⁵ อื่นๆ ระบุ................

| Q4005 | |

6. อาการของโรคหืดเกิดขึ้นครั้งแรกเมื่อบุตรของท่านอายุเท่าไหร่ (ระบุ)..............................ปี

| Q4006 | |

7. ในรอบ 1 เดือนที่ผ่านมา บุตรของท่านมีอาการหายใจเสียงวี้ด ระหว่าง หรือภายหลัง

ออกกำลังกายหรือไม่   ☐¹ ไม่มี   ☐² มี

| Q4007 | |

8. ในรอบ 1 เดือนที่ผ่านมาบุตรของท่านมีอาการไอแห้งในเวลากลางคืน ทั้งที่ไม่เป็นไข้หวัด

หรือไม่มีอาการป่วยติดเชื้อทางเดินหายใจ หรือไม่

☐¹ ไม่มี   ☐² มี

| Q4008 | |

9. ในรอบ 1 เดือนที่ผ่านมาบุตรของท่านมีอาการจาม หรือน้ำมูกไหล หรือคัดจมูก ทั้งที่ไม่เป็นไข้หวัด

หรือไข้หวัดใหญ่ หรือไม่   ☐¹ ไม่มี   ☐² มี

| Q4009 | |

10. ในรอบ 1 เดือนที่ผ่านมาบุตรของท่านมีอาการป่วยเกี่ยวกับจมูกที่ต้องรักษา หรือผ่าตัด หรือไม่

☐¹ ไม่มี   ☐² มี

| Q4010 | |

11. บุตรของท่านเคยเป็นโรคปอดบวมหรือไม่ (ได้รับการวินิจฉัยโดยแพทย์)

☐¹ ไม่เคย   ☐² เคย

| Q4011 | |

12. ในรอบ 12 เดือนที่ผ่านมา บุตรของท่านเคยใช้ยาเม็ด หรือยาพ่น ที่เกี่ยวกับการรักษาอาการ

หายใจเสียงหวีดหรือโรคหืด หรือไม่

☐¹ ไม่เคย   ☐² เคย

| Q4012 | |

13. ในรอบ 12 เดือนที่ผ่านมา บุตรของท่านหยุดเรียนเนื่องจากอาการหายใจเสียงหวีดหรือโรคหืด

หรือไม่   ☐¹ ไม่มี   ☐² มี (ระบุ) .... วัน

| Q4013 | |

048.1/61

เลขที่โครงการวิจัย..........................

วันที่รับรอง – 9 เม.ย. 2561

วันหมดอายุ – 8 เม.ย. 2562

3

ส่วนที่ 4 (ต่อ) อาการของโรคระบบทางเดินหายใจและเบาหวาน ในเด็กนักเรียน ในรอบ 1 เดือนที่ผ่านมา

คำอธิบาย สัญลักษณ์:

1. (อ.) บุตรของท่านมีประวัติการป่วยด้วยโรคหืดในระยะเวลาสองสัปดาห์ ใครอบ 1 เดือนที่ผ่านมา หรือไม่ (ถ้ามี หรือเคยเป็นโรคหืดมาระยะเวลานานแล้ว)

2. (ข.) บุตรของท่านเกี่ยวข้องกับการแพ้สารต่างๆ หรือมีอาการแพ้ ในรอบ 1 เดือนที่ผ่านมา

3. (ค.) บุตรของท่านมีอาการของโรคหืด หรือมีบ่อยแค่ไหน หรือมีบุคคลในบ้าน หรือในโรงเรียน

คำถาม	พาหะในชุมชน Q4014(1)	โอนแห่ง (ข) Q4014(2)	มีอาการะ (ค) Q4014(3)	หายใจเสียง Q4014(4)	น้ำมูกไหล (ง) Q4014(5)
14 ในรอบ 1 เดือนที่ผ่านมา บุตรของท่านมีอาการหลอดน้ำหรือไม่	☐¹ ไม่มี ☐² มี	☐¹ ไม่มี ☐² มี	☐¹ ไม่มี ☐² มี	☐¹ ไม่มี ☐² มี	☐¹ ไม่มี ☐² มี
15 ในรอบ 1 เดือนที่ผ่านมา บุตรของท่านมีอาการหลอดมีกี่ครั้ง	☐¹ ไม่มี Q4015(1) ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	☐¹ ไม่มี Q4015(2) ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	☐¹ ไม่มี Q4015(3) ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	☐¹ ไม่มี Q4015(4) ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	☐¹ ไม่มี Q4015(5) ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง
16 ในรอบ 1 เดือนที่ผ่านมา บุตรของท่านนอนหลับไม่สนิทเนื่องจากการหายใจเสียงวี๊ด โอนแห่ง และน้ำมูกไหล กี่ครั้ง ทั้งที่ไม่เป็นหวัด	☐¹ ไม่เคย Q4016(1) ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์	☐¹ ไม่เคย Q4016(2) ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์		☐¹ ไม่เคย Q4016(3) ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์	☐¹ ไม่เคย Q4016(4) ☐² 1 คืน ต่อ สัปดาห์ ☐³ > 1 คืน ต่อ สัปดาห์
17 ในรอบ 1 เดือนที่ผ่านมา อาการหลอดนี้ มีความรุนแรง และส่งผลให้บุตรของท่านพูดได้เพียง 1-2 คำ หรือไม่สามารถพูดได้ หรือไม่	☐¹ ไม่มี Q4017(1) ☐² มี	☐¹ ไม่มี Q4017(2) ☐² มี	☐¹ ไม่มี Q4017(3) ☐² มี	☐¹ ไม่มี Q4017(4) ☐² มี	☐¹ ไม่มี Q4017(5) ☐² มี
18 ในรอบ 1 เดือนที่ผ่านมา อาการหลอดนี้ รบกวนกิจกรรมในชีวิตประจำวัน และบุตรของท่านมีผลอย่างไร	☐¹ ไม่มี Q4018(1) ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	☐¹ ไม่มี Q4018(2) ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	☐¹ ไม่มี Q4018(3) ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	☐¹ ไม่มี Q4018(4) ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	☐¹ ไม่มี Q4018(5) ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก

