ASSESS THE PEAK EXPIRATORY FLOW RATE BY USING PEAK FLOW METER AMONG SCHOOL CHILDREN IN SELECTED SCHOOL

By
Revathi .R

A DISSERTATION SUBMITTED TO THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY, CHENNAI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR DEGREE OF MASTER OF SCIENCE IN NURSING

APRIL 2012.
ASSESS THE PEAK EXPIRATORY FLOW RATE BY USING PEAK FLOW METER AMONG SCHOOL CHILDREN IN SELECTED SCHOOL AT CHENNAI

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DECLARATION

I hereby declare that the present dissertation entitled “ASSESS THE PEAK EXPIRATORY FLOW RATE BY USING PEAK FLOW METER AMONG SCHOOL CHILDREN IN SELECTED SCHOOL AT CHENNAI” is the outcome of the original research work undertaken and carried out by me, under the guidance of Prof. S. Ani Grace Kalaimathi M.Sc (N), PGDNA., DQA., Ph.D., Principal, MIOT College of Nursing and Prof. S.Kanakambujam, M.Sc(N), M.Phil., Head of the Department, Community Health Nursing, MIOT College of Nursing, Chennai. I also declare that the material of this has not found in any way, the basis for the award of any degree or diploma in this university or other universities.

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II year M.Sc (N).
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ABSTRACT

The study is to assess the peak expiratory flow rate among school children by using peak flow meter in selected school at Chennai. A conceptual frame work of the study was developed on the basis of Epidemiological Triad Model. A quantitative research approach was used to achieve the objectives of the study. The objectives of the study is to assess the peak expiratory flow rate among school children, to compare the findings with normal peak expiratory flow rate and to associate the peak expiratory flow rate of the school children with selected demographic variables. A non-probability convenient sampling technique was used in the study. The total sample was 500 school children which includes both sexes. The peak expiratory flow rate was found by using mini Wright peak flow meter. The peak expiratory flow rate was compared with Clement Clarke International private limited guidelines. The mean weight of the school children are 36.36. The mean height of the school children are 146.77. The mean best trial score of the peak expiratory flow rate was 278.48. The mean normal best trial score of the peak expiratory flow rate was 324.58 and the mean below normal best trial score of the peak expiratory flow rate was 240.76. The findings of the study reveals that among 500 school children 275 of them had below normal peak expiratory flow rate and only 225 school children had normal peak expiratory flow rate. There was significant association between the peak expiratory flow rate and demographic variables like age, sex and standard. There was no association between peak expiratory flow rate and the family history of asthma. The correlation between weight and height of the school children was analyzed. Compared to weight, height is a very good indicator for predicting peak expiratory flow rate.
# LIST OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Contents</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INTRODUCTION</td>
<td>1-8</td>
</tr>
<tr>
<td></td>
<td>Need for the study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Statement of the problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Objectives of the study</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Operational definitions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assumptions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delimitations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Projected outcome</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>REVIEW OF LITERATURE</td>
<td>9-49</td>
</tr>
<tr>
<td></td>
<td>Review related to impact of air pollution on respiratory status of school children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Review related to using of peak expiratory flow rate to identify the at risk school children</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conceptual frame work</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>RESEARCH METHODOLOGY</td>
<td>50-54</td>
</tr>
<tr>
<td></td>
<td>Research approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Research design</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Setting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Population</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sample</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sample size</td>
<td></td>
</tr>
</tbody>
</table>
Sampling technique
Inclusion criteria
Exclusion criteria
Data collection tool
Validity
Reliability
Pilot study
Data collection procedure
Human rights protection

IV  DATA ANALYSIS AND INTERPRETATION  55-64
V   DISCUSSION  65-69
VI  SUMMARY, CONCLUSION, LIMITATIONS, IMPLICATIONS AND RECOMMENDATIONS  70-74
    REFERENCES  75-80
    APPENDICES  ix–xv
## LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE NO.</th>
<th>TABLES</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal peak expiratory flow rate for pediatrics</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>Distribution of demographic variables among school children</td>
<td>57-58</td>
</tr>
<tr>
<td>3</td>
<td>Comparison of findings with normal peak expiratory flow rate</td>
<td>61</td>
</tr>
<tr>
<td>4</td>
<td>Association between best trial score and demographic profiles like standard, age, sex and family history of asthma</td>
<td>62-63</td>
</tr>
<tr>
<td>5</td>
<td>Correlation between best trial score with weight and height among school children</td>
<td>64</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE NO.</th>
<th>DESCRIPTION</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Conceptual framework based on Epidemiological Triad</td>
<td>49</td>
</tr>
<tr>
<td>2.</td>
<td>Descriptive statistics for weight, height and best trial score among school children</td>
<td>59</td>
</tr>
<tr>
<td>3.</td>
<td>Distribution of normal peak expiratory flow rate among school children</td>
<td>60</td>
</tr>
</tbody>
</table>
## LIST OF APPENDICES

<table>
<thead>
<tr>
<th>APPENDIX</th>
<th>DESCRIPTION</th>
<th>PAGE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>Letters seeking permission to conduct the study</td>
<td>ix</td>
</tr>
<tr>
<td>B.</td>
<td>Informed consent form</td>
<td>x</td>
</tr>
<tr>
<td>C.</td>
<td>Calibration certificate</td>
<td>xi- xii</td>
</tr>
<tr>
<td>D.</td>
<td>Data collection tool - English</td>
<td>xiii-xiv</td>
</tr>
<tr>
<td>E.</td>
<td>Hand out</td>
<td>xv</td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

“CHILDREN ARE THE FUTURE OF THE NATION ”

School Children are more prone to get respiratory infections as they are more exposed to both outdoor and indoor air pollutants. More than 53 million children spend a significant portion of their days in more than 120,000 public and private school buildings. Many of these buildings are old and in poor condition, and may contain environmental conditions that inhibit learning and pose increased risks to respiratory infection of the children.

Breathing is one of the critical, vital functions, which takes place in our body, hardly with our conscious thought. In addition, without that function, one cannot survive in this world. The lungs are different from most of the other organs in our body because their delicate tissues are directly connected to the outside environment. Anything you breathe can affect our lungs. Germs, tobacco smoke and other harmful substances can cause damage to our airways and threaten the lungs ability to work properly.

Lung capacity has everything to do with health. How much air can you breathe in? This is known as lung capacity and has everything to do with how healthy you are. On exhaling you breathe out stale air or carbon dioxide and you exchange this stale air for fresh new oxygen when you inhale. This new oxygenated air is carried by the blood stream via its arteries to every part of your body. When a part of
your body is lacking in this new rejuvenated nourishing system, then it falters and is not up to the task it is assigned to do.

Maintaining a healthy lung capacity for one's age and height is an essential component of maintaining good health. Our lungs are responsible for taking in oxygen which is critical for sustaining metabolic processes. Oxygen is the mechanism by which all of the cells in our bodies convert nutrients into energy. Reduced lung capacity will, therefore, compromise one's ability to maintain an adequate level of oxygen in his or her bloodstream, while causing a build up of carbon dioxide within the body. This can result in organ damage; especially to the heart and brain; both of which require large quantities of oxygen to perform.

Children’s airways are narrower than those of adults. Triggers that may cause only a slight problem in adult can create more serious problems in children. Children are particularly vulnerable to respiratory infections because of their developmental stage and physical differences from adults. Children’s lungs and airways are immature and especially susceptible to insults from pollution. The developing lungs present a large surface area through which pollutants may be easily absorbed.

Children breathe faster and therefore inhale and absorb a relatively greater volume of contaminants compared to adults. Their breathing zone is lower than adults so they are more exposed to vehicle exhausts and heavier pollutants that concentrate at lower levels in the air. Perhaps the most important difference between adults and children is that children are growing and developing. Along with their increased body size, children's lungs are growing and changing, too. Children living in the high
polluted area showed a higher prevalence of cough during the day or at night, which is assumed to be due to the difference in pollution level.

Children take in more air per unit body weight at a given level of exertion than do adults. When a child is exercising at maximum levels, they may take in 20 percent to 50 percent more polluted air than would an adult in comparable activity. Another important difference is that children do not necessarily respond to air pollution in the same way as adults. Adults exposed to low levels of the pollutant will experience symptoms such as coughing, soreness in their chests, sore throats, and sometimes headaches. Children, on the other hand, may not feel the same symptoms, or at least they do not acknowledge them when asked by parents.

Air pollution is the major problem faced by people across the globe and in modern cities like Chennai. India has been ranked as seventh most environmentally hazardous country in the world.

According to World Health Organisation (WHO), air pollution is one of the world's biggest killers. It causes around two million people to die prematurely each year. Many of these deaths happen in developing countries (over half a million in India alone). Allergic respiratory disorders, in particular asthma is increasing in prevalence, which is a global phenomenon. Even though genetic pre-disposition is one of the factors in children for the increased prevalence, urbanization, air pollution and environmental tobacco smoke contributes more significantly.

In recent years, India has been more polluted due to urbanization, industrial pollution, deforestation and increasing number of automobiles. The problem of air pollution especially in urban areas is more due to increase number of vehicles. One in every 100 children in India between age group of 0-14 years suffers from acute
respiratory infection, because children breathe more rapidly and inhale more air per
breath compared to adults and because they spend more time in outdoors, being
physically active they tend to be more exposed to outdoor air pollution than do adults.

The mini Wright peak flow meter is an internationally recognized "Gold
Standard" in peak flow measurement. The mini Wright peak flow meter measures the
speed at which air is exhaled from lungs, giving you a measurement of how well your
airways are working. Many professionals use peak expiratory flow rate readings to
aid decisions about treatment, and many patients rely on their peak flow meter to act
as a marker for their disease. Peak expiratory flow rate can be measured by a
simplified device. Mini Wright peak flow meter, which is cheap, easily portable,
available and clinically reproducible.

Peak expiratory flow rate is the maximal expiratory flow rate sustained by a
subject for at least 10 milliseconds expressed in Litre per minute (L/min).

Peak expiratory flow rate is simple, effective & useful test obtaining
information on lung function in children. It is measured by variety of peak flow
meters including mini Wright peak flow meter which gives excellent results. Peak
expiratory flow rate is highly sensitive and accurate index of airway obstruction. Use
of peak expiratory flow rate as a measurement of ventilator function test is an ancient.
This simple ventilatory lung function test, measured by mini Wright peak flow meter,
is very useful in diagnosis, management and follow up of reversible air way diseases
mainly bronchial asthma.

Peak expiratory flow rate measurement gives the idea of status of airway
calibre of respiratory system and regulatory function of respiration which some times
affected by certain progressive neurological disease. Performance of accuracy of the
mini Wright peak flow meter meets National Asthma Education Programme (NAEP) guideline variation ± 5% with standard Wright peak flow meter (Clement Clarke int. Ltd, 1997).

**Need for the study**

Our children deserve to breathe healthy air. Polluted air in classrooms and playground areas can be hazardous to their health. Second hand smoke, outdoor air pollution, chemicals in the home and workplace, and radon can all cause or worsen lung disease in children. Lack of playground facilities in the urban schools and lack of breathing exercise lead to decreased lung capacity and thereby they are more prone to get restrictive lung disease.

“Air pollution is a major environmental health issue and it is vital that we increase efforts to reduce the health burden it creates,” said Dr Maria Neira, WHO Director for Public Health and Environment.

In 2008, the number of premature deaths attributed to urban outdoor air pollution is estimated to about 1.34 million worldwide.

According to World Health Organisation report, acute respiratory infections are the leading cause of child mortality (30%) followed by diarrhoea (20%) in India. The vehicular pollution, mainly due to auto rickshaws, followed by industrial pollution is the major reasons behind this high number of children suffering from respiratory problems.

Dr. Sameer Kumar Sharma (2008) conducted the study and revealed that every second, a city kid is prone to respiratory disease. Almost every second child visiting a paediatrician, the child shows one or another kind of symptoms pertaining to respiratory diseases.
Madhi. SA, Klugman .KP (2006) conducted a study and revealed that acute respiratory infections, particularly lower respiratory tract infections, are the leading cause of death among children under five years of age and are estimated to be responsible for between 1.9 million and 2.2 million childhood deaths globally.

In recent reports, air pollution has been linked to increased mortality, an increased risk of asthma, and decreased development of lung function in childhood. Approximately 5,00,000 annual hospitalizations, 34.6 percentages comprise of individuals aged 18 year or younger due to asthma.

