CHAPTER ONE

1.1 INTRODUCTION

With the very high incidence of allergic diseases in the general population (especially younger children), the question is often asked if meteorological changes, such as variance in temperature, rainfall, barometric pressure and other factors have an influence on the prevalence of these diseases.

If so, can these weather parameters then be used as markers of disease, as evidenced by an increase in prescriptions written by doctors?

1.2 LITERATURE REVIEW

In a study in Israel done by Garty et al in 1998, a positive correlation between emergency room (ER) visits of asthmatic children and high barometric pressure, and a negative correlation with O_2 concentration and temperature were demonstrated. Sudden rainstorms and a sudden fall in temperature, have also led to epidemics of asthma: this is explained by the release of large numbers of airborne pollen or mould spores.[1]

The inhalation of cold air is known to induce intrapulmonary airway obstruction in sensitive asthmatic patients and this is a condition often ascribed to heat and water losses from the airway mucosa. According to Millqvist (1999), cold air stimulation at the nose induces a decrease in airway conductance and FEV1 and warm air stimulation has the opposite effect.[2]

The association between air pollution and various signs and symptoms of asthma is well described. These include pulmonary function decrements, increased bronchial hyper-responsiveness, visits to emergency departments, hospital admissions, increased medication use and symptom reporting, inflammatory changes, interactions between air pollution and allergen challenges, and immune system changes.[3]

There has also been an increased tendency, at least in the United Kingdom, to use weather forecasts to help health care providers plan and give early warning of increases in illnesses that may be linked to changes in the weather -- such as myocardial infarction, strokes, respiratory diseases, infectious diseases, and fractures. "Health weather forecasts" are thus currently being piloted in five regions of England.[4]

This seems to reflect what Hippocrates said more than 2000 years ago: "Whoever wishes to investigate medicine properly, should proceed thus: In the first place consider the seasons of the year, and what effects each of them produces, for they are not all alike, but differ much from themselves in regard to their changes".[4]

Respiratory allergic diseases (rhinitis, rhinosinusitis, bronchial asthma and its equivalents) appear to be increasing in most countries, and subjects living in urban and industrialized areas are more likely to experience symptoms. This increase has been linked, among various factors, to air pollution. The most abundant air pollutants in urban areas with high levels of vehicle traffic are respirable particulate matter, nitrogen dioxide (NO_2) and ozone. Besides acting as irritants, airborne pollutants can modulate the allergenicity of antigens carried by airborne particles. Pollutants also overcome the mucosal barrier and so facilitate the allergen induced inflammatory responses.[5]

Short-term NO_2 exposure from indoor and outdoor sources has been associated with non-specific respiratory symptoms and decreased lung function, particularly in children with pre-existing asthma. Chronic exposure to respirable particles, sulphur dioxide (SO_2) and NO_2, leads to an up to three-fold increase in non-specific chronic respiratory symptoms. Truck traffic and diesel exhaust fumes lead to significant increases in respiratory symptoms and decreases in lung function.[6]

The home environment can also play an important role in asthma and related diseases. Airborne allergens such as those from house dust mites may be important, as well as factors like pollution from particulate materials associated with combustion and smoking, e.g. chemical vapours and gases including the above mentioned, NO_2, SO_2 and volatile organic compounds, including also passive smoking.[7]

The effect of thermally induced asthma and airway drying, has been extensively studied.[8] Technical difficulties associated with measuring expired air temperature and water loss led to a mass of inconsistent data and the abandonment of this technology: there were local differences in water flux in different regions along the tracheo-bronchial tree.[9] Direct measurements of airway surface fluid (ASF) osmolality revealed that cool dry air does increase ASF osmolality during and after hyperventilation, and these changes correlate with the development of airway obstruction in a canine model of exercise-induced asthma.[10]

Of the pollen spores Ambrosia pollen counts demonstrated the strongest correlation with allergic rhinitis and asthma symptoms, with a lag period of up to 7 days. A non-

linear relationship was found between the clinical measures and pollen counts; the clinical consequences of a given pollen load also increased as the season progressed, probably due to a priming effect.[11]

Concerning the burden of disease: the annual cost of asthma in the United States has been estimated to exceed 6 billion U.S. dollars. The average cost of an outpatient visit (1999) was $188, but was $3812 for a hospital admission. It was found that a substantial portion of asthma costs results from the use of inpatient or urgent emergency services that may represent failure of preventive management and treatment. Here an Education and Prevention Programme may help to increase awareness and reduce costs.[12]

1.3 RELEVANCE

The relevance of this study lies in the ability to predict increases in symptoms amongst a population requiring drug treatment for allergic diseases. This will lead to better patient awareness, as well as a better ability to plan and provide a cost effective service to patients.