048·1/61
- 9 เม.ย. 2561
- 8 เม.ย. 2562

ส่วนที่ 4 (ต่อ) อาการของโรคระบบทางเดินหายใจและโรคหืด ในเด็กนักเรียน ในรอบ 12 เดือนที่ผ่านมา

คำอธิบาย สัญลักษณ์:

1. (a): บุตรของท่านมีอาการเหล่านี้หรือการไอแห้งในช่วงกลางคืน ในขณะที่ยังไม่เป็นหวัด หรือไม่เกิดจากการเป็นหวัดหรือหลอดลมอักเสบหรือไม่
2. (b): บุตรของท่านมีอาการมีเสมหะเป็นหนองหรือไม่ออกมีเสมหะ ในขณะที่ยังไม่เป็นหวัดหรือไม่
3. (c): บุตรของท่านมีอาการจาม หรือจมูกน้ำมูกไหล หรือคัดจมูก ที่เกิดขึ้นในขณะที่ไม่เป็นไข้หวัด หรือไข้หวัดใหญ่

คำถาม	อาการของโรคระบบทางเดินหายใจและโรคหืด				
	หายใจเสียงวี๊ด	ไอแห้ง (a)	มีเสมหะ (b)	หายใจลำบาก	น้ำมูกไหล (c)
19. ในรอบ 12 เดือนที่ผ่านมา บุตรของท่านมีอาการเหล่านี้หรือไม่	Q4019(1) ☐¹ ไม่มี ☐² มี	Q4019(2) ☐¹ ไม่มี ☐² มี	Q4019(3) ☐¹ ไม่มี ☐² มี	Q4018(4) ☐¹ ไม่มี ☐² มี	Q4019(5) ☐¹ ไม่มี ☐² มี
20. ในรอบ 12 เดือนที่ผ่านมา บุตรของท่านมีอาการเหล่านี้กี่ครั้ง	Q4020(1) ☐¹ ไม่มี ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	Q4020(2) ☐¹ ไม่มี ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	Q4020(3) ☐¹ ไม่มี ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	Q4020(4) ☐¹ ไม่มี ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง	Q4020(5) ☐¹ ไม่มี ☐² 1–3 ครั้ง ☐³ 4–12 ครั้ง ☐⁴ >12 ครั้ง
21. ในรอบ 12 เดือนที่ผ่านมา บุตรของท่านมีแนวโน้มเมื่อมีอาการเหล่านี้ ไอแห้ง หายใจวี๊ด และแน่นหน้าอก มีความถี่ ที่ทำให้นับเป็นครั้งๆ ได้	Q4021(1) ☐¹ ไม่เคย ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์	Q4021(2) ☐¹ ไม่เคย ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์		Q4021(3) ☐¹ ไม่เคย ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์	Q4021(4) ☐¹ ไม่เคย ☐² 1 คืน ต่อ สัปดาห์ ☐³ ≥ 1 คืน ต่อ สัปดาห์
22. ในรอบ 12 เดือนที่ผ่านมา อาการเหล่านี้ มีการรบกวน และรบกวนจนเด็กพูดหรือขอความช่วยเหลือ โดยพูดได้เพียง 1–2 คำ หรือไม่สามารถพูดได้ หรือไม่	Q4022(1) ☐¹ ไม่มี ☐² มี	Q4022(2) ☐¹ ไม่มี ☐² มี	Q4022(3) ☐¹ ไม่มี ☐² มี	Q4022(4) ☐¹ ไม่มี ☐² มี	Q4022(5) ☐¹ ไม่มี ☐² มี
23. ในรอบ 12 เดือนที่ผ่านมา อาการเหล่านี้ รบกวนกิจกรรมในชีวิตประจำวัน ของบุตรของท่านมากน้อยเพียงใด	Q4023(1) ☐¹ ไม่มี ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	Q4023(2) ☐¹ ไม่มี ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	Q4023(3) ☐¹ ไม่มี ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	Q4023(4) ☐¹ ไม่มี ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก	Q4023(5) ☐¹ ไม่มี ☐² มีเล็กน้อย ☐³ ปานกลาง ☐⁴ มาก

5

ส่วนที่ 5 ข้อมูลเกี่ยวกับสิ่งแวดล้อมที่อยู่อาศัยของเด็ก

ข้อมูลส่วนนี้จะเป็นประโยชน์ในการวิเคราะห์สาเหตุของอาการโรคระบบทางเดินหายใจ และโรคหืดในเด็ก

คำชี้แจง : กรุณาระบุเครื่องหมาย ✓ หรือเติมข้อความในช่องว่างที่กำหนด

ส่วนนี้ สำหรับผู้วิจัย

1. ที่ตั้งที่อยู่อาศัย (ระบุ) เขต .... แขวง ....

2. ที่อยู่อาศัยมีระยะห่างจากถนนสายหลักที่มีรถวิ่งผ่านตลอดเวลา โดยประมาณ
   - [ ]¹ ถนนตั้งแต่ 4 เลน ขึ้นไป (ระบุ).................... ม.
   - [ ]² ถนน 2 เลน (ในซอย) (ระบุ).................... ม.

3. ประเภทที่อยู่อาศัย และมีพื้นที่โดยประมาณ (ระบุ)........................... ตารางเมตร
   - [ ]¹ บ้านเดี่ยว [ ]² ทาวน์เฮ้าส์
   - [ ]³ คอนโดมิเนียม/ อพาร์ตเมนต์ / แฟลต [ ]⁴ อื่นๆ (ระบุ)...........................

4. ที่อยู่อาศัยของท่าน มีอายุอาคารประมาณ .... ปี
   และก่อสร้างเสร็จในช่วงเวลาใด พ.ศ...................