Globally morbidity and mortality associated with asthma has increased over the last two decades. According to the most recent report from the Centre for Disease Control (CDC) and the National Centre for Health Statistics, 187 children aged 0-17 years died of asthma in the year 2002. Asthma affects an estimated 300 million individual’s world wide. Evidence shows that the prevalence of asthma is increasing, especially in children.

As per American Lung Association, asthma is the most common chronic disease among children due to polluted air. 1 in 11 children in the United Kingdom has asthma. In the USA, 7 million children have asthma. In India about 1 out of every 12 children has asthma.

In Chennai, exhaust from vehicles, dust from construction debris, industrial waste, burning of municipal and garden waste are all on the rise in the city. At least six of the above mentioned causes of death are related to respiratory disease, says Dr. D. Ranganathan, Director (In-charge), Institute of Thoracic Medicine.
Hence the investigator is interested in assessing the lung capacity of the school children by using peak flow meter as they are more prone for respiratory infections.

**Statement of the problem**

An exploratory study to assess the peak expiratory flow rate by using peak flow meter among school children in selected school at Chennai.

**Objectives**

- To assess the peak expiratory flow rate among school children
- To compare the findings with normal peak expiratory flow rate.
- To associate the peak expiratory flow rate of the children with selected demographic variables

**Operational definitions**

**Assess**

To estimate the peak expiratory flow rate of the school children

**Peak expiratory flow rate**

Peak expiratory flow rate is the maximal expiratory flow rate sustained by a subject for at least 10 milliseconds expressed in Litre per minute (L/min). This is measured by using peak flow meter.

**School children**

Students studying in a selected school from 6th to 10th standard

**Peak flow meter**

Peak flow meter is a portable hand-held device used to measure how well a person can blow air out of the lungs. It measures the airflow through the bronchi and thus the degree of obstruction in the airways.
Assumptions

- Children may have decreased lung capacity which leads to many respiratory problems like acute respiratory infections, asthma etc..

- Using peak expiratory flow rate, the risk among children can be identified at an early stage.

Delimitations

- The study was delimited to the selected school children.

- Data collection period was limited to 6 weeks.

Projected outcome

- The study findings will help to identify the risk posed to a child at an early stage and this will reduce the respiratory diseases.

- It will help the health personnel to conduct further research studies in assessment of respiratory status.

- The study findings will help to suggest the Government to appoint the school health nurse to conduct regular health check up.
CHAPTER II
REVIEW OF LITERATURE

The review of literature refers to the activities involved in identifying and searching for information on a topic, developing and understanding the state of knowledge on the topic.

- Polit and Hungler [2004]

Literature review was done by means of extensive survey, books, journal, internet and media. Research as well as non-research literatures were reviewed to broaden the understanding and gain insight into the problem under study.

The literature review for this study is divided into two sections:

SECTION 1: Literature related to impact of air pollution on respiratory status of the school children

SECTION 2: Literature related to using of peak expiratory flow rate to identify the at risk school children

Section 1: Literature related to impact of air pollution on respiratory status of school children:

Cakmak.S, et al (2012) conducted the study on influence of neighborhood traffic density on the respiratory health of elementary school children. They identified the roadways within a 200 meter radius of the child's neighborhood using the latitude and longitude of the residential postal code. Traffic exposure was defined as the sum of the annual volume of vehicles on all of these roadways. Volume was calculated using sensors to detect passing vehicles (simple traffic counts), and by counts and direction of traffic at intersections (turning movement counts). Ventilatory lung
function was measured by spirometry and airway inflammation by exhaled nitric oxide. The odds ratio between an interquartile increase in truck turning movement counts and chest congestion was 1.20 (1.06-1.35). The percentage of predicted Forced Vital Capacity declined 0.68%, (95% CI 1.32, and 0.03) for an interquartile increase in simple traffic counts (33,787 vehicles daily). Among those with self-reported asthma, effect sizes were larger. Percentage predicted Forced Expiratory Volume declined 1.84% (95% CI 0.07, 3.61) associated with an interquartile range increase in turning movement counts. No statistically significant change was detected between traffic measures and exhaled nitric oxide. The findings concluded that exposure to traffic-related air pollution increases respiratory symptoms and reduce ventilatory function in children, especially those with self-reported asthma.

Ghosh, R, et al (2012) conducted the study on ambient nitrogen oxides exposure and early childhood respiratory illnesses. This longitudinal study was conducted in Teplice and Prachatice districts, Czech Republic. Children were followed from birth to 4.5 years of age. Data were compiled from medical records at delivery and at follow up, and from self-administered questionnaires from the same two time points. Air pollution monitoring data were used to estimate exposure over five different averaging periods ranging from three to 45 days prior to an episode. To quantify the association between exposure and outcome, while accounting for repeated measure correlation we conducted logistic regression analysis using generalized estimating equations. During the first 2 years of life, the adjusted rate ratio for bronchitis associated with interquartile increase in the 30-day average NO(x) was 1.31 [95% confidence interval (CI): 1.07, 1.61] and for two to 4.5 year olds, it was 1.23 (95% CI: 1.01, 1.49). The 14-day exposure also had stable
association across both age groups: below 2 years it was 1.25 (95% CI: 1.06, 1.47) and for two to 4.5 years it was 1.21 (95% CI: 1.06, 1.39). The association between bronchitis and nitrous oxide increased with child's age in the under 2 years group, which is a relatively novel finding.

Jephcote.C, (2012) conducted the study on environmental injustices of children's exposure to air pollution from road-transport within the model British multicultural city of Leicester. This article addresses these gaps by spatially examining the distribution of respiratory hospitalisation incidents of children aged 0-15 years in relation to social circumstances and residential exposures of annual road-transport emissions within Leicester during 2000-09. Continuing upon the theme of 'Environmental Justice', the research explores the intra-urban spatial distribution of those who produce and residentially experience the majority of road-transport emissions. The findings indicate significant global relationships to exist between children's hospitalisation rates and social-economic-status, ethnic minorities, and road-transport emissions within Leicester.

Kodgule.R, et al (2012) conducted the study on exposure to biomass smoke as a cause for airway disease in women and children. An estimated 3 billion people (about half the world's population) burn biomass fuel (wood, crop residues, animal dung and coal) for cooking and heating purposes exposing a large population, especially women and children, to high levels of indoor air pollution. Biomass smoke comprises gaseous air pollutants as well as particulate matter air pollutants, which have significant harmful effects. Exposure to biomass smoke is a major contributor to morbidity and mortality. Children, women and the elderly are most affected. Apart from poor lung growth seen in growing children, the risk of developing respiratory
tract infections (both upper as well as lower) is greatly increased in children living in homes using biomass. Women who spend many hours cooking food in poorly ventilated homes develop Chronic Obstructive Pulmonary Disease (COPD), asthma, respiratory tract infections, including tuberculosis and lung cancer. It has been argued that exposure to biomass fuel smoke is a bigger risk factor for COPD than tobacco smoking. Children are more vulnerable to get respiratory infections.

Roy.A, et al (2012) conducted the study on indoor air pollution and lung function growth among children in four Chinese cities. Air pollution has been associated with decreased growth in lung function among children; we examined relationships between indoor air pollution metrics and lung function growth, among children years 3273) aged 6-13= (n living in four Chinese cities. Lung function parameters (Forced Vital Capacity and Forced Expiratory volume) were measured twice a year. Questionnaires were used to determine home coal burning and ventilation practices. Generalized estimating equations were used to examine ml/year associations. Among children living in houses where coal was used as a fuel and no ventilation devices were present, adjusted Forced Vital Capacity (FVC) and Forced Expiratory Volume (FEV) growth, respectively, were 37% and 61% that of the average growth per year in the full cohort. This suggests that household coal use may cause deficits in lung function growth, while using ventilation devices may be protective of lung billion people use solid fuels development

Coneus.K, Spiess.C.K, (2011) conducted the study on pollution exposure and child health: Evidence for infants and toddlers in Germany. This paper examines the impact of outdoor pollution and parental smoking on children's health from birth until the age of three years in Germany. They use representative data from the German
Socio-Economic Panel (SOEP), combined with five air pollution levels. These data were provided by the Federal Environment Agency and cover the years 2002-2007. Our work makes two important contributions. First, they used European data to replicate and extend an important US study by following the effects of pollution exposure and parental smoking on child health during the first four years of life. Second, they had health measures not only for infants but for toddlers as well. For infants, as well as for two- to three-year-olds, we are able to account for time-invariant and unobserved neighborhood and maternal characteristics. Our results suggest a significantly negative impact of some pollutants on infant health. High exposure to Carbon monoxide (CO) prior to birth causes, on average, a 289g lower birth weight. With respect to toddler health, they found that disorders and in particular those as bronchitis and respiratory illnesses are affected particularly by Oxygen levels.

Grigg J, (2011) conducted the study on air pollution and children's respiratory health-gaps in the global evidence. There is now convincing evidence that air pollution, especially the Particulate Matter (PM) fraction, adversely affects children's health. In general, the health effects of traffic-derived PM are well described in children living in high-income countries. Conversely, studies into the health effects of PM from biomass and solid fuels are limited to children in lower-income countries. As PM from different combustion sources have components in common (e.g. elemental black carbon). Using lung function growth and vulnerability to infection as examples of health effects of global significance to children, this review addresses the question whether high-income-country research into air pollution can inform effects of pollution in low-income countries and vice versa.
Harris A.M, et al (2011) conducted the study on air pollution and anemia as risk factors for pneumonia in Ecuadorian children. We enrolled 408 children from LP (more polluted) and 413 children from JR (less polluted). All subjects were aged 18-42 months. The result revealed that in anemic children, higher pollution exposure was significantly associated with pneumonia hospitalization (OR = 6.82, 95% CI = 1.45-32.00; P = 0.015). In non-anemic children, no difference in hospitalizations by pollution exposure status was detected (OR = 1.04, NS). Children exposed to higher levels of air pollution had more pneumonia hospitalizations (OR = 3.68, 1.09-12.44; P = 0.036), total respiratory illness (OR = 2.93, 95% CI 1.92-4.47; P < 0.001), stunting (OR = 1.88, 1.36-2.60; P < 0.001) and anemia (OR = 1.45, 1.09-1.93; P = 0.013) compared to children exposed to lower levels of air pollution. Also, children exposed to higher levels of air pollution had significantly lower oxygen saturation (92.2% ± 2.6% vs. 95.8% ± 2.2%; P < 0.0001), consistent with air pollution related dyshemoglobinemia.

Holtby S, et al (2011) conducted the study on children's exposure to second hand smoke: nearly one million affected in California. Despite the steady decline of smoking rates in California, over 200,000 children under age 12 live in homes where smoking is allowed, and another 742,000 live with an adult or adolescent smoker. Significant differences in children's exposure to tobacco smoke and risk of exposure are found by race/ethnicity, geographic regions within the state and by poverty level. African-American children were found to have a significantly higher rate of exposure than other racial and ethnic groups, while children in the Northern/Sierra and San Joaquin Valley regions were at the highest risk of exposure to second hand smoke. Children living in lower-income households were also at higher risk. These findings
can aid strategies to decrease children's exposure to tobacco smoke in the home through targeted public health messages.

Jasinski.R, (2011) conducted the study on air pollution and pediatric hospital admissions due to respiratory diseases in Brazil. The aim of this study was to evaluate the effects of air pollutants and their lag structures in relation to respiratory morbidity among children and adolescents. An ecological time-series study was performed, analyzing respiratory hospital admissions of children and adolescents in National Health System hospitals in Brazil. Generalized linear Poisson regression models were used to control for seasonality, temperature, humidity, and short-term trends. The study concluded that efforts to reduce air pollutants need to be adopted to minimize the adverse effects on children and adolescents in Brazil.

Kabir.Z, et al (2011) conducted the study on second hand smoke exposure and neurobehavioral disorders among children in the United States. A total of 6% of 55358 children (aged < 12 years), corresponding to a weighted total of 4.8 million children across the United States, were exposed to second hand smoke in the home. The weighted prevalence and 95% confidence intervals of each of the children's neurobehavioral outcomes were 8.2% (7.5-8.8) with learning disabilities, 5.9% (5.5-6.4) with attention-deficit/hyperactivity disorder, and 3.6% (3.1-4.0) with behavioral and conduct disorders. Children exposed to second hand smoke at home had a 50% increased odds of having ≥2 childhood neurobehavioral disorders compared with children who were not exposed to second hand smoke. Boys had a significantly higher risk. Older children, especially those aged 9 to 11 years, and those living in households with the highest poverty levels were at greater risk. In absolute terms, 274
100 excess cases in total of these 3 disorders could have been prevented if children had not been exposed to second hand smoke in their homes.