5. บ้านที่เด็กอาศัยอยู่กับท่านในปัจจุบัน ท่านเป็นเจ้าของ หรือเช่าเพื่ออยู่อาศัย
   - [ ]¹ เป็นเจ้าของเอง [ ]² เช่าเพื่ออยู่อาศัย

6. ที่อยู่อาศัยของเด็ก อยู่ใกล้สถานประกอบการเหล่านี้หรือไม่ (ตอบได้มากกว่า 1 ข้อ)
   - [ ]¹ ร้านเฟอร์นิเจอร์ [ ]² ร้านตัดเย็บเสื้อผ้า
   - [ ]³ อู่ซ่อมรถ หรือล้างรถ [ ]⁴ ปั้มน้ำมัน
   - [ ]⁵ อื่นๆ (ระบุ)...........................

7. จำนวนสมาชิกในบ้านของเด็ก (ไม่รวมตัวของเด็กเอง) .... คน

8. สมาชิกในครอบครัวของท่าน มีผู้สูบบุหรี่หรือไม่
   - [ ]¹ ไม่มี (ข้ามไปข้อ 10) [ ]² มี

9. บุตรของท่านมักจะอยู่ในบริเวณที่มีสมาชิกในครอบครัวของท่านสูบบุหรี่เสมอ
   - [ ]¹ ไม่ใช่ [ ]² ใช่

10. เครื่องทำความเย็นที่ใช้ในห้องนอนของเด็ก (ตอบได้มากกว่า 1 ข้อ)
    - [ ]¹ ไม่มี [ ]² เครื่องปรับอากาศ (แอร์คอนดิชัน)
    - [ ]³ พัดลม [ ]⁴ พัดลมไอน้ำ
    - [ ]⁵ อื่นๆ (ระบุ)...........................

11. เชื้อเพลิงที่ใช้ทำอาหารในครัวเรือนคืออะไร (ตอบได้มากกว่า 1 ข้อ)
    - [ ]¹ เตาแก๊ส [ ]² เตาไฟฟ้า
    - [ ]³ เตาถ่าน [ ]⁴ อื่นๆ (ระบุ)...........................

Q5001		
Q5002(1)		
Q5002(2)		
	(กม.)	(ม.)
Q5003 พื้นที่ (ตร.ม.)		
Q5004(1) (2)		
Q5005		
Q5006		
Q5007		
Q5008		
Q5009		
Q5010		
Q5011		

048-1/61
เลขที่โครงการวิจัย...........................
- 9 เม.ย. 2561
วันที่รับรอง...........................
- 8 เม.ย. 2562
วันหมดอายุ...........................

6

	ส่วนนี้ สำหรับผู้วิจัย

12. ในห้องนอนของเด็ก มีจำนวนหน้าต่าง หรือระเบียงที่เปิดใช้งานประจำ กี่บาน (ระบุ)..............บาน
(ไม่นับรวมบานที่ปิดตาย)

Q5012

13. ในห้องนอนของเด็กมีม่าน หรือมูลี่ หรือไม่

☐¹ ไม่มี ☐² มี

Q5013

14. ในห้องนอนของเด็กมีพรม หรือไม่

☐¹ ไม่มี ☐² มี

Q5014

15. ท่านทำความสะอาดห้องนอนของเด็กอย่างไร (ตอบได้มากกว่า 1 ข้อ)

☐¹ ใช้เครื่องดูดฝุ่น ☐² ใช้ไม้กวาด
☐³ ถูพื้น ☐⁴ อื่นๆ (ระบุ)..

Q5015

16. ในรอบ 1 ปีที่ผ่านมา ท่านทำความสะอาดสิ่งเหล่านี้ ในห้องนอนของเด็กบ่อยเพียงใด

(1) เครื่องปรับอากาศ ☐¹ ไม่เคย ☐² 3 ครั้ง/ปี ☐³ 2 ครั้ง/ปี ☐⁴ 1 ครั้ง/ปี
☐⁵ อื่นๆ ....

Q5016(1)

(2) พัดลม ☐¹ ไม่เคย ☐² 3 ครั้ง/ปี ☐³ 2 ครั้ง/ปี ☐⁴ 1 ครั้ง/ปี
☐⁵ อื่นๆ ....

Q5016(2)

(3) ผ้าม่าน หรือมูลี่ ☐¹ ไม่เคย ☐² 3 ครั้ง/ปี ☐³ 2 ครั้ง/ปี ☐⁴ 1 ครั้ง/ปี
☐⁵ อื่นๆ ....

Q5016(3)

(4) พื้นห้อง ☐¹ ทุกวัน ☐² 3 ครั้ง/สัปดาห์ ☐³ 1 ครั้ง/สัปดาห์
☐⁴ อื่นๆ ....

Q5016(4)

17. ในบริเวณที่อยู่อาศัยของเด็กมีสิ่งเหล่านี้หรือไม่ (ตอบได้มากกว่า 1 ข้อ)

☐¹ ดอกไม้ ☐² แมลง/สัตว์พาหะนำโรค (แมลงสาบ, หนู)
☐³ สัตว์เลี้ยง (สุนัข, แมว, นก) ☐⁴ ควันบุหรี่
☐⁵ ควันจากเตาถ่าน ☐⁶ ควันธูป
☐⁷ อื่นๆ ....

Q5017

18. ดอกไม้ชนิดที่มีเกสรในบริเวณโดยรอบที่อยู่อาศัยของเด็กมีอะไรบ้าง (โปรดระบุชื่อ)

1) .... 2) .... 3) ....
4) .... 5) .... 6) ....
7) .... 8) .... 9) ....