Kashima.S, et al (2011) conducted the study on effects of traffic-related outdoor air pollution on respiratory illness and mortality in children, taking into account indoor air pollution, in Indonesia. The subjects were 15,242 children from 2002 to 2003 Indonesia Demographic and Health Survey. The result revealed that increased the prevalence of acute respiratory infection both in urban and rural areas after adjusting for indoor air pollution. In urban areas, the prevalence of acute upper respiratory infection increased by 1.012 (95% confidence intervals: 1.005 to 1.019) per 2 km proximity to a major road. Adjusted odds ratios tended to be higher in the high indoor air pollution group. The study concluded that exposure to traffic-related outdoor air pollution would increase adverse health effects after adjusting for indoor air pollution. Furthermore, indoor air pollution could exacerbate the effects of outdoor air pollution.

Kim.J.L, (2011) conducted the study on respiratory health among Korean pupils in relation to home, school and outdoor environment. All pupils in 4th grade in 12 selected schools in three urban cities in Korea received a questionnaire (n = 2,453), 96% participated. Gaseous pollutants and ultra fine particles were measured indoors (n = 34) and outdoors (n = 12) during winter, 2004. Indoor dampness at home was investigated by the questionnaire. The mean age of pupils was 10 yr and 49% were boys. No school had mechanical ventilation and CO$_2$-levels exceeded 1,000 ppm in all except one of the classrooms. The indoor mean concentrations of SO$_2$, NO$_2$ and formaldehyde were 0.6 µg/m$^3$, 19 µg/m$^3$, 8 µg/m$^3$ and 28 µg/m$^3$, respectively. There
were positive associations between wheeze and outdoor NO\textsubscript{2}, and between current asthma and outdoor ultra fine particles.

Leuppi.J.D, et al (2011) conducted the study on intermittent or persistent rhinitis in children and adolescents with Asthma the Swiss paediatrics survey. Asthma and allergic rhinitis are chronic inflammatory airway diseases of the children often occur concomitantly. The objective of the program was to identify the comorbidities and characteristics of asthma, intermittent or persistent rhinitis and physician defined atopic dermatitis in 6- to 16-year old asthmatic Swiss children and adolescents. Approximately one third of the asthmatic children in Switzerland had well-controlled asthma. Almost two thirds of these asthmatics suffered from concomitant IPR. However, there were almost twice as many passive smokers in the less well-controlled group. The prevalence of atopic dermatitis was similar in both groups. IPR and AD may play an important role as risk factors in the future development of asthma.

Levy.D.E, et al (2011) conducted the study on school absenteeism among children living with smokers. They analyzed data on health and absenteeism among schoolchildren aged 6 to 11 years identified in the 2005 National Health Interview Survey (NHIS). The result shows that children living with 1 or $\geq 2$ adults who smoked in the home had 1.06 (95% confidence interval [CI]: 0.54-1.55) and 1.54 (95% CI: 0.95-2.12) more days absent from school per year, respectively, than children living with 0 smokers in the home. Living with $\geq 2$ adults who smoked in the home was associated with increased reports of having $\geq 3$ ear infections in the previous 12 months (adjusted odds ratio [aOR]: 2.65 [95% CI: 1.36-5.16]) and having a chest cold
in the 2 weeks before interview (aOR: 1.77 [95% CI: 1.03-3.03]) but not with having vomiting/diarrhea in the previous 2 weeks (aOR: 0.93 [95% CI: 0.45-1.89]). Caregivers’ time tending children absent from school was valued at $227 million per year.

Mengersen.k, et al (2011) conducted the study on association between indoor air pollution measurements and respiratory health in women and children in Lao, one of the least developed countries in South East Asia. The study reveals that emission from wood burning IS the dominant source of indoor air pollution. The result shed light on the impact of human activities and urban design on pollutant concentrations and respiratory health.

Nardocc.A.C, et al (2011) conducted the study on traffic related air pollution and population health: a review about Sao Paulo, Brazil. As results were obtained several studies that found relation between air pollution in Sao Paulo and respiratory and cardiovascular problems, fetal growth, increased mortality and hospitalizations, particularly in children and elderly people.

Panatto.D, et al (2011) conducted the study on air pollution and related respiratory diseases: the experience of a local health authority in Liguria (north Italy). The study was carried out from June 2005 to July 2008. The study did not bring to light any specific health problems attributable with certainty to industrial emissions. The impact of pollution caused by motor traffic proved to be greater than that due to industrial emissions. More exhaustive sampling campaigns should be
implemented in order to quantify the effects of specific sources of emissions and to correlate these sources with pollutants (industry, urban traffic, motorway traffic).

Poursafa.P, et al (2011) conducted a cross sectional study on association of air pollution and hematological parameters in children and adolescents. The study participants consisted of 134 students (48.5% boys) with a mean age of 13.10±2.21 years. While the mean Pollutant Standards Index (PSI) was at moderate level, the mean particulate matter ≤ 10 µm (PM10) was more than twice the normal level. Multiple linear regression analysis showed that PSI and most air pollutants, notably PM10, had significant negative relationship with hemoglobin and Red Blood Count (RBC), and positive significant relationship with White Blood Count (WBC) and platelet counts. The odds ratio of elevated WBC increased as the quartiles of PM10, ozone and PSI increased, however these associations reached significant level only in the highest quartile of PM10 and PSI. The corresponding figures for hemoglobin and RBC were in opposite direction.

Poursafa.P, et al (2011) conducted the study on what health professionals should know about the health effects of air pollution and climate change on children and pregnant mothers. Health professionals face the adverse health effects of climate change and air pollution in their practices. This review underscores the effects of these environmental factors on maternal and children’s health, as the most vulnerable groups to climate change and air pollution. The result revealed that environmental factors, notably climate change and air pollution influence children's health before conception and continue during pregnancy, childhood, and adolescence. The accumulation of greenhouse gases such as carbon dioxide, primarily from burning
fossil fuels, results in warming which has an impact on air pollution particularly on levels of ozone and particulates. Heat-related health effects include increased rates of pregnancy complications, pre-eclampsia, eclampsia, low birth weight, renal effects, vector-borne diseases as malaria and dengue, increased diarrheal and respiratory disease, food insecurity, decreased quality of foods, malnutrition, water scarcity, exposures to toxic chemicals, worsened poverty, natural disasters and population displacement. Air pollution has many adverse health effects for mothers and children. In addition to short-term effects like premature labour, intrauterine growth retardation, neonatal and infant mortality rate, malignancies, respiratory diseases, allergic disorders and anaemia are common in children.

Portnov B.A, et al (2011) conducted the study on high prevalence of childhood asthma in Northern Israel is linked to air pollution by particulate matter. The medical records of 3922 school children residing in the Greater Haifa Metropolitan Area in Northern Israel were analyzed. Individual exposure to ambient air pollution Sulphur oxide (SO$_2$ and PM (10) for each child was estimated using Geographic Information Systems tools. Factors affecting childhood asthma risk were then investigated using logistic regression and the more recently developed Bayesian Model Averaging (BMA) tools. The analysis reveals that childhood asthma in the study area appears to be significantly associated with particulate matter of less than 10 μm in aerodynamic diameter (PM(10)) (Odds Ratio (OR) = 1.11; P < 0.001. Thus, it is concluded that exposure to airborne particular matter, even at relatively low concentrations (40-50 μg/m$^3$), generally below international air pollution standards (55-70 μg/m$^3$), appears to be a considerable risk factor for childhood asthma in urban areas.
Rao.D, et al (2011) conducted the study on impact of environmental controls on childhood asthma. Exposure to allergens early in life can lead to sensitization and the development of childhood asthma. It is thought that increased exposure with the advent of modern housing is likely contributing to the rise in prevalence of childhood asthma during the past few decades. The progression from allergen exposure to sensitization and asthma development has been noted with respect to dust mites, pets, cockroach, mouse, mold, tobacco smoke, endotoxin, and air pollution, although some have found a protective effect with pet and endotoxin exposure.

Seo.W.H, et al (2011) conducted the study on the standard range of peak expiratory flow rates of Korean children. The Mini Wright Peak Flow Meter (MWPFM) and spirometry were used in this study. The total sample was 1586 children which include both sexes. The result revealed that PEFR increased with height, age, weight, sitting height and Body Surface Area (BSA). Height and BSA were found to be better predictors of PEFR than the other parameters. The correlation coefficient between FEV1 and PEFR using the MWPFM was 0.886 (p < .001). The reference values of PEFR for height in our study were higher for both sexes than for those previously reported in Korea (p < .005).

Seyidov.T.H, et al (2011) conducted the study on passive smoke exposure is associated with perioperative adverse effects in children. Data were collected from 385 children, who underwent elective surgery during general anesthesia from June to November, 2008. Respiratory adverse events were reported in 58 patients (15.1%): 50 patients (21.4%) were in the PSE (Passive Smoke Exposure) and 8 patients (5.3%) were in the non-PSE group (P = 0.00). The frequency of laryngospasm during
anesthesia (P = 0.03) and hyper secretions in the recovery room (P = 0.00) were significantly increased in the PSE group. Children who are exposed to environmental tobacco smoke and who undergo general anesthesia seem to have an increased risk of respiratory complications in the recovery period rather than during anesthesia.

Cara.A.C, et al (2010) conducted the study on impact of early childhood air pollution on respiratory status of school children. The sample of the study includes children between 6 to 7 years of age. The report was concluded that there has a strong relation between early life wheezing and asthma symptoms at school age. Children, who had been living near an iron and steel factory during their early years, are still at increased risk for asthma symptoms at school age.

Kasznia-Kocot.J, et al (2010) conducted the study on environmental risk factors for respiratory symptoms and childhood asthma. This cross-sectional study includes 1130 children from 13-15 years of age living in upper Silesia. Bronchial asthma was identified in 4.5% of the children, asthma diagnosed by physicians in 8.7% and prevalence of wheezing is 12.6%. This study revealed that exposure to indoor (tobacco smoke, coal stove, emission, mould or dampness in dwelling) and outdoor (traffic pollution) air contaminants are major environmental factors responsible for adverse respiratory health effects in children.

Linares.B, et al (2010) conducted the study on impact of air pollution on pulmonary function and respiratory symptoms in children at Salamanca, Mexico. The study includes 464 children from 6 to 14 years of age, from two schools differing in distance from the major stationary air pollution sources. The result shows that
abnormalities in lung function and frequency of respiratory symptoms were higher in the school closer to major stationary air pollution sources than in the distant school.

Milosevic.Z, et al (2010) conducted a time series study on influence of air pollution on hospital admissions for cardiovascular and respiratory diseases in Serbia. A significant increase in hospital admissions was associated with a 10 microg/m3 increase in the concentration of black smoke, for cardiovascular diseases: 3.14% (<0.01) in children and youth under 19 years of age, 1.85% (<0.001) in 19-64 age group, and 0.84% (<0.05) in all ages, and for respiratory diseases: 1.77% (<0.05) in 19-64 age group, and 0.91% (<0.05) in all ages. The effects on hospitalizations for respiratory diseases in children and youth under 19 years of age, and for cardiovascular and respiratory diseases in the elderly were not statistically significant. The increase of sulphur dioxide level was associated with the increased number of hospitalizations, for both cardiovascular and respiratory diseases in all age groups, but the influence was not statistically significant.

Perez-Padilla.R, et al (2010) conducted the study on respiratory health effects of indoor air pollution. Domestic pollution is relevant to health because people spend most of their time indoors. One half of the world's population is exposed to high concentrations of solid fuel smoke (biomass and coal) that are produced by inefficient open fires, mainly in the rural areas of developing countries. Concentrations of particulate matter in kitchens increase to the range of milligrams per cubic meter during cooking. Solid fuel smoke possesses the majority of the toxins found in tobacco smoke and has also been associated with a variety of diseases, such as chronic obstructive pulmonary disease in women, acute respiratory infection in children and lung cancer in women (if exposed to coal smoke). Other tobacco smoke-
associated diseases, such as tuberculosis, asthma, respiratory tract cancer and interstitial lung diseases may also be associated with solid fuel smoke inhalation, but evidence is limited. As the desirable change to clean fuels is unlikely, efforts have been made to use efficient, vented wood or coal stoves, with varied success due to inconsistent acceptance by the community.

Rodriguez.L.A, et al (2010) conducted a cross-sectional study on respiratory symptoms associated with asthma prevalence and air pollution in preschool children. The sample includes 768 children less than seven years in two urban zones. The result showed that the use of cigarettes (27.5%) and aerosols (22.7%) were the most frequent source of indoor air pollution. Wheezing prevalence was 25.6% (95% CI 23.2-29.8%) and diagnosis of asthma was 8.4% (95% CI 6.2-11.5%).

Suwanwaipatthana.W, et al (2010) conducted the study on outdoor air pollution and children’s health. Children spend almost 90% of their time indoors, though outside air can be a significant source of potential and actual exposure to outdoor air pollutants. Children are vulnerable to pollutants and toxins because of their size and developing organ systems. Young children have increased respiratory rates and inhale more toxins, and young children often ignore respiratory symptoms and continue play. Outdoor play and recreational activities expose children to outdoor air pollution from sources such as automobiles, power plants, industry, and other combustion sources, which can impact children. Outdoor air pollution has been linked to respiratory illness exacerbations, infant mortality, the development of asthma, and atopy and reduction in lung development in children. This article will examine outdoor air pollution and its impact on children's health, as well as implications for pediatric nursing clinical practice.
Castro. H.A., et al (2009) conducted the study on effect of air pollution on lung function of schoolchildren in Brazil. The samples of 118 students (between 6 and 15 years of age) were taken. The result shows that mean peak expiratory flow was 243.5 l/mt (SD=58.9). The lowest mean peak expiratory flow was 124 l/mt, and the highest, 450 l/mt.

Hermano, et al (2009) conducted the panel study on association between daily exposure to air pollution and lung function in school children. The samples were 118 students between 6 and 15 years of age. Random sampling technique was used to select the samples. The result revealed that air pollution was associated with a reduction in students’ lung function in the short term. Specific increases in PM10 and NO2 levels were associated with decreases in lung function.

Liu. L, et al (2009) conducted the study on acute effects of air pollution on pulmonary function, airway inflammation, and oxidative stress in asthmatic children. In this study they studied 182 children with asthma, 9-14 years of age, for 4 weeks. The result shows that interquartile-range increases in 3-day average SO2(5.4 ppb), NO2 (6.8 ppb), and PM(2.5) (5.4 microg/m3) were associated with decreases in forced expiratory flow between 25% and 75% of forced vital capacity, with changes being -3.1% [95% confidence interval (CI), -5.8 to -0.3], -2.8% (95% CI, -4.8 to -0.8), and -3.0% (95% CI, -4.7 to -1.2), respectively. SO2, NO2, and PM (2.5) were associated with increases in thiobarbituric acid reactive substances (TBARS), with changes being 36.2% (95% CI, 15.7 to 57.2), 21.8% (95% CI, 8.2 to 36.0), and 24.8% (95% CI, 10.8 to 39.4), respectively. Risk estimates appear to be larger in children not taking corticosteroids than in children taking corticosteroids. O3 (5.3 ppb) was not
associated with health end points. FeNO (fractional exhaled nitric oxide), 8-isoprostane, and interleukin-6 (IL-6) were not associated with air pollutants. The study concluded that air pollution may increase airway oxidative stress and decrease small airway function of asthmatic children. Inhaled corticosteroids may reduce oxidative stress and improve airway function.

Pavlov. N, (2009) conducted the study on lung function in children residually exposed to asbestos. The study includes 40 girls and 41 boys, aged (10.69+/−2.24) years. Patients were selected randomly among pre-school and elementary school from the split area, which were residually exposed to asbestos. The result shows that exposure to asbestos in childhood leads to neoplasm, pulmonary fibrosis, or respiratory insufficiency.

Dherani. M, et al (2008) conducted the study on indoor air pollution from unprocessed solid fuel use and pneumonia risk in children aged less than five years: a systematic review and meta-analysis. This review updates a prior meta-analysis and investigates whether risk varies by etiological agent and pneumonia severity among children aged less than 5 years who are exposed to unprocessed solid fuels. The overall pooled odds ratio was 1.78 (95% confidence interval, CI: 1.45-2.18), almost unchanged at 1.79 (95% CI: 1.26-2.21) after exclusion of studies with low exposure prevalence (< 15%) and one high outlier. There was evidence of publication bias, and the implications for the results are explored. Sensitivity sub analyses assessed the impact of control selection, adjustment for confounding, exposure and outcome assessment, and age, but no strong effects were identified. Evidence on respiratory syncytial virus was conflicting, while risk for severe or fatal pneumonia was similar to
or higher than that for all pneumonia. Despite heterogeneity, this analysis demonstrated sufficient consistency to conclude that risk of pneumonia in young children is increased by exposure to unprocessed solid fuels by a factor of 1.8. Greater efforts are now required to implement effective interventions.

Kumar.R, et al (2008) conducted an exposure response study on indoor air pollution and respiratory function of children in Delhi. The sample includes 441 children (59% male, 41% female) between ages 7 and 15 years of age. The result revealed that indoor SO$_2$, NO$_2$, and suspended particulate matter levels were high in houses where there was a family history of smoking. It is concluded that indoor air pollution had an association with respiratory function of children.

Diette.G.B, (2008) conducted the study on environmental issues in managing asthma. Management of asthma requires attention to environmental exposures both indoors and outdoors. The indoor environment contains both pollutants (e.g., particulate matter, nitrogen dioxide, second hand smoke, and ozone) and allergens from furred pets, dust mites, cockroaches, rodents, and moulds. Indoor particulate matter consists of particles generated from indoor sources such as cooking and cleaning activities, and particles that penetrate from the outdoors. Indoor particulate matter and nitrogen dioxide are linked to asthma morbidity. The health effects of indoor ozone exposure have not been well studied. In contrast, there is substantial evidence of detrimental health effects from second hand smoke. The 2007 National Asthma Education and Prevention Program asthma guidelines recommend eliminating indoor smoking and improving the ventilation. Outdoor air pollutants that impact asthma include particulate matter, ozone, nitrogen dioxide, and sulphur dioxide (SO$_2$).
and guidelines recommend that individuals with asthma avoid exertion outdoors when these pollutants are elevated.

Moura.M, et al (2008) conducted the study on Air quality and acute respiratory disorders in children. A time series ecological study was carried out in three public health posts in a region of the city of Rio de Janeiro (Southeastern Brazil), between April 2002 and March 2003. Data for PM10, SO₂, NO₂, CO and O₃ were analyzed daily and as closure variables, a total of 45,595 emergency pediatric consultations for respiratory symptoms or specifically for disorders in the upper and lower airways. The result shows that only O₃ had a positive and statistically significant effect, both among emergency consultations for respiratory problems and consultations for symptoms relating to the lower airways. Effect and exposure occurred on the same day (lag 0). A significant negative association was found with CO and pediatric consultations for respiratory complaints. Other air pollutants were not found to have a significant effect. The study concluded that there is an associations between outdoor air pollution and the number of emergency pediatric consultations for respiratory problems in the studied area.

Nikic.D, et al (2008) conducted the study on impact of air pollution on the rate of hospital admission of children with respiratory diseases. They compared daily data of sulphur dioxide and black smoke concentrations in air with data of daily hospital admissions for respiratory diseases in children 0-14 years of age in two periods (1992-1995) and (2002-2005). There were totally 4,283 and 3,842 hospital admissions for respiratory diseases in children in the first (1992-1995), and the second (2002-2005) period observed, respectively. The highest number of hospital admissions was
registered in children aged 0-4 years, and the lowest one in children aged 10-14 years. Statistically significant influence of pollutants on the number of hospital admissions for respiratory diseases was observed in the period 1992-1995 in children aged 0-4 years.

Hnadadjev.M, et al (2007) conducted the study on smoking and asthma in children. Case-control study was realized at the Public Health Centre in the City of Novi Sad, the Province of Vojvodina, Republic of Serbia, between 2003 and 2005 and included 504 participants. The study explored the relation between asthma in children and tobacco smoke exposure during pregnancy, the first year of life and/or onwards. The reports on smoking exposure were obtained by a questionnaire. The result shows that the cases comprised 252 schoolchildren with asthma confirmed by the specialist. The controls (n=252) were respectively matched by age, gender and place of residence, selected from children's classmates, without any diagnostic or anamnestic records of asthma. Multivariate logistic regression analysis identified one positive characteristic associated with asthma occurrence in children - current environmental tobacco smoke exposure by persons other than parents (p=0.0132). The study concluded that the smoking habit has an influence on risk factors for the development of asthma in childhood and indicates a need of deeper understanding of lifestyle in asthma occurrence in children.

Kohlhammer.Y, et al (2007) conducted the study on high prevalence of pneumonia in children of a smelter town. Although air quality has improved in terms of sulfur dioxide and particulate matter (PM), the content of certain metals in PM in industrial areas is persistently high. Lifetime pneumonia prevalence in schoolchildren
born after unification in the heavy-metal industrial area Hettstedt remain elevated. One difference between low and high pneumonia-prevalence areas seems to be the residual concentrations of heavy metals in respirable air. Toxicological and human exposure studies of Hettstedt particles have shown metal-rich PM from Hettstedt to have greater toxicity and inflammatory properties than the PM of the control region. Past industrial emissions might still play a decisive role decade after the closing of sources, and pneumonia should be considered a possible acute health burden caused by metal-rich air pollution.

Moorman J.E, et al (2007) presented a report on National Surveillance for Asthma United States, 1980 – 2004. This report presents national data on asthma for self-reported prevalence (1980-1996 and 2001-2004). During 2001-2003, current asthma prevalence was higher in children (8.5%) compared with adults (6.7%), females (8.1%) compared with males (6.2%), blacks (9.2%) compared with whites (6.9%), those of Puerto Rican descent (14.5%) compared with those of Mexican descent (3.9%)

Pintér A, et al (2007) conducted the study on air pollution and children's respiratory morbidity in the Tata area, Hungary. Irritant gases, like SO2 and NO2 levels exceed national and international standards in many settlements. Longitudinal and cross-sectional studies have been conducted in children in the winter period of 1993/1994, with respect to SO2 and NO2 concentration. Average SO2 levels exceeded the national standard levels and daily peaks as high as 450 micrograms/m were recorded. Excessive NO2 levels were also found but they were not as high as those of SO2. Acute respiratory morbidity, based on a uniform protocol was recorded
daily and evaluated on a daily and weekly basis. A statistically significant correlation with SO2 levels was observed in relation to the frequency of acute daily respiratory morbidity. Other health parameters, like pulmonary function, haematology and sensory performance were also tested. Although no statistically significant correlations were observed, the tendency in all parameters demonstrated impairment, in relation with ambient air pollution. Smoking history of the family did not alter significantly the pulmonary functions of other parameters.

Khalequzzaman.M, et al (2007) conducted the study on indoor air pollution and its impact on children under five years old in Bangladesh. The health impacts of these pollutants were assessed on 65 and 51 children under five years old from families who use biomass and fossil fuel as main source of energy, respectively. Mean concentrations of CO were found to be significantly higher in biomass fuel users (P = 0.010), while geometric mean concentrations of benzene, xylene, toluene, hexane, and NO2 were significantly higher (P < 0.01) in the fossil fuel users. Symptoms such as redness of eyes, itching of skin, nasal discharge, cough, shortness of breath, chest tightness, wheezing, or whistling chest were found to be associated with the choice of biomass fuel, with the odds ratio ranging from 4.0 to 6.3. The health of children under five years old in Bangladesh, especially those living in poor socioeconomic conditions, is considered to be worsening because of indoor air pollution.

Sritippayawan.S, et al (2006) conducted the study on environmental tobacco smoke exposure and Respiratory Syncytial Virus (RSV) infection in young children hospitalized with acute lower respiratory tract infection. The present study was performed to determine the relationship between environmental tobacco smoke (ETS) exposure and acute lower respiratory tract infection (LRI) caused by respiratory
syncytial virus (RSV) in children. The authors did the study in 71 children (median age 12 months; 60% male) who were admitted to King Chulalongkorn Memorial Hospital with acute LRI between June and September 2004. 27% had RSV infection. The result revealed that RSV-LRI required longer duration of oxygen therapy than non RSV-LRI (4.5 +/- 1.7 vs 2.8 +/- 1.3 days; p < 0.001). Desaturation in room air was more common in the former group compared to the latter group (37 vs 11%; p = 0.01). There was no difference in urinary cotinine level between the two groups (median 0.5 vs 0.6 mcg/mg Cr; ns). Among RSV-LRI, those with desaturation had higher urinary cotinine level than those without desaturation (median 0.8 vs 0.0 mcg/mg Cr; p = 0.04).