Q5018

19. ท่านพบแมลงหรือสัตว์พาหะนำโรค เช่น แมลงสาบ หนู ในห้องนอนของเด็กบ่อยเพียงใด

☐¹ ไม่เคยพบ ☐² 1 ครั้ง/เดือน
☐³ 1 ครั้ง/สัปดาห์ ☐⁴ >1 ครั้ง/สัปดาห์

Q5019

20. บุตรของท่านสัมผัส เช่น กอด หรือเล่นกับสัตว์เลี้ยง (เช่น สุนัข แมว นก) บ่อยเพียงใด

☐¹ ไม่เคย ☐² 1 ครั้ง/เดือน
☐³ 1 ครั้ง/สัปดาห์ ☐⁴ >1 ครั้ง/สัปดาห์ ☐⁵ ทุกวัน

Q5020

21. บุตรของท่านนำสัตว์เลี้ยง (เช่น สุนัข แมว นก) ไปเล่น หรือนอนในห้องนอน บ่อยเพียงใด

☐¹ ไม่เคย ☐² 1 ครั้ง/เดือน
☐³ 1 ครั้ง/สัปดาห์ ☐⁴ >1 ครั้ง/สัปดาห์ ☐⁵ ทุกวัน

Q5021

เลขที่โครงการวิจัย. 048.1/61
วันที่รับรอง. − 9 เม.ย. 2561
วันหมดอายุ. − 8 เม.ย. 2562

		ส่วนนี้ สำหรับผู้วิจัย

22. บุตรของท่านมักวางตุ๊กตาที่ทำจากผ้า หรือเส้นใย ไว้บริเวณเตียงนอนของเขาหรือไม่ และมีจำนวนประมาณเท่าไหร่?   **Q5022(a) Q5022(b)**

    a. ☐¹ ไม่มีตุ๊กตาในห้องนอน   ☐² <5 ตัว   ☐³ >5 ตัว

    b. ☐¹ ไม่วางบนเตียง   ☐² มักวางบนเตียง

23. บุตรของท่านมักจะช่วยท่าน หรืออยู่ในบริเวณที่มีการใช้ถ่าน เช่น ขณะปรุงประกอบอาหาร   **Q5023**

    ☐¹ ไม่ใช่   ☐² ใช่

24. (1) ที่บ้านของท่านจุดธูปบ่อยเพียงใด   **Q5024 (1)**

    ☐¹ ไม่เคยจุดธูป   ☐² 1 ครั้ง/เดือน

    ☐³ 1 ครั้ง/สัปดาห์   ☐⁴ >1 ครั้ง/สัปดาห์   ☐⁵ ทุกวัน

    (2) บุตรของท่านมักจะอยู่ในบริเวณที่มีควันธูปเสมอ   **Q5024 (2)**

    ☐¹ ไม่ใช่   ☐² ใช่

25. ในบ้านของท่านมีบริเวณที่มีน้ำรั่วซึม หรือมีความชื้นที่ผนังหรือไม่   **Q5025**

    ☐¹ ไม่มี (ข้ามไปตอบข้อ 27)   ☐² มี

26. ถ้ามี โปรดระบุบริเวณที่มีน้ำรั่วซึม หรือมีความชื้นที่ผนัง (ตอบได้มากกว่า 1 ข้อ)   **Q5026**

    ☐¹ บริเวณหน้าห้องน้ำ   ☐² บริเวณห้องครัว

    ☐³ บริเวณห้องรับแขก/ห้องนั่งเล่น   ☐⁴ บริเวณห้องนอนของเด็ก

    ☐⁵ บริเวณห้องนอนของท่าน หรือสมาชิกครอบครัวที่ไม่ใช่เด็ก

    ☐⁶ อื่นๆ ระบุ...

27. ท่านพบว่ามีน้ำรั่วซึม หรือมีความชื้นที่ผนัง บ่อยเพียงใด   **Q5027**

    ☐¹ น้อยมาก หรือแทบไม่พบ   ☐² พบ แต่ไม่บ่อย

    ☐³ พบ ค่อนข้างบ่อย   ☐⁴ พบ บ่อยมาก

    ☐⁵ อื่นๆ ระบุ ....

28. ในรอบ 1 เดือนที่ผ่านมา ท่านพบเชื้อราบริเวณผนังในห้องนอนของเด็กหรือไม่   **Q5028**

    ☐¹ ไม่พบ   ☐² พบ

29. ท่านใช้สารเคมีกำจัดแมลงภายในบ้านหรือไม่   **Q5029**

    ☐¹ ยากันยุง   ☐² ยาฆ่าแมลง เช่น มด แมลงสาบ

    ☐³ อื่นๆ ระบุ ....

30. บ้านของท่านเคยมีการปรับปรุง เช่น ปูพื้นบ้าน ผนัง หลังคา ทาสี หรือต่อเติมห้อง ซึ่งทำให้มีฝุ่น หรือใช้สารเคมีในระหว่างที่ท่านตั้งครรภ์เด็ก หรือตั้งแต่คลอดเด็กแล้วจนถึงปัจจุบันหรือไม่   **Q5030**

    (ถ้ามี ตอบได้มากกว่า 1 ข้อ)

    ☐¹ ไม่มี

    ☐² มี   ◯¹ ปูพื้นบ้าน   ◯² เปลี่ยนผนัง/ วอลเปเปอร์   ◯³ เปลี่ยนหลังคา

            ◯⁴ ต่อเติมห้อง   ◯⁵ ทาสี

            ◯⁶ อื่นๆ ระบุ.............................

--- ขอขอบพระคุณที่กรุณาตอบแบบสอบถาม ---

048.1/ค

วันที่รับรอง........ - 9 เม.ย. 2561

วันหมดอายุ........ - 8 เม.ย. 2562

8

APPENDIX F

Screening questionnaire English version

for inclusion and exclusion criteria of study population

The screening questionnaire for participant is enrolled into this study,
and answer the questionnaire of "Residential Environment and Respiratory
and Asthma Symptoms of School Children"

Please answer the screening question. And thank you for your participation.

<u>**Direction:**</u> **Please answer by TICKING (✓) or writing in the given spaces.**

1. Has your child have cold or influenza during you answer this questionnaire?

   ☐¹ No   ☐² Yes

2. *Has your child have sinus surgery due to chronic rhino sinusitis and respiratory complication disease during you answer this questionnaire?*

   ☐¹ No   ☐² Yes

3. Has your child had or ever had underlying respiratory diseases *which are Gerd, chronic rhino sinusitis and respiratory complication disease*?

   ☐¹ No   ☐² Yes

                    ○¹ *Gerd*
                    ○² *Chronic rhino sinusitis*
                    ○³ *Respiratory complication disease*

4. *The location of children house is in Din Daeng district, Bangkok?*

   ☐¹ *No*   ☐² *Yes (answer question 5)*

5. *Does children live in this house more than 1 year?*

   ☐¹ *No*   ☐² *Yes*

Thank you

APPENDIX G

Questionnaire English version

Questionnaire

Residential Environment in Relation to Respiratory and Asthma Symptoms of Primary School Children in Inner Bangkok Thailand

The questionnaire aim to explore an association between residential environment factors and respiratory and asthma symptoms among primary school children in Bangkok, Thailand. The answer of this questionnaire only use for the research that will be useful for academic user and policy maker to develop and provide appropriate guideline for improve residential environment which is healthy for children in city.

Please write your answers to these questions in the space provided. All other questions require you to tick your answer in a box. If you make a mistake put a cross in the box and tick the correct answer. Be assured that your answers will be kept confidential. There is no way we can link your name with your answer on the questionnaires. The questionnaire is divided into 5 parts as follow:

Part I: Socio-demographic factors; Children's information

Part II: Socio-demographic factors; Child's parent information

Part III: Children activity

Part IV: Respiratory and Asthma symptoms of children

Part V: Residential Environment

Information about the research

1. Study population: Primary school children aged 6-10 years who register as full-time students in primary public schools under Bangkok Metropolitan Administration in *Din Daeng district and their houses are in Din Daeng district*.

2. Objectives of the study

1) To estimate the prevalence of respiratory and asthma symptoms in primary school children at school in *Din Daeng district* Bangkok, Thailand.

2) To find an association between children characteristic and respiratory and asthma symptoms among primary school children in *Din Daeng district* Bangkok, Thailand.

3) To explore an association between residential environment factors and respiratory and asthma symptoms among primary school children in *Din Daeng district* Bangkok, Thailand.

3. The data will be collect during *March - May,* 2018.

Please feel free to contact me if you have any questions. My direct line is 06 2640 4442

Part I: Socio-demographic factors; Children's information

On this part are questions about your child's name, school, and birth dates.

Please answer by TICKING (✔) or writing in the given spaces.

1. School: ……………………………………………………………………………………………

2. Child's Age: ……………years

3. Child's Sex: ☐¹ Male ☐² Female

4. Child's height: …………… cm.

5. Child's weight (now): …………… kg.   weight (at birth): …………… kg.

6. Which is the floor of your child's classroom? (specify): …………………..

Part II: Socio-demographic factors; Child's parent information

On this part are questions about parent's child; relationship, age, sex, education level, currently working, income, and religion.

1. Parent's children: ☐¹ Mother   ☐² Father

    ☐³ Other (specify): …………………………….…………………

Part III: Children activity

1. What sport does your child usually play? (Answers one more)

    ☐¹ No (skip to question 3)   ☐² Football

    ☐³ Swim   ☐⁴ Badminton

    ☐⁵ Other (specify) ………… ………………

2. If "Yes", how long does he play per day and how often?

    2.1 How long per day   ☐¹ 30 min   ☐² 1 hr.   ☐³ 2 hrs.   ☐⁴ 3 hrs.   ☐⁵ > 3 hrs.

    2.2 Frequency   ☐¹ 1-2 days/week   ☐² 3-4 days/week   ☐³ everyday

3. How long does your child spend their time at home?

    3.1 Monday to Friday (specific) ………… ………………. hrs.

    3.2 Weekend

        ☐¹ < 12 hr.   ☐² 12 - 15 hr.   ☐³ 16 - 20 hr.   ☐⁴ 21 – 24 hr.

4. Which are the room that your child spend mostly of their time when they live at home?

(The Most = 1, follow by the low = 2, 3 and 4 respectively)

    ☐¹ Child's bedroom

    ☐² Living room

    ☐³ Kitchen

    ☐⁴ Outside the house such as in front of the house, playground, etc.

    ☐⁵ Other (specific) ………… ………………

Part IV: Respiratory and Asthma symptoms of children

On this part are questions about your child's respiratory and asthma symptoms; Wheezing, Cough, Phlegm, Shortness of breath, Running nose.

1. Has your child ever had allergy (doctors diagnosed)?

☐[1] No (skip to question 3)　　☐[2] Yes

2. If "Yes", what is type of allergy? (Please tick any which apply)

☐[1] Skin Allergy　　　　☐[2] Dust Allergy　　　☐[3] Insect Sting Allergy

☐[4] Pet Allergies　　　　☐[5] Eye Allergy　　　　☐[6] Allergic rhinitis

☐[7] Mold Allergy　　　　☐[8] Cockroach Allergy ☐[9] Do not know

☐[10] Other (specific) ………………..…

3. In children family, has family member ever had asthma? (Do not include children in this study)

☐[1] No (skip to question 4)　　☐[2] Mother　　　　　☐[3] Father

☐[4] Sibling of this child　　　☐[5] Grandfather and grandmother

4. Has your child ever had asthma or bronchitis due to asthma (doctors diagnosed)?

☐[1] No (skip to question 7)　　☐[2] Yes

5. If "Yes", what is type of asthma? (Please tick any which apply)

☐[1] Allergic asthma　　　　　☐[2] Exercise-Induced asthma

☐[3] Cough-Induced asthma　　☐[4] Nocturnal asthma

☐[5] Others (specific) ………………..…

6. At what age did this asthma first occur? (specific) ………………..… year.

7. In this month, has your child's chest sounded wheezy during or after exercise?

☐[1] No　　　☐[2] Yes

8. In this month, has your child had a dry cough at night, apart from a cough associated with a cold or chest infection?

☐[1] No　　　☐[2] Yes

9. In this month, has your child ever had a problem with sneezing, or a runny, or blocked nose when he/she DID NOT have a cold or the flu?