Barnet.A.G, et al (2005) conducted the study on air pollution and child respiratory health. The study used data on respiratory hospital admissions in children (three age groups: < 1, 1–4, and 5–14 years) for five cities in Australia and two in New Zealand. Time series of daily numbers of hospital admissions were analyzed using the case crossover method. Significant increases across the cities were observed for hospital admissions in children for pneumonia and acute bronchitis (0, 1–4 years), respiratory disease (0, 1–4, 5–14 years), and asthma (5–14 years). The study found strong and consistent associations between outdoor air pollution and short-term increases in childhood hospital admissions.

Ramamurthy.N, et al (2005) conducted the study on influenza activity among the paediatric age group in Chennai. During January to December 2002, 240 children with acute respiratory infection attending the out patient clinic of Institute of Child Health were included by convenient sampling. Throat swabs were collected from 4 to 5 cases every week. Virus isolation was positive in 30 (12.5%) of the 240 samples.
Influenza A/H3N2/Panama/2000/99 was the predominant serotype isolated accounting for 24 (80%) of the 30 isolates. Influenza B/Sichuan/379/99 was isolated in 4 (13.33%) and a combination of Influenza A/H3N2 and B/Sichuan in 2 (6.6%) of the isolates.

Phipatanakul. W, (2006) conducted the study on environmental factors and childhood asthma. Indoor allergens are potent triggers for acute and chronic pediatric asthma. Environmental control measures of these allergens should be considered first-line treatment measures. Allergen avoidance can produce changes in disease activity and symptoms that can be beneficial before any medical intervention is implemented. In addition to allergen avoidance, studies evaluating other exposures, such as endotoxin and diet, in the pathogenesis of asthma are in progress. Understanding the complex relationships between exposure and allergy/asthma development is vitally important to the development of potentially more effective primary and secondary prevention strategies.

Richards. W, et al (2006) conducted the study on Los Angeles air pollution and asthma in children. Indices of air pollution, meteorological conditions and airborne allergens were correlated with emergency room census and hospitalizations for asthma at the Children’s’ Hospital of Los Angeles (CHLA) during a six-month period encompassing high and low periods of air pollution. Increases in asthma emergency room visits and hospitalizations correlated significantly with increases in nitric oxide, coefficient of haze, hydrocarbons, Santa Ana wind conditions and total airborne allergen counts. Significant correlations were also found with decreases in ambient levels of O3, SO2, temperature and relative humidity. Among Sunair Home for Asthmatic Children (SHAC) patients morning peak flow levels were significantly
lower during the 10-day peak pollution period than during two control periods of low pollution.

Kim.J.J (2004) American Academy of Pediatrics Committee on Environmental Health stated that Ambient (outdoor) air pollution is recognized as an important problem, both nationally and worldwide. Our scientific understanding of the spectrum of health effects of air pollution has increased, and numerous studies are finding important health effects from air pollution at levels once considered safe. Children and infants are among the most susceptible to many of the air pollutants. In addition to associations between air pollution and respiratory symptoms, asthma exacerbations, and asthma hospitalizations, recent studies have found links between air pollution and preterm birth, infant mortality, deficits in lung growth, and possibly, development of asthma.

Viegi.G, et al (2004) conducted the study on indoor air pollution and airway disease. The study shows that indoor pollution plays a significant role in affecting health. Indoor air pollution may increase the risk of irritation phenomena, allergic sensitisation, acute and chronic respiratory disorders and lung function impairment. Recent conservative estimates have shown that 1.5-2 million deaths per year worldwide could be attributed to indoor air pollution. Approximately 1 million of these deaths occur in children aged under 5 years due to acute respiratory infections.

Wong.G.W, et al (2004) conducted the study on outdoor air pollution and asthma. This article reviews that Traffic Related Pollution has been confirmed in both
cross-sectional and longitudinal studies to be associated with increased asthma morbidity and cardiopulmonary mortality.

Ayten Pamukcu Uyan et al (2003) conducted the study on: Prevalence of Asthma and Allergic Disorders Among Children In Duzce, Turkey. The sample includes 1171 (50.3%) were boys, 1159 (49.7%) were girls, and the mean age of the study group was found to be 10.2±0.20 years. In this study, the total number of children diagnosed by a physician as having asthma was found to be 149 and the prevalence was 6.4%. Prevalence of allergic rhinitis and eczema were respectively 3.35% and 2.8%.

The Tamil Nadu Pollution Control Board (TNPCB) (2003) conducted the study on the ambient air quality in the city under the `Emission Inventory and Source Apportionment' study commissioned. And they found that vehicular emissions were the major contributor to air pollution. The draft second Master Plan prepared by the Chennai Metropolitan Development Authority and made public on Wednesday refers to the 2003 study. It said the major contributors to Chennai air pollution load are vehicles (71.28 percent) and industry (19.7 percent).

Busquets. R.M, et al (2002) conducted a cross-sectional study to determine the prevalence of asthma and bronchial responsiveness to exercise in children aged 13 – 14 yrs in Barcelona (Spain). For this study 3,033 schoolchildren aged 13- 14 yrs were studied from the general population. A total of 2,842 children underwent bronchial responsiveness testing by exercise challenge. The prevalence of "current asthma" was 4% and the prevalence of "wheezing only" 10%. A fall in Peak Expiratory Flow Rate
(PEFR) $> \text{or} = 15\%$ after exercise testing was found in 324 (11\%) children, 29 (9\%) of whom presented clinical symptoms of asthma.

Chen.P.C, et al (2002) conducted the study on adverse effect of air pollution on respiratory health of primary school children in Taiwan. The samples were 5,072 primary school students in six communities were chosen. Respiratory health was assessed by evaluation of the children's respiratory symptoms and diseases using a parent-completed questionnaire. Data were analyzed using logistic regression analysis to compute odds ratios of adverse effect. The school children in the urban communities had significantly more respiratory symptoms (day or night cough, chronic cough, shortness of breath, and nasal symptoms) and diseases (sinusitis, wheezing or asthma, allergic rhinitis, and bronchitis) when compared with those living in the rural community.

Lewis.P.R, et al (2002) conducted the study on relationship between outdoor air pollution and the respiratory health of children aged 8 to 10 years at new South Wales. A cross-sectional survey method was used. The study includes 3023 primary school children. The result shows that the proportion of children reported to have the main outcome symptoms were: chest colds, 3.0\%-9.7\%; night cough, 12.3\%-30.5\%; and wheeze, 3.4\%-11.3\%. There was no significant association with SO2, but a significant increase in the odds of symptoms per 10 micrograms/m3 increase in PM10 on chest colds (odds ratio [OR], 1.43; 95\% confidence interval [CI], 1.12-1.82) and night-time cough (OR, 1.34; 95\% CI, 1.19-1.53), but not wheeze. These results provide evidence of health effects at lower than expected levels of outdoor air pollution.
pollution in the Australian setting. They also suggest differences in contributions of environmental and hereditary factors to cough and chest colds compared with wheeze.

Smith.K.R, et al (2002) conducted the study on indoor air pollution in developing countries and acute lower respiratory infections in children. The studies of indoor air pollution from household biomass fuels are reasonably consistent and, as a group, show a strong significant increase in risk for exposed young children compared with those living in households using cleaner fuels or being otherwise less exposed. Not all studies were able to adjust for confounders, but most of those that did so found that strong and significant risks remained. The study findings concluded that since acute lower respiratory infection is the chief cause of death in children in less developed countries, and exacts a larger burden of disease than any other disease category for the world population, even small additional risks due to such a ubiquitous exposure as air pollution have important public health implications. In the case of indoor air pollution in households using biomass fuels, the risks also seem to be fairly strong, presumably because of the high daily concentrations of pollutants found in such settings and the large amount of time young children spend with their mothers doing household cooking.

Section 2: Literature related to using of peak expiratory flow rate to identify the at risk school children.

Radziavicius.F.R, et al (2010) conducted an observational study on Peak Expiratory Flow values are higher in older and taller healthy male children. The sample includes 1942 children. Peak expiratory flow rate and height were measured
between five and ten year’s old children. The result shows that significant differences were found in values for peak expiratory flow: higher values were seen in older students in comparison with younger students, in males in comparison with females and in students from private schools in comparison with public schools, with average values ranging from 206 L/min to 248 L/min. Linear correlations were seen for Peak Expiratory Flow values with both height and age (Spearman Coefficient).

Raji.V.Sugumar, Meena.K (2010) conducted a descriptive study on Peak Expiratory Flow Rate among school going children of 6-14 years of age in Banglore. The sample size was 580 from both the sex. Systematic random sampling was used to pick the samples. Peak flow expiratory meter was used to measure peak flow expiratory rate. Selected socio- economic, cultural and environmental factors were compared with peak expiratory flow rate. Percentages, statistical tools, illustrations were used to analyse the data. There was a significant relation among age, height, and environmental hazards like smoke, dust, presence of pets at home with Peak Expiratory Flow Rate in school going children.

Grad.R, et al ( 2009) conducted the study on Peak Flow Measurements in children with asthma .Three hundred twenty-three urban children with persistent asthma were enrolled in a school-based study that implemented an internet-based asthma monitoring and data collection system. The mean age of the children was 10.0 (SD = 2.1) years; 57% were male and 91% were Africo American. A total of 12,245 child reports were completed; 98% (n = 11,974) had corresponding teacher reports, confirming the peak flow meter readings reported by the children.
Rosenlund. M, (2009) conducted the study on Traffic-related air pollution in relation to respiratory symptoms, allergic sensitisation and lung function in schoolchildren. The samples were 2107 children aged 9-14 years from 40 schools in Rome in 2000-1 were included in a cross-sectional survey. The result revealed that there was a strong association between estimated NO2 exposure per 10 microg/m3 and lung function, especially expiratory flows, in linear regression models adjusted for age, gender, height and weight: -0.62% (95% CI -1.05 to -0.19) for forced expiratory volume in 1 s as a percentage of forced vital capacity, -62 ml/s (95% CI -102 to -21) for forced expiratory flow between 25% and 75% of forced vital capacity and -85 ml/s (95% CI -135 to -35) for peak expiratory flow. The associations appeared stronger in girls, older children, in children of high socioeconomic status and in those exposed to parental smoking.

Abid Ali. M, Vahali. KV (2008) conducted a study on some observation of peak expiratory flow in normal school children in northern Nigeria. Peak expiratory flow rate & anthropometric measurement was taken on 248 healthy secondary school children in Northern Nigeria. The male children have significantly higher value (p 0.01) of peak expiratory flow rate in comparison to female children.

Dhungel. K.U, et al (2008) conducted the study on Peak expiratory flow rate of Nepalese children and young adults. One hundred ninety six (196) students were selected by inclusion criteria from different schools and colleges in Pokhara Sub-Metropolitan City, Nepal. The anthropometric measurements and Peak Expiratory Flow Rate (PEFR) were measured. The mean PEFR values of males and females are found to have 350.3 (+/-135.0) l.min-1 and 280.2 (+/-98.77) l. min-1 respectively. The PEFR values of Nepalese males of the present study are found to be higher as
compared to their females' counterparts. It is interestingly noted that at preadolescence
time, PEFR is almost comparable in both sexes but after puberty males attained
significantly higher values than females. The trend of PEFR values with development
of the age is also been noted. It is interestingly pointed out that PEFR values of
Nepalese males in the present study increases significantly with the advancement of
age up to 20 years of age and then after PEFR do not change. On the other hand,
females showed significant PEFR increment with the advancement of age up to 15
years of age only and then after PEFR do not improve significantly. PEFR was found
to be influenced significantly by height not by the weight.

reference values in children and adolescents aged 6 to 18 years in Galicia, Spain. The
sample includes children and adolescents aged 6 to 18 years from randomly selected
schools in 14 municipalities in Galicia . We developed equations to predict the main
spirometry parameters for this age group according to sex, height, and weight. Mean
spirometry values in relation to height were higher for boys than for girls, except in
the 140-160 cm range, where they were higher for girls. Equations published in other
studies in similar populations gave different predictions, ranging from an
underestimation of forced mid expiratory flow rate (FEF(25%-75%)) by 16% in
comparison to ours to an overestimation of peak expiratory flow (PEF) rate by 15%
for an average boy. For a girl, the corresponding differences ranged from an
underestimation of FEF (25%-75%) by 17% to an overestimation of PEF by 19%.

expiratory flow rate variability in apparently healthy school children aged 10-15 years
in Oredo, Nigeria. The sample includes 438 subjects (10-15 years), attending the
public Junior Secondary Schools, between March and November 2005. The study took place in the Oredo Local Government area. Peak expiratory flow rate variability (mean+/−SD) was 4.5+/−1.3% for all subjects (4.4+/−1.0% for males, and 4.6+/−1.6% for females). Females had higher peak expiratory flow rate variability. The upper limits of 95% CI were 7.1% for all subjects (6.4% for males, and 7.8% for females). The peak expiratory flow rate showed an inverse relationship with height, age, and weight.