☐[1] No　　　☐[2] Yes

10. In this month, has this nose problem been accompanied by itchy-watery eyes?

☐[1] No　　　☐[2] Yes

11. Has your child ever had Pneumonia (doctors diagnosed)?

☐[1] No　　　☐[2] Yes

12. In the last 12 months, has your child use any medicines, pills, inhalers or other medicine for wheezing or asthma?

☐[1] No　　　☐[2] Yes

13. In the last 12 months, how many days (or part days) of school has your child missed because of wheezing or asthma?

☐[1] No　　　☐[2] Yes (specific) ………………days

Part IV: Respiratory and Asthma symptoms of children (Cont.): in this month

Remark 1. [a]: *Your child has dry cough at night, apart from a cough associated with a cold or chest infection.*
    2. [b]: *Your child usually seemed congested in the chest or coughed phlegm (mucus) when he/she did not have a cold.*
    3. [c]: *Your child has a problem with sneezing or a runny or blocked nose when he/she did not have a cold or the flu.*

Questions	Respiratory and Asthma Symptoms				
	Wheezing or whistling in the chest	Dry cough[a]	Phlegm[b]	Shortness of breath	Running nose[c]
14. Has your child ever had these symptoms at any time in this month?	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes
15. How many attacks of symptoms has your child had in this month?	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12
16. In this month, how often, on average, has your child's sleep been disturbed due to wheezing, dry cough, and shortness of breath?	□1 Never woken □2 *one night per week* □3 One or more nights per week	□1 Never woken □2 *one night per week* □3 One or more nights per week		□1 Never woken □2 *one night per week* □3 One or more nights per week	□1 Never woken □2 *one night per week* □3 One or more nights per week
17. In this month, has symptoms ever been severe enough to limit your child's speech to only one or two words at a time between breaths?	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes
18. In this month, how much did these problems interfere with your child's daily activities?	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot

Part IV: Respiratory and Asthma symptoms of children (Cont.): in the past 12 months

Remark   1. [a]: Your child has dry cough at night, apart from a cough associated with a cold or chest infection.

           2. [b]: Your child usually seemed congested in the chest or coughed phlegm (mucus) when he/she did not have a cold.

           3. [c]: Your child has a problem with sneezing or a runny or blocked nose when he/she did not have a cold or the flu.

Questions	Respiratory and Asthma Symptoms				
	Wheezing or whistling in the chest	Dry cough[a]	Phlegm[b]	Shortness of breath	Running nose[c]
19. Has your child ever had these symptoms at any time in the past 12 months?	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes
20. How many attacks of symptoms has your child had time in the past 12 months?	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12	□1 None □2 1 to 3 □3 4 to 12 □4 More than 12
21. In the past 12 months?, how often, on average, has your child's sleep been disturbed due to wheezing, dry cough, and shortness of breath?	□1 Never woken □2 *one night per week* □3 One or more nights per week	□1 Never woken □2 *one night per week* □3 One or more nights per week		□1 Never woken □2 *one night per week* □3 One or more nights per week	□1 Never woken □2 *one night per week* □3 One or more nights per week
22. In the past 12 months, has symptoms ever been severe enough to limit your child's speech to only one or two words at a time between breaths?	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes	□1 No □2 Yes
23. In the past 12 months, how much did these problems interfere with your child's daily activities?	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot	□1 Not at all □2 A little □3 A moderate amount □4 A lot

Part V: Residential Environment

On this part are questions about child's residential environment which can link to respiratory and asthma symptoms.

1. Which district and sub-district of Bangkok do you belong to?

   (specific) district ………… ……………………… sub-district………… ………………………

2. How is child's residence far from main road?

   ☐[1] > 4 lane road (specific) ………………… km. or ………………….. m.

   ☐[2] 2 lane road (specific) …………….…… km. or ………………….. m.

3. What is child's residence type? Estimated area ………………………m^2

   ☐[1] Single family house   ☐[2] Townhouse

   ☐[3] Condominium/ apartment/ flat   ☐[4] Others (specific) ………….…..…

4. When did the child's residence finish construction?

   ☐[1] 2013 - 2017   ☐[2] 2008 - 2012   ☐[3] 2003 - 2007

   ☐[4] 1998 - 2002   ☐[5] 1993 - 1997   ☐[4] Others (specific)......................................

5. Are you the child's residence owner?

   ☐[1] Yes, I am owner.   ☐[2] No, I am tenant.

6. What kind of these are there in child's residence? (Answers one more)

   ☐[1] Furniture shop   ☐[2] Garment/ clothing

   ☐[3] Garage/ Car care   ☐[4] Petrol station

7. How many people are there in family (not include this child)? (specific)…………………..

8. Are there people who smoke in your family?

   ☐[1] No (skip to question10)   ☐[2] Yes

9. Does your child usually live in the area which has cigarette smoke?

   ☐[1] No   ☐[2] Yes

10. What are cooling devices used in child's residence bedroom? (Answers one more)

    ☐[1] No   ☐[2] air conditioner

    ☐[3] Fan   ☐[4] Others (specific) …………….…..

11. What fuel is usually used for cooing in child's residence?

    ☐[1] Gas Stove   ☐[2] Electricity   ☐[2] Stove   ☐[4] Others (specific) …………………

12. How many windows or balconies are there in child's residence bedroom? (specific) ……..……

13. Does child's residence bedroom has curtain or chick?

    ☐[1] No   ☐[2] Yes

14. Does child's residence bedroom have carpet?

    □^{1} No   □^{2} Yes

15. How do you clean your child's residence? (Answers one more)

    □^{1} using vacuum cleaner   □^{2} sweeps the floor

    □^{3} mop the floor   □^{4} Others (specific) ……………...…

16. How often do you clean them in this year?

    a. air conditioner □^{1} No   □^{2} 3 times/year □^{3} 2 times/year □^{4} 1 times/year □^{5} Others……

    b. fan   □^{1} No   □^{2} 3 times/year □^{3} 2 times/year □^{4} 1 times/year □^{5} Others……

    c. curtain or chick □^{1} No   □^{2} 3 times/year □^{3} 2 times/year □^{4} 1 times/year □^{5} Others……

    d. floor   □^{1} Every day □^{2} 3 times/week □^{3} 1 times/ week □^{4} Others……

17. What are there these in area of child's residence? (Answers one more)

    □^{1} Flowers   □^{2} Vectors (cockroach, rat, etc.)   □^{3} Pets (dog, cat, bird, etc.)

    □^{4} Cigarette smoking   □^{5} Charcoal using   □^{6} Incense

18. What kind of pollen flowers are there in area of child's residence? (specific)

    1) …………............................ 2) …………………………… 3) ………………………………

    4) …………............................ 5) …………………………… 6) ………………………………

    7) …………............................ 8) …………………………… 9) ………………………………

19. How often do you see vectors (cockroach, rat, etc.) in your child's bedroom?

    □^{1} Never see   □^{2} *1 times/month*

    □^{3} *1 times/week*   □^{4} >1 times/week

20. How often does your child touch pets (dog, cat, bird, etc.) like hug?

    □^{1} Never   □^{2} *1 times/month*

    □^{3} *1 times/week*   □^{4} >1 times/week   □^{5} every day

21. How often does your child bring the pets (dog, cat, bird, etc.) or sleep with them?

    □^{1} Never   □^{2} *1 times/month*

    □^{3} *1 times/week*   □^{4} >1 times/week   □^{5} every day

22. How many dolls are there in your child's bedroom, and where are them?

    a. □^{1} Not have   □^{2} <5 dolls   □^{3} >5 dolls

    b. □^{1} Not on the bed   □^{2} On the bed

23. Does your child usually help you or live in the area which has charcoal using?

    □^{1} No   □^{2} Yes

24. Does your child usually live in the area which has incense smoke?

    □^{1} No   □^{2} Yes

25. Does your home have water leakage or wall dampness?

    ☐¹ No (Skip to question 27) ☐² Yes

26. If "Yes", where are they? (Answers one more)

    ☐¹ Near bathroom   ☐² Near kitchen

    ☐³ Near restroom   ☐⁴ Near bedroom of your child

    ☐⁵ Near bedroom of yours and other in family

    ☐⁶ Others (specific) ……………..…

27. How often do you see water leakage or wall dampness?

    ☐¹ Never or hardly ever   ☐² Not very often

    ☐³ Quite often   ☐⁴ Always or almost always

    ☐⁵ Others (specific) ……………..…

28. In this month, do you see mold or mildew in the walls or ceilings in the child's room?

    ☐¹ No   ☐² Yes

29. Do you use insecticide in your house?

    ☐¹ Mosquito control   ☐² Insecticide control such as ant, cockroach, etc.

    ☐³ Others (specific) ……………..…

30. Do your house has ever renovated, repaired, repainted, or changed material such as floor, wall, and room during pregnancy/child's life? (If "Yes", Answers one more)

    ☐¹ No

    ☐² Yes   ○²·¹ changed floor material ○²·² changed wall material

              ○²·³ changed roof material ○²·⁴ room renovation

              ○²·⁵ repainted   ○²·⁶ Others (specific) ……………..…

--- Thank you very much ---

APPENDIX H

Table of result

1. Symptoms occurrence during 1 month

Table 29 Occurrence of respiratory and asthma symptoms during 1 month

Symptoms occurrence	Total (n=658) n (%)	Wheezing or whistling in the chest (n = 58) n(%)	Dry cough at night (n = 176) n(%)	Phlegm (n=251) n(%)	Shortness of breath (n=45) n(%)	Running nose without cold (n=312) n(%)
Frequency attacks of symptoms						
1 - 3 times		51 (87.9)	143 (81.3)	217 (86.5)	40 (88.9)	251 (80.4)
> 4 times		7 (12.1)	33 (18.7)	34 (13.5)	5 (11.1)	61 (19.6)
Frequency of sleep disturbed						
Never woken		26 (44.8)	72 (40.9)		20 (44.4)	154 (49.4)
1 night per week		26 (44.8)	78 (44.3)		18 (40.0)	127 (40.7)
> 1 night per week		6 (10.3)	26 (14.8)		7 (15.6)	31 (9.9)
Severe enough to limit child's speech to only one or two words at a time between breathing						
Yes		5 (8.6)	23 (13.1)	48 (19.1)	10 (22.2)	48 (15.4)
No		53 (91.4)	153 (86.9)	203 (80.9)	35 (77.8)	264 (84.6)
These problems interfere with child's daily activities						
Not at all		21 (36.2)	70 (39.8)	90 (35.9)	11 (24.4)	118 (37.8)
A little		27 (46.6)	79 (44.9)	119 (47.4)	24 (53.3)	129 (41.3)
A moderate amount		7 (12.1)	24 (13.6)	39 (15.5)	9 (20.0)	36 (11.5)
A lot		3 (5.2)	3 (1.7)	3 (1.2)	1 (2.2)	29 (9.3)

Table 30 Occurrence of respiratory and asthma symptoms in the past 12 months

Symptoms occurrence	Total (n=658) n (%)	Wheezing or whistling in the chest (n = 75) n(%)	Dry cough at night (n = 214) n(%)	Phlegm (n=285) n(%)	Shortness of breath (n=60) n(%)	Running nose without cold (n=347) n(%)
Frequency attacks of symptoms						
1 - 3 times		62 (82.7)	156 (72.9)	203 (71.2)	42 (70.0)	242 (69.7)
> 4 times		13 (17.3)	58 (27.1)	82 (28.8)	18 (30.0)	105 (30.3)
Frequency of sleep disturbed						
Never woken		33 (44.0)	93 (43.5)		20 (33.3)	151 (43.5)
1 night per week		35 (46.7)	91 (42.5)		31 (51.7)	144 (41.5)
> 1 night per week		7 (9.3)	30 (14.0)		9 (15.0)	52 (15.0)
Severe enough to limit child's speech to only one or two words at a time between breathing						
Yes		5 (6.7)	35 (16.4)	62 (21.8)	16 (26.7)	65 (18.7)
No		70 (93.3)	179 (83.6)	223 (78.2)	44 (73.3)	282 (81.3)
These problems interfere with child's daily activities						
Not at all		28 (37.3)	73 (34.1)	97 (34.0)	18 (30.0)	111 (32.0)
A little		31 (41.3)	108 (50.5)	138 (48.4)	30 (50.0)	172 (49.6)
A moderate amount		14 (18.7)	29 (13.6)	43 (15.1)	10 (16.7)	49 (14.1)
A lot		2 (2.7)	4 (1.9)	7 (2.5)	2 (3.3)	15 (4.3)