Pulickal.A.S, et al (2007) conducted the study on peak expiratory flow rate in healthy rural south Indian school children predicted from body height. Peak expiratory flow rate was measured in 1403 children aged 5 to 17 years using mini Wright peak flow rate meter. Significant linear correlation was seen of peak expiratory flow rate with height in males (P<0.001, R= 0.856) & in females (P< 0.001, R=0.762).

Chen.H.H, et al (2007) conducted the study on detection of peak expiratory flow in healthy children in Xinjiang at China. A total of 3520 healthy children (1705 males and 1815 females) aged from 7 to 16 years were enrolled in this study. Peak expiratory flow was measured using micro peak flow meter. Children’s age, sex, height and weight were recorded. Peak expiratory flow values increased with the increase of age, height and weight and correlated significantly with age, height, weight and sex.

Benjaponpitak.S, et al (2006) conducted a cross sectional study on peak expiratory flow rate values of students in Bangkok. Peak expiratory flow rate measured with standard Wright peak flow meter. 501 normal students, aged 5 to 15 years, from five public schools in Bangkok were investigated. The relationship
between PEFR and height was approximately linear in both male and female children. Prediction equations for each sex were: Male children: PEFR (L/min) = [3.52 x Height (cm)] - 186.80 Female children: PEFR (L/min) = [3.48 x Height (cm)] - 204.11.

Mohammedzadeh.I, et al (2006) conducted the study on normal values of peak expiratory flow rate in children from the town of Babol, Iran. The study includes 1050 students in Babol. Mini Wright peak flow meter was used for measurement of peak expiratory flow rate. The range of age, weight and height were defined. Correlation between peak expiratory flow rate and height was more significant and between peak expiratory flow rate and weight was lower.

AL Dawood.K, (2005) conducted the study on peak expiratory flow rate of school boys at Al-Khobar City, Saudi Arabia. The samples of 1312 school boys were selected as per the selection criteria of the study. Peak expiratory flow rate was measured for them, using Wright peak flow meter. The findings revealed that height, age and weight were found to correlate significantly with peak expiratory flow rate. However, only height and age were included in the final regression model which had a reasonably high coefficient of multiple determination value (R2 =0.72).

Chattopadhyay.B.P, et al (2005) conducted the study on respiratory health status of the road side school children at Kolkata. The samples were two schools for boys (n = 210) and two schools for girls (n = 200) and in rural area one school for boys (n = 99) and the other school for girls (n = 95) were investigated. The detail histories about health status of children, if they have any subjective feelings of health related problems during the school hours or after returning from the school, and the family histories were taken by questionnaire method. The Pulmonary Function Tests
(PFT) were carried out by Spirometric method by Spirovit-Sp-10 and Wright's Peak flow meter. The results revealed that the mean PFT values of the students found in the normal range. Boys were having higher values compared to the girls in both city and rural schools. Lung volumes and flow rates were significantly higher in rural students. Symptomatic changes like breathlessness, cough and other problems (sneezing, eye irritation, running nose etc.) among city schoolboys found 13%, 7% and 15% and in girls found 12%, 6% and 7% respectively. In symptomatic students, mean PFT values were significantly lowered compared to non-symptomatic. PFT values were presented in relation to age and height. It has been found that a number of city school students are having different types of respiratory symptoms. Long-term effect of exposure into such environment may develop lung functional impairments.

Ljustina Pribi, et al (2005) conducted a study on reference values for the peak expiratory flow. Peak Expiratory Flow (PEF) is an important screening method for investigation and follow up of the pulmonary function. The result showed an increase of peak expiratory flow values with age and body height in both sexes. Elevation of peak expiratory flow was more significant in boys: high correlation was found in regard to age and height in boys and moderate correlation in girls.

Singh.V (2005) conducted the study on the burden of pneumonia in children: an Asian perspective. Pneumonia results in two million deaths each year among children worldwide (20% of all child deaths), 70% of them in Africa and South-east Asia. Most nations employ a WHO standard case management protocol using age-specific cut-offs for increased respiratory rates and chest in-drawing for a clinical definition of pneumonia. Measles infection increases pneumonia morbidity and mortality. Low birth weight, under-nutrition, hypovitaminosis A, zinc deficiency, lack
of breastfeeding, air pollution (including environmental tobacco smoke) and overcrowding increase the risk for pneumonias in children. Standard case management protocols used for acute respiratory infections in these countries have brought down the disease burden but an improvement in the diagnostic algorithm is needed to appropriately recognise those with associated wheeze. Research is needed to find effective and affordable preventive strategies.

Beeza Bacab.M.A (2004) conducted an observational study on Peak Expiratory in 6-12 year old children from Merida. They included school children between 6 and 12 years old of both sexes. The samples were 621 healthy school children between 6 and 12 years old of which, 321 girls and 300 boys of two schools were selected by random sampling. The result shows that the pulmonary function values increase proportionally to height, which showed the higher correlation to peak expiratory flow rate.

Romero-Placeres.M, et al (2004) conducted the study on air pollution, bronchial asthma, and acute respiratory infections in minors, Habana City. They identified the relationship between the presence of acute respiratory illnesses and exposure to levels of particles less than 10 microg/m3 (PM10), smoke, and sulfur dioxide (SO2); negative binomial regression models were used to assess latency periods of one to five days as well as the cumulative effect of seven days before the emergency visit. The levels of atmospheric pollutants were low, in general. The 24-hour mean values for PM10 levels, smoke, and SO2, were 59.2 microg/m3 (SD=29.2), 27.7 microg/m3 (SD=21.2), and 21.1 microg/m3 (SD=20.1), respectively. An increase of 20 microg/m3 in the daily average of black smoke was associated with a 2.2%
increase (95% CI 0.9-3.6) in the number of emergency visits for Acute Bronchial Asthma Crisis (ABAC). A 20 microg/m3 increase in the daily average of black smoke and SO was associated with an increase in ARI of 2.4% (95% CI 1.2-3.6), and 5% (95% CI 1.3-5.3), respectively.

Veeranna.N (2004) conducted a study on of peak expiratory flow rates among tribal children of Mysore district. Two hundred forty-two children belonging to two scheduled tribes 'Soliga' and 'Jenukurubas' were studied; their PEFR was recorded and correlated with anthropometric data. There was a significant positive correlation between PEFR and age, height, weight, body surface area, arm span and chest expansion in the study group. This was compared with other Indian and Western studies and a nomogram to predict PEFR from height was constructed.

Swaminathan.S, et al (2003) conducted the study on peak expiratory flow rate in South Indian children. They measured peak expiratory flow rate in 345 healthy South Indian children aged 4-15 years, using the mini Wright peak flow meter. A nomogram was constructed relating Peak expiratory flow rate to height. Prediction equations for peak expiratory flow rate using height alone or height, age and weight were determined for both sexes. The prediction equation for boys based on height alone was peak expiratory flow rate = 4.08 height (cm) 284.55 and for girls was peak expiratory flow rate = 3.92 height (cm) 277.01.

Pande.J.N, Mohan et al (2002) conducted the study on peak expiratory flow rate in school going children at New Delhi. Peak Expiratory Flow Rate (PEFR) was measured with mini Wright's peak flow meter in 783 children (aged 6-17 years) from a school in urban Delhi and 523 children (aged 6-15 years) from another school in
Nellore, Andhra Pradesh. Age, sex, height and weight were independent predictors of peak expiratory flow rate in children from Nellore. Age, sex and height, were independent predictors of peak expiratory flow rate in boys from Delhi while height alone was an independent predictor of peak expiratory flow rate in Delhi girls. Common prediction equations for predicting peak expiratory flow rate in boys and girls have been developed for both regions based on age and height. For the same height and age, boys had higher peak expiratory flow rate than girls. In the females, the peak expiratory flow rate seemed to have a plateau effect after the age of 14 years; such an effect was, however, not seen in the boys in the age range studied.

Sagher.F.A, et al (2002) conducted the study on peak expiratory flow rate nomogram in school children. The study aimed to develop a peak expiratory flow rate nomogram for Libyan children. Of 900 children randomly selected from four Tripoli primary schools, 670 (330 girls and 340 boys) with age range 4.5-14.9 years, fulfilled the selection criteria. Peak expiratory flow rate was recorded in a standing position using a mini-Wright peak flow meter. Anthropometric measurements, weight, height, head circumference and mid-upper-arm circumference were recorded and surface area and body mass index were calculated. Our findings showed PEFR to be significantly related to height\(r = 0.74\), age \(r = 0.70\), surface area \(r = 0.64\) and weight \(r = 0.62\) at \(P < 0.001\).
**Conceptual framework**

This chapter deals with conceptual framework adopted for this study. A conceptual framework is comprised of interrelated concepts of the natural phenomena. Since air pollution is more common which causes respiratory infections among children in the urbanized areas like Chennai, the investigator aimed to assess the lung capacity among school children, the Epidemiological Triad was found suitable.

Epidemiological Triad helps to harvest the valid and precise information about the causes, preventions, and treatments for disease. The triad consists of an external agent, a host and an environment in which the host and agent are brought together causing the disease to occur in the host.

The triangle has three corners (called vertices)

- Agent or microbe that causes the disease
- Host or organism harbouring the disease
- Environment or those external factors that allow or cause disease transmission

The mission is to break atleast one of the sides of the triangle, disrupting the connection between the environment, the host and the agent and interrupting the continuation of disease.

**Agent**

Agent is the cause of disease. Disease causing microbes are bacteria, virus, fungi and protozoa. Here the causative organism which cause respiratory infections are respiratory syncitial virus, influenza virus, staphylococcus pneumonia and chemical agents like asbestos, fibers, tobacco smoke etc..
Host

Hosts are organisms usually humans or animals which are exposed to and harbour a disease. The host are the children who are under poor economic status, poor immune status and malnourished children.

Environment

Environment is the favourable surroundings and conditions external to the host that cause or allow the disease to be transmitted. Here the environment includes population density, exposure to cigarette smoke etc..

Outdoor air pollutants: Industrial pollution, urbanization, deforestation, increased automobile utilization

Indoor air pollutants: Biomass fuels, building material, and combustion
OUT DOOR POLLUTANTS:
   a) Industrial pollution
   b) Urbanization
   c) Deforestation
   d) Increase automobile utilization

INDOOR POLLUTANTS:
   a) Biomass fuels, Building material
   b) Combustion
   c) Exposure to cigarette smoke
   d) Population density

CAUSATIVE ORGANISMS:
   a) Respiratory synctial virus
   b) Influenza virus
   c) Staphylococcus pneumoniae
   d) Epstein Barr virus

CHEMICAL AGENTS:
   Asbestos, fibers and tobacco smoke

Figure 1: CONCEPTUAL FRAMEWORK BASED ON EPIDEMIOLOGICAL TRIAD
CHAPTER III

RESEARCH METHODOLOGY

This chapter describes the methodology to assess the peak expiratory flow rate by using peak flow meter among school children in selected corporation higher secondary school, Chennai. It consists of research approach, research design, settings, population, sample, sample size, sampling techniques and sample selection criteria.

It also deals with the development of data collection procedure, blue print of the tool, validity and reliability, pilot study, procedure for data collection and human rights protection.

Research approach

Quantitative research approach was used in this study

Research design

An exploratory study design was adopted for this study

Setting

The study was conducted in corporation higher secondary school, Chennai. The total strength of the school is 2200 children which includes both boys and girls. The classes are from 6th to 10th standard. In each class there are six sections and each section comprises of 50 to 60 children.

Population

The target population comprised of school children studying in corporation higher secondary school, Chennai
Sample

The sample includes children who were studying from 6th to 10th standard in the selected corporation higher secondary school at Guindy, Chennai.

Sample size

The sample size was 500 school children

Sampling technique

A non–probability convenient sampling technique was used for this study

Criteria for sample collection

Inclusion criteria:

- School children who are studying from 6\textsuperscript{th} standard to 10\textsuperscript{th} standard
- School children who are willing to participate
- School children who are available during data collection procedure

Exclusion criteria:

- School children with any respiratory problem

Data collection tool

As study aimed to assess the lung capacity of the school children, the data collection instrument were developed through extensive review of literature in consultation with the experts. The tools used in the study were Demographic data and Observation Check List by using Peak Flow Meter.
Description of the tool

Section I: It consists of demographic data of the school children which include the standard and section, age, sex, weight, height and family history of asthma or respiratory disease.

Section II: It consists of observational checklist of peak expiratory flow rate of the school children by using peak flow meter.

Criteria of the scoring

Section I: No scoring

Section II: The score has been compared with standard tool established by Clement Clarke International which is given below.

Table 1: Normal peak expiratory flow rate of paediatics

<table>
<thead>
<tr>
<th>Height (m)</th>
<th>Height (ft)</th>
<th>Predicted EU PEFR(L/m)</th>
<th>Height (m)</th>
<th>Height (ft)</th>
<th>Predicted EU PEFR(L/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.85</td>
<td>2’9”</td>
<td>87</td>
<td>1.30</td>
<td>4’3”</td>
<td>212</td>
</tr>
<tr>
<td>0.90</td>
<td>2’11”</td>
<td>95</td>
<td>1.35</td>
<td>4’5”</td>
<td>233</td>
</tr>
<tr>
<td>0.95</td>
<td>3’1”</td>
<td>104</td>
<td>1.40</td>
<td>4’7”</td>
<td>254</td>
</tr>
<tr>
<td>1.00</td>
<td>3’3”</td>
<td>115</td>
<td>1.45</td>
<td>4’9”</td>
<td>276</td>
</tr>
<tr>
<td>1.05</td>
<td>3’5”</td>
<td>127</td>
<td>1.50</td>
<td>4’11”</td>
<td>299</td>
</tr>
<tr>
<td>1.10</td>
<td>3’7”</td>
<td>141</td>
<td>1.55</td>
<td>5’1”</td>
<td>323</td>
</tr>
<tr>
<td>1.15</td>
<td>3’9”</td>
<td>157</td>
<td>1.60</td>
<td>5’3”</td>
<td>346</td>
</tr>
<tr>
<td>1.20</td>
<td>3’11”</td>
<td>174</td>
<td>1.65</td>
<td>5’5”</td>
<td>370</td>
</tr>
<tr>
<td>1.25</td>
<td>4’1”</td>
<td>192</td>
<td>1.70</td>
<td>5’7”</td>
<td>393</td>
</tr>
</tbody>
</table>
Criteria for scoring

Section A : No Scoring.

Section B : The data has been compared with the Clement Clarke International standard tool as per table 1 and the scoring is given as:

Normal – 1
Below normal – 0

Validity

The tool was developed through extensive review of literature for content validity. The instrument was reviewed by experts in the area of the study. Alterations have been made as per suggestion from experts.

Reliability

The reliability of the tool was established through pilot study. The reliability was tested by split half method, the score was $r = 1$.

Pilot study

The pilot study was conducted for one week after getting permission from the principal of Sivasakthi matriculation school, Chennai. The pilot study was conducted on a sample of 50 school children. Before conducting the study informed consent was obtained from each subject. The findings revealed that 52% of the students had below normal peak expiratory flow rate. The result proved that the tool is valid and reliable. These students were then excluded from the main study.

Data collection procedure

The data was collected for 6 weeks from 30-05-2011 to 09-07-2011 in the Corporation Higher Secondary School at Guindy, Chennai. Before starting the study,
the investigator obtained permission from the District Commissioner of Education, Chennai and Headmaster of the selected Corporation Higher Secondary School to conduct the study. Time schedule for the data collection was programmed. On each day 13-15 samples were selected. Non probability convenient sampling technique was used to collect the samples. The samples were selected as per inclusion criteria. The purpose of the study was explained to each respondent and informed consent was obtained. Personal data was obtained through self administered questionnaire. The investigator demonstrated the procedure to each subject. After which three trials were given to each of them and the best trial was taken. No time interval was given in between the trials. The data was collected as per the following schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>No of days</th>
<th>No of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-05-2011 to 04-06-2011</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>06-06-2011 to 11-06-2011</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>13-06-2011 to 18-06-2011</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>20-06-2011 to 25-06-2011</td>
<td>6</td>
<td>84</td>
</tr>
<tr>
<td>27-06-2011 to 02-07-2011</td>
<td>6</td>
<td>83</td>
</tr>
<tr>
<td>04-07-2011 to 09-07-2011</td>
<td>6</td>
<td>84</td>
</tr>
</tbody>
</table>

**Human rights protection**

The pilot and main study were conducted only after approval of the research proposal by the College of Nursing and the Institutional Ethical Committee. Also permission was obtained from the concerned Head of the Department to conduct the study. Informed consent was obtained from each sample before conducting the study.
CHAPTER IV
ANALYSIS AND INTERPRETATION

This chapter describes the analysis of the numerical data collected by the study instruments and their meaning and relevance. Statistics is a field of study concerned with techniques or methods of collection of data, classification, summarizing, interpretation, drawing inferences, testing of hypothesis, making recommendation, etc.,

The data was collected from 500 school children and analyzed according to objectives and hypothesis of the study. This chapter deals with analysis and interpretation includes both descriptive and inferential statistics. The findings of the study were organized and presented under the following headings.

Section I

- Describes the distribution of demographic variables among school children.
- Descriptive statistics for weight, height and best trial score among school children.

Section II

- Distribution of normal peak expiratory flow rate among school children
- Comparison of the findings with normal peak expiratory flow rate
Section III

- Association between best trial score and demographic variables like age, sex, standard and family history of asthma
- Correlation between best trial score with weight and height among school children
SECTION I

This section deals with the description of sample characteristics according to the baseline variables like standard, age, sex and family history of asthma.

Table 2: Distribution of demographic variables among school children

n = 500

<table>
<thead>
<tr>
<th>Demographic Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Standard</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 6\textsuperscript{th} std – a1</td>
<td>42</td>
<td>8.0</td>
</tr>
<tr>
<td>b) 6\textsuperscript{th} std – a2</td>
<td>63</td>
<td>12.6</td>
</tr>
<tr>
<td>c) 7\textsuperscript{th} std – a1</td>
<td>43</td>
<td>8.6</td>
</tr>
<tr>
<td>d) 7\textsuperscript{th} std – a2</td>
<td>47</td>
<td>9.4</td>
</tr>
<tr>
<td>e) 8\textsuperscript{th} std – a1</td>
<td>45</td>
<td>9.0</td>
</tr>
<tr>
<td>f) 8\textsuperscript{th} std – a2</td>
<td>42</td>
<td>8.4</td>
</tr>
<tr>
<td>g) 9\textsuperscript{th} std – a1</td>
<td>48</td>
<td>9.6</td>
</tr>
<tr>
<td>h) 9\textsuperscript{th} std – a2</td>
<td>51</td>
<td>10.2</td>
</tr>
<tr>
<td>i) 10\textsuperscript{th} std – a1</td>
<td>64</td>
<td>12.8</td>
</tr>
<tr>
<td>j) 10\textsuperscript{th} std – a2</td>
<td>55</td>
<td>11.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>2. Age in years</strong></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) 10 yrs</td>
<td>27</td>
<td>5.4</td>
</tr>
<tr>
<td>b) 11 yrs</td>
<td>88</td>
<td>17.6</td>
</tr>
<tr>
<td>c) 12 yrs</td>
<td>76</td>
<td>15.2</td>
</tr>
<tr>
<td>d) 13 yrs</td>
<td>116</td>
<td>23.2</td>
</tr>
<tr>
<td>e) 14 yrs</td>
<td>98</td>
<td>19.6</td>
</tr>
<tr>
<td>f) 15 + yrs</td>
<td>95</td>
<td>19.0</td>
</tr>
</tbody>
</table>
3. Sex

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Male</td>
<td>269</td>
<td>53.8</td>
</tr>
<tr>
<td>b) Female</td>
<td>231</td>
<td>46.2</td>
</tr>
</tbody>
</table>

4. Family history of asthma

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Yes</td>
<td>10</td>
<td>2.0</td>
</tr>
<tr>
<td>b) No</td>
<td>490</td>
<td>98.0</td>
</tr>
</tbody>
</table>

Table 2 reveals that majority of them (23.2\%) were belonging to 13 years of age, (19.6\%) were 14 years of age, (19\%) were 15+ years, (17.6\%) were 11 years of age, (15.2\%) were 12 years of age and (5.4\%) were 10 years of age. Among them, 53.8\% were boys and 46.2\% were girls. 98\% of the children had no family history of asthma and only 2\% of the children had family history of asthma.
The data presented in the above figure 2 shows that mean weight of the school children are $M = 36.36$, $SD = 10.25$. The mean height of the school children are $M = 146.77$, $SD = 11.04$. The mean best trial score are $M = 278.48$, $SD = 68.69$. 

Figure 2: Descriptive statistics for weight, height and best trial score among school children

n= 500
SECTION II

Figure 3: Distribution of normal peak expiratory flow rate among school children

The data presented in the above figure shows that only 45% of the school children had normal peak expiratory flow rate and 55% of them had below normal peak expiratory flow rate.
Table 3: Comparison of findings with normal peak expiratory flow rate

n = 500

<table>
<thead>
<tr>
<th>Peak expiratory flow rate</th>
<th>Best trial score</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>Normal</td>
<td>225</td>
<td>324.58</td>
<td>61.89</td>
</tr>
<tr>
<td>Below Normal</td>
<td>275</td>
<td>240.76</td>
<td>47.83</td>
</tr>
</tbody>
</table>

Independent t test and P value

\[ T = 17.075, P = 0.000 \ (P<0.001) \]

The data presented in the above table 3 shows that mean normal best trial score of the school children are \( M = 324.58, \ SD = 61.89 \) and the mean below normal best trial score of the school children are \( M = 240.76, \ SD = 47.83 \).
Table 5: Correlation between best trial score with weight and height among school children

\[ n = 500 \]

<table>
<thead>
<tr>
<th>Physical variables</th>
<th>Best trial score</th>
<th>P – value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>( r = 0.541 )</td>
<td>( P &lt; 0.001 ) (Significant)</td>
</tr>
<tr>
<td>Height</td>
<td>( r = 0.683 )</td>
<td>( P &lt; 0.001 ) (Significant)</td>
</tr>
</tbody>
</table>

Table 5 indicates that a positive correlation existed between weight and height with the best trial score. The correlation was found statistically significant at \( P < 0.05 \).
CHAPTER V

DISCUSSION

An exploratory study was conducted to assess the peak expiratory flow rate of the school children by using peak flow meter in corporation higher secondary school at Chennai. The samples were selected by non–probability convenient sampling technique and their lung capacity was assessed by using peak flow meter. The result of the study has been discussed based on the objectives stated for the study.

The findings of the demographic variables shows that majority of the children 23.2 % were belonging to 13 years of age, 19.6 % were 14 years of age, 19% were 15+ years, 17.6% were 11 years of age 15.2 % were 12 years of age and 5.4% were 10 years of age. Among them 53.8% were boys and 46.2% were girls. 98% of the children had no family history of asthma and only 2% of the children had family history of asthma.

The first objective was to assess the peak expiratory flow rate among school children

Figure 2 shows that the mean weight of the school children are $M = 36.36$, $SD = 10.25$. The mean height of the school children are $M = 146.77$, $SD = 11.04$. The mean best trial score are $M= 278.48$, $SD = 68.69$.

The findings of the study are consistent with the study conducted by Mohammadzadeh.I, et al (2006) on normal values of peak expiratory flow rate in children from the town of Babol, Iran. The aim of this study was to determine normal PEFR of the healthy children .This study was randomly done on 1050 students.
(primary and secondary schools) in Babol. Mini-Wright peak flow meter was used for measurement of PEFR. The range of age, weight and height were defined. Mean age of 1050 students (525 male and 525 female) who participated in this study was 10.26 years. The mean peak expiratory flow rate was 262.35+/−71.97 L/Min.

It could be interpreted that mean height and weight of the school children is important in predicting the peak expiratory flow rate.

The second objective was to compare the findings with normal peak expiratory flow rate.

Figure 3 reveals that 225 school children had normal peak expiratory flow rate and 275 school children had below normal peak expiratory flow rate. As per percentage 45% of the school children had normal peak expiratory flow rate and 55% of them had below normal peak expiratory flow rate.

Table 3 shows that mean normal best trial score of the school children are M = 324.58, SD = 61.89 and the mean below normal best trial score of the school children are M= 240.76, SD = 47.83.

The findings can be supported by the study conducted by Castro.H.A, et al (2009) with a random sample of 118 students (between 6 and 15 years of age), enrolled in a public school of the city of Rio de Janeiro and living within 2 km of the study site. Data on students' characteristics were obtained with a questionnaire, including the International Study of Asthma and Allergies in Childhood - ISAAC. Daily peak expiratory flow measurements were taken to measure lung function. The result revealed that mean peak expiratory flow was 243.5 l/m (sd=58.9) The study concluded that even within acceptable levels most of the time, air pollution,
especially PM(10) and Nitrous Oxide (NO) was associated with a decrease in lung function in children living in the city of Rio de Janeiro.