2. Environmental factors

Table 31 Environment at children's residence

Frequency of seen factors	Total (n=658)	
	n	(%)
Environment at children's residence		
Wall dampness/ water leakage		
Near bathroom	105	(16.0)
Near kitchen	44	(6.7)
Near restroom	6	(0.9)
Near bedroom of child	40	(6.1)
Near bedroom of others in family	8	(1.2)
Wall dampness/ water leakage at residence		
Never or hardly ever	63	(9.6)
Not very often	63	(9.6)
Quite often	17	(2.6)
Always or almost always	14	(2.1)
Others	6	(0.9)
Home renovation		
Changed floor material	55	(8.4)
Changed wall material	21	(3.2)
Changed roof material	26	(4.0)
Room renovation	31	(4.7)
Repainted	93	(14.1)
Using stove for cooking in residence		
Gas Stove	527	(80.1)
Electricity	155	(23.6)
Stove	106	(16.1)
Using incense at residence	304	(46.2)
Never see	146	(22.2)
1 time/month	135	(20.5)
1 times/week	57	(8.7)
> 1 times/week	16	(2.4)

Table 32 Frequency of seen environment factors in children's bedroom

Frequency of seen factors	Total (n=658)	
	n	(%)
Environment in children's bedroom		
Vectors in child's bedroom		
Never	327	(49.7)
1 time/ month	175	(26.6)
1 time/ week	106	(16.1)
> 1 time/ week	50	(7.6)
Child close to pets (like hug)		
Never	462	(70.2)
1 time/ month	65	(9.9)
1 time/ week	34	(5.2)
> 1 time/ week	26	(4.0)
Every day	71	(10.8)
Child bring pets into bedroom		
Never	598	(90.9)
1 time/ month	11	(1.7)
1 time/ week	7	(1.1)
> 1 time/ week	10	(1.5)
Every day	32	(4.9)
Mold/ mildew in children's bedroom (This month)	36	(5.5)

Table 33 Practice of cleaning in children's bedroom

	Total (n=658)	
Practice of cleaning	n	(%)
Environment in children's bedroom		
Cleaning process		
Using vacuum cleaner	109	(16.6)
Sweeps the floor	567	(86.2)
Mop the floor	520	(79.0)
Frequency of cleaning those in child's bedroom		
Air conditioner		
Never	9	(1.4)
1 time/year	104	(15.8)
2 times/year	104	(15.8)
3 times/year	38	(5.8)
> 3 times/year	22	(3.3)
Fan and misting fans		
Never	4	(0.6)
3 times/year	278	(42.2)
2 times/year	39	(5.9)
1 times/year	11	(1.7)
12 times/ year	142	(21.6)
> 12 times/ year	87	(13.2)
Curtain or chick		
Never	28	(4.3)
3 times/year	143	(21.7)
2 times/year	62	(9.4)
1 times/year	40	(6.1)
12 times/ year	94	(14.3)
> 12 times/ year	24	(3.6)
Floor in child bedroom		
Every day	424	(64.4)
3 times/week	133	(20.2)
1 time/week	101	(15.3)

APPENDIX I

Residences and Environments in Din Daeng district, Bangkok Thailand

1. Type of residence

1.1 Single family house

1.2 Townhouse/ townhome

1.3 Flat/ Apartment/ Condominium

1.4 Community (Slum)

2. Places near residence

2.1 Fresh market and restaurant (cooking smoke)

2.2 Waste

3. Environment at residence

3.1 Residence with a lot of things

3.2 Pets (Bird)

APPENDIX J

Administration & Time Schedule

1) Review literature to determine research topic, and drafting the research proposal.

2) Edit and complete the research proposal.

3) Submit the research proposal.

4) Submit the research ethical considerations.

5) Plan the steps for conducting the data collection as follow:

    a. Development the research tools: questionnaires.

    b. Preparing the questionnaire;

    c. Sample selection and talks with school which is selected;

    d. Validation of equipment;

    e. Data collection.

7) Coordinate with the target groups.

8) Collect the data: the data was collected between Januarys to Aprils 2018.

9) Enter and analyze the data.

10) Write the research report.

Table 34 Administration & Time Schedule

No.	Activities	2017				2018						
		Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.
1	– Review literature – Determine research topic, and – Drafting the research proposal											
2	Edit and complete the research proposal.											
3	Submit the research proposal											
4	Submit the research ethical considerations.											
5	Plan the steps for data collection: – Development QN. – Validation of equipment. – Preparing the QN. – Sample selection – Talks with school. – Data collection.											
6	Coordinate with the target groups.											
7	Collect the data											
8	Enter and analyze the data.											
9	Write the research report.											
10	Publish the research											

VITA

PERSONAL INFORMATION

Name: Ms. Nawarat Apichainan

Date of Birth: May 17, 1982

Nationality: Thai

Adress: Nonthaburi, Thailand

Email: nawarat.t@anamai.mail.go.th

EDUCATION

Bachelor of Science (Environmental Health), Walailak University, Nakhorn Si thammarat, Thailand

WORKING EXPERIENCE

• 2009   Sanitation Technical Officer at Food Sanitation Division, Health Department, Bangkok Metropolitan Administration

• 2012   Public Health Technical Officer at Bureau of Environmental Health, Department of Health, Ministry of public Health