The results are consistent with the study conducted by Linares.B, et al (2010) on impact of air pollution on pulmonary function and respiratory symptoms in children at Salamanca, Mexico. The study includes 464 children from 6 to 14 years of age, from two schools differing in distance from the major stationary air pollution sources. The result shows that abnormalities in lung function and frequency of respiratory symptoms were higher in the school closer to major stationary air pollution sources than in the distant school.

The findings were also supported by the study conducted by Barnet.A.G, et al (2005) on air pollution and child respiratory health. The study used data on respiratory hospital admissions in children (three age groups: < 1, 1–4, and 5–14 years) for five cities in Australia and two in New Zealand. Time series of daily numbers of hospital admissions were analyzed using the case crossover method. Significant increases across the cities were observed for hospital admissions in children for pneumonia and acute bronchitis (0, 1–4 years), respiratory disease (0, 1–4, 5–14 years), and asthma (5–14 years). The study found strong and consistent associations between outdoor air pollution and short-term increases in childhood hospital admissions.

The investigator felt that clean water and clean air are basic human rights. Children who breathe traffic-related air pollution at school are more likely to develop acute respiratory infections, asthma etc. Public schools in urban areas are located in the highly polluted areas. Hence immediate measures to be taken by the Government
to control the traffic related pollution and appoint the School Health Nurse to assess the school children periodically to prevent the respiratory disease in children.

The conceptual framework formulated for the study was based on the Epidemiological Triad Model. This model focused on causes of low peak expiratory flow rate was due to urbanisation, increased automobile utilisation, population density etc… which affects the school children with poor economic status and poor immune status.

The findings also revealed that school children have low lung capacity hence constant health awareness and motivation is essential to improve their lung capacity. In school, periodic health assessment must be done every six months to identify the risk posed to a child at an early stage and this will reduce the respiratory diseases like pneumonia, acute respiratory infections, asthma etc…

The third objective was to find out the association between the peak expiratory flow rate of the children with selected demographic variables.

Table 4 reveals that there is significant association between the standard, age and sex at P<0.05 level. There is no significant association between the family history of asthma at P > 0.05.

The results are consistent with the study conducted by Takshanda (2008) on peak expiratory flow rate of rural school children from Wardha district Maharashtra in India. The peak expiratory flow rate was measured in 1078 rural healthy school children, living in Wardha district using the mini Wright peak flow meter. Result shows that positive correlation was seen between age, height, weight & peak expiratory flow rate. The findings of the present study revealed that age, sex, height and weight of the children determines the peak expiratory flow rate.
Table 5 indicates that a positive correlation existed between weight and height with the best trial score. The findings of the study also revealed that height is a good indicator for predicting peak expiratory flow rate compared to weight. The correlation was found statistically significant at P<0.05.

The results can also be supported by the study conducted by Agaba P.A, et al (2003) on Peak expiratory flow rates in healthy Nigerian children. Peak expiratory flow rate was measured in 1023 urban Nigerian children aged 6-12 years, using a portable peak flow meter. The mean peak expiratory flow rate values were 213.3 +/- 47.3 and 211.0 +/- 45.9 l/min for males and females, respectively. Peak expiratory flow rate showed significant correlation with the various anthropometric parameters measured, with height having the best correlation. Height can thus be used in deriving prediction formula for peak expiratory flow rate.
CHAPTER VI
SUMMARY, CONCLUSION, LIMITATIONS, IMPLICATIONS
AND RECOMMENDATIONS

Summary

The focus of the study was to assess the peak expiratory flow rate of the school children by using peak flow meter in corporation higher secondary school, Chennai.

The following objectives were set for the study:

- To assess the peak expiratory flow rate among school children
- To compare the findings with normal peak expiratory flow rate.
- To associate the peak expiratory flow rate of the children with selected demographic variables

An exploratory study design was adopted for the study. Non–probability convenient sampling technique was used to select the samples. The total sample was about 500 school children which included both sexes. The samples were taken as per the inclusion criteria. The conceptual framework formulated for the study was based on the Epidemiological Triad Model.

Data collection tool

As study aimed to assess the lung capacity of the school children, the data collection instrument were developed through extensive review of literature in consultation with the experts and with the opinion of faculty members. The tool used
in the study was demographic data and observation check list by using Peak Flow Meter.

**The major findings of the study**

The findings revealed that majority of the students were (23.2 %) belonging to 13 years of age, (19.6 %) 14 years of age, (19%) 15+ years, (17.6%) 11 years of age, (15.2 %) 12 years of age and (5.4%) 10 years of age. Among them 53.8% were boys and 46.2% were girls. 98% of the school children had no family history of asthma and only 2% of the students had family history of asthma.

The overall 45 % of school children have normal peak expiratory flow rate and 55% of the school children have below normal peak expiratory flow rate.

There was significant association between the peak expiratory flow rate and demographic variables such as standard, age and sex of the school children at P>0.05. There was no significant association between the peak expiratory flow rate and the family history of asthma. The correlation between height and weight was analyzed. The findings reveal that height is a good indicator for predicting the peak expiratory flow rate compared to weight.

**Conclusion**

The study concluded that majority (55%) of the school children are having low peak expiratory flow rate and only (45%) of them have normal peak expiratory flow rate. School students in metro cities are often exposed to vehicle exhausts as their schools are situated mostly on the high traffic roadside. Acute exposure to automobile exhaust is associated with increased respiratory symptoms and may decrease and
impair lung function in children. Hence periodic health assessment in schools and education about importance of breathing exercise to improve their lung capacity is essential for school children which would reduce the risk of respiratory diseases. The investigator fulfilled this role by imparting knowledge through distributing leaflets to all the school children of her study.

**Limitations**

- The sample size is only 500 therefore the results cannot be generalized
- Data collection period was limited to 6 weeks only hence long term effects cannot be identified.

**Nursing implications**

The investigator had drawn the following implications from the study which is vital concern for nursing services, nursing education, nursing administration and nursing research.

**Nursing Practice**

The community nurse plays a vital role in educating and motivating the school children for preventing lung infection in children. Repeated education or emphasis on the importance of protection of lungs from pollution and other preventive sources should be stressed.

The findings revealed that school children are more prone to get respiratory infections since many of the urban schools lack ground facilities and hence donot
encourage children to play. The school management does not give enough importance to yoga class since it is a well known measure to improve lung capacity. The Community Health Nurse has vital role in creating health consciousness among school children as “Today’s students are tomorrow citizens”.

Nursing Education

The nursing students will be able to understand the importance of protection of lungs from respiratory infection among school children. It helps the children to understand lung infection like acute respiratory infection, pneumonia, asthma etc... is the commonest among children which may lead to increased mortality rate. It helps them to know that simple measures like diet, hygiene and healthy practices can drastically make a change in the indicators of the health followed promptly by the people. Health promotion and primary prevention should be integrated as the main component in all aspects of community health nursing practise by means of focusing on Nursing Education curriculum. Health education regarding preventive aspects should be emphasised.

Nursing administration

Nursing administrators can formulate policies which will include all nursing staff to be actively involved in Health Education Programmes. The school health nurse administrator should initiate to carryout periodic survey on corrective or preventive measures by emphasizing the importance of play activities in the ground and yoga classes to be conducted regularly. Nursing administractor could organise and
co-ordinate school health programme to provide mass education on importance of breathing techniques.

**Nursing research**

The Instinct of research is to build up a body of knowledge in Nursing as an evolving profession. Community Health Nurse has a vital role in preventing disease. Therefore various studies should be conducted from time to time to find out the at risk children. There is a need for extensive research in this concept so that better strategies and better interventions would be developed in the conquest of respiratory infections for school children.

**Recommendations**

- A similar study can be conducted for a larger group of sample, there by finding can be generalized.
- A similar study can also be conducted among primary school children.
- A comparative study can be conducted among rural and urban school children.
- A comparative study can be conducted among Government schools and Private schools.
REFERENCES
American Lung Association 1301, Pennsylvania Ave NW, Suite 800, Washington, DC 20004
| T: 202 785 3355 | F: 202 452 1805 | E: info@lungusa.org @ 130 HRS


The Tamil Nadu Pollution Control Board (TNPCB). (2003). 'Emission Inventory and Source Apportionment' study commissioned.


World Health Organisation, New Delhi office wrindia@searo.who.int

http://www.searo.who.int/ @ 170hrs


APPENDIX A

Letter seeking permission to conduct the study

From
R. Revathi
1st Year M.Sc. Nursing,
MIOT College of Nursing,
Chennai.

Forwarded through
Prof. Mrs. S. Ani Grace Kalaimathi M.Sc. Nursing, PhD,
Principal,
MIOT College of Nursing,
Chennai.

To
The Deputy commissioner education,
Corporation of Chennai,
Chennai.

Subject: - Requesting permission to conduct research in Chennai Corporation Schools.

Respected Sir/Madam,

As a part of M.Sc. (N) requirement under the fulfillment of Tamil Nadu Dr. M.O.R. Medical University, Guindy, Chennai. I am conducting a research on “An exploratory study to assess the peak expiratory flow rate among school children in selected schools in Chennai. Kindly i request you to permit me to do my study in Chennai corporation schools.

Thanking you,

Yours’ Sincerely,

Prof. Mrs. ANIGRACE KALAIWATHI
M.Sc.,(N), POONA, DQA, Ph.D.,
Principal,
MIOT COLLEGE OF NURSING
No. 1/70, Maraimalai Koli Street,
Mugalivakkam, Chennai - 600 119.
APPENDIX B

INFORMED CONSENT FORM

I am R.Revathi, M.Sc Nursing II year student at MIOT College of Nursing, Chennai.

As a part of my research study on "An exploratory study to assess the Peak Expiratory Flow Rate by using Peak Flow Meter among school children in selected school at Chennai", is selected to be conducted. The finding of the study will be helpful in assessing the lung capacity of the school children by using Peak Flow Meter.

I hereby seek your consent and cooperation to participate in the study. Please be frank and honest in your response. The information collected will be kept confidentially and anonymity.

Signature of the investigator.

I ___________________ hereby consent to participate and undergo the study

Date:

Place: Signature of the participant.
APPENDIX C

SIMCO CALIBRATION LABORATORY
103, SRI BALAJI HOME, TEACHERS COLONY
CHENNIMALAI, ERODE 638009

CALIBRATION CERTIFICATE
CERTIFICATE NO: 12674
ORDER NO: 3093178
INSTRUMENT: Weighing scale

CUSTOMER NAME: R. Revathi
ADDRESS: 33, jeeva nagar
Rangampalayam, (post)
Erode-9

Results of calibration

<table>
<thead>
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<th>NOMINAL (Kg)</th>
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Note:

The instrument has been calibrated at the customer premises under the ambient conditions. The instrument was calibrated as per method no: MSB in NLQM/001/05 Part IV of the Quality manual.

Authorized signatory/Calibration Officer

SIMCO Calibration Laboratory
CALIBRATION CERTIFICATE

CERTIFICATE NO: 12674
ORDER NO: 3093179
INSTRUMENT: Measuring tape

CUSTOMER NAME: R. Revathi
ADDRESS: 33, jeeva nagar,
Rangampalayam, (post)
Erode-6

Results of calibration

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<th>Measured (mm)</th>
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Note:
The instrument has been calibrated at the customer premises under the ambient conditions. The instrument was calibrated as per method no: MSB in NLQM/001/05 Part VII of the Quality manual.

[Signature]
Authorised signatory/Calibration Officer

SIMCO Calibration Laboratory
APPENDIX D

DATA COLLECTION TOOL

SECTION - I

DEMOGRAPHIC PROFILE

PERSONAL DATA OF THE CHILD:

1. Sample number:

2. Standard and section:

3. Age:

4. Sex:

5. Weight (Kg):

6. Height (cm):

7. Any family history of asthma or respiratory disease:
SECTION -II

OBSEVATIONAL CHECKLIST BY USING PEAK FLOW METER

<table>
<thead>
<tr>
<th>SAMPLE NUMBER</th>
<th>PEAK EXPIRATORY FLOW RATE OF THE CHILD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I TRIAL</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

TIPS TO IMPROVE YOUR LUNG CAPACITY

1. Breathe Deeply
2. Blow up balloons.

3. Breathe in more than your brain thinks you can
4. Play a wind instrument

5. Jogging
6. Cycling

7. Swimming
6. Stay away from any kind of smoking