

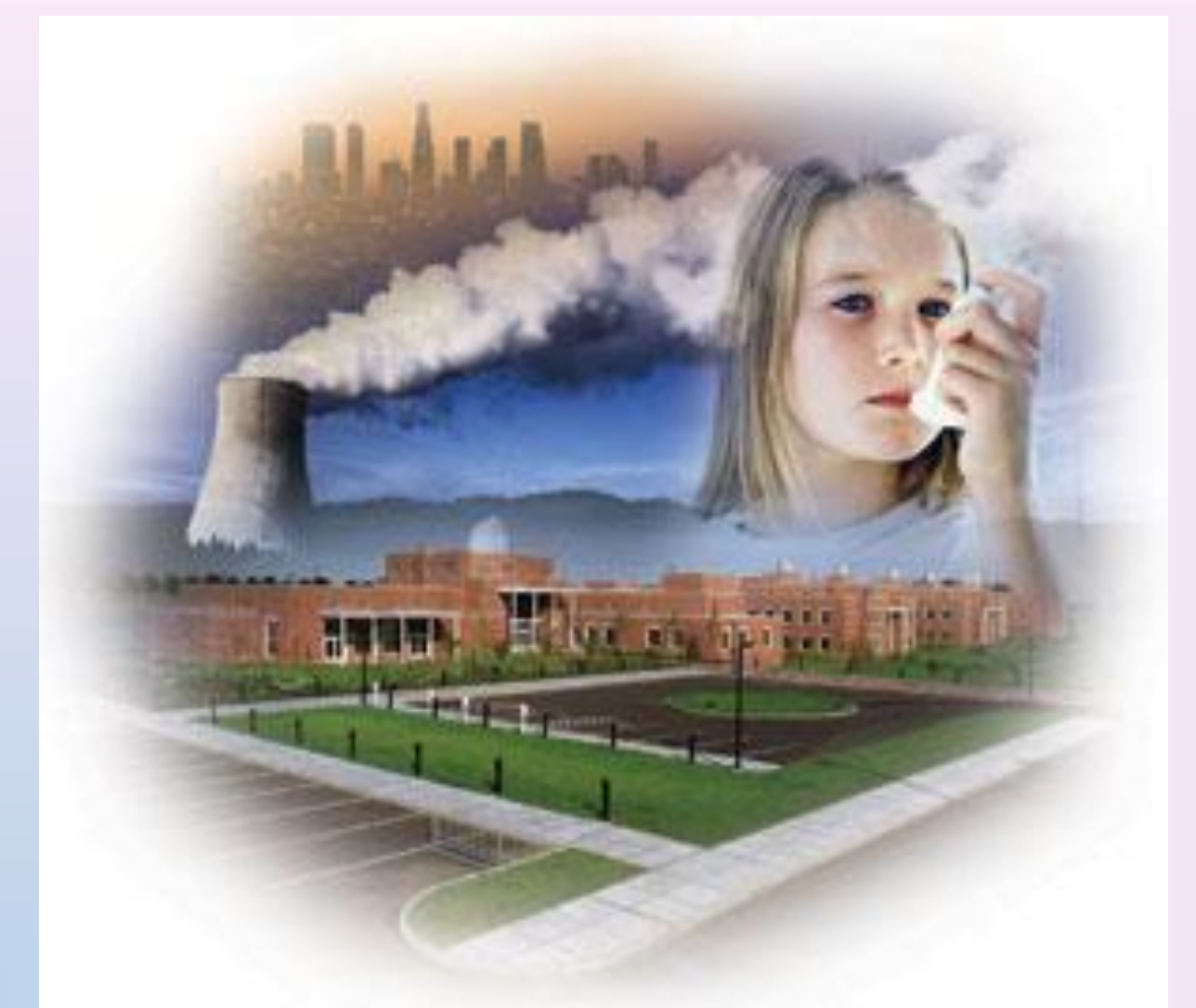


ST. THOMAS  
UNIVERSITY  
School of SCIENCE, TECHNOLOGY  
& ENGINEERING MANAGEMENT

# About the possible influence of the weather on asthma episodes: St. Thomas University and surrounding communities.

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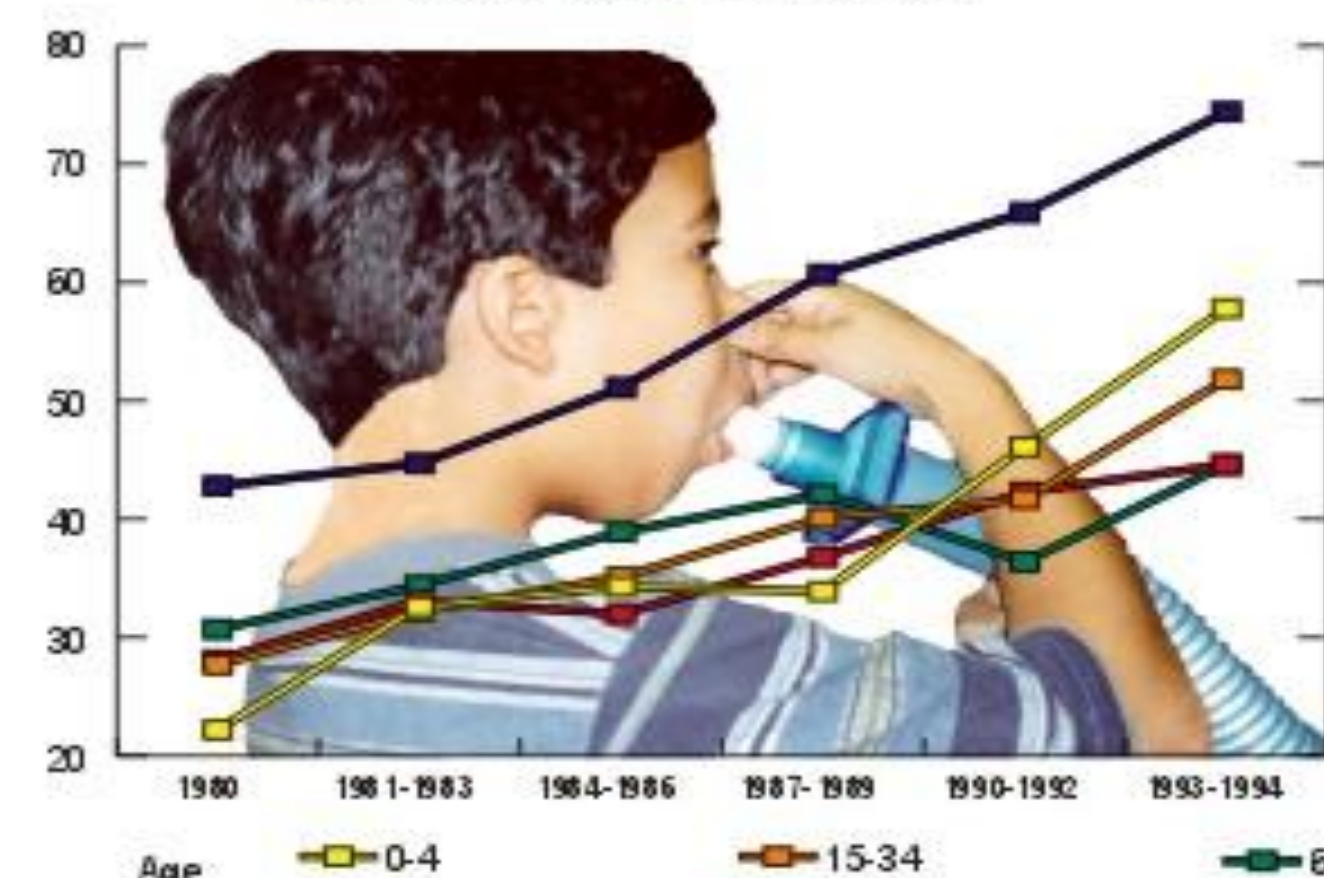
## Introduction

Asthma is estimated to affect about 5 % of adults and about 10 % of children worldwide. Both, asthma prevalence and mortality have increased considerably over the last ten years and it is foreseen to be one of the most important respiratory and occupational lung diseases in the coming decade. Additionally, climatic and environmental changes occurring since the middle of the Twentieth Century as well as the aggravating pollution levels in megacities seems to exacerbate asthma episodes and number of hospitalizations. According to the latest estimates, in the U.S. the prevalence of asthma in children under 18 years ranges from 4.5 to 7 %, while in children 2 – 5 years is around 5.6 %. In Miami Dade County, where St. Thomas University is located, in 1999 the hospitalization rates were double the Healthy People 2010 objectives in every age group. Motivated by this existing situation, it was decided at St. Thomas School of Science to initiate a gathering of weather and health information, and also, look for possible correlations between these data. It is noteworthy that St. Thomas University is surrounded by many communities with a Hispanic and African – American composition predominantly. These minority groups are the one with the highest rates of asthma prevalence and severity. Then, in partnership with AWS Convergence Technologies (WeatherBug) a weather tracking station operating on campus 24/7 year round has recorded weather data for six years. A careful statistical analysis of these data is included in this presentation. Based on health information obtained from regional hospitals located in different areas of Miami Dade, some seasonal patterns of asthma as well as some possible indicators are discussed for further correlation analysis. Our results are compared with others obtained from different States within continental U.S. as well as from oversea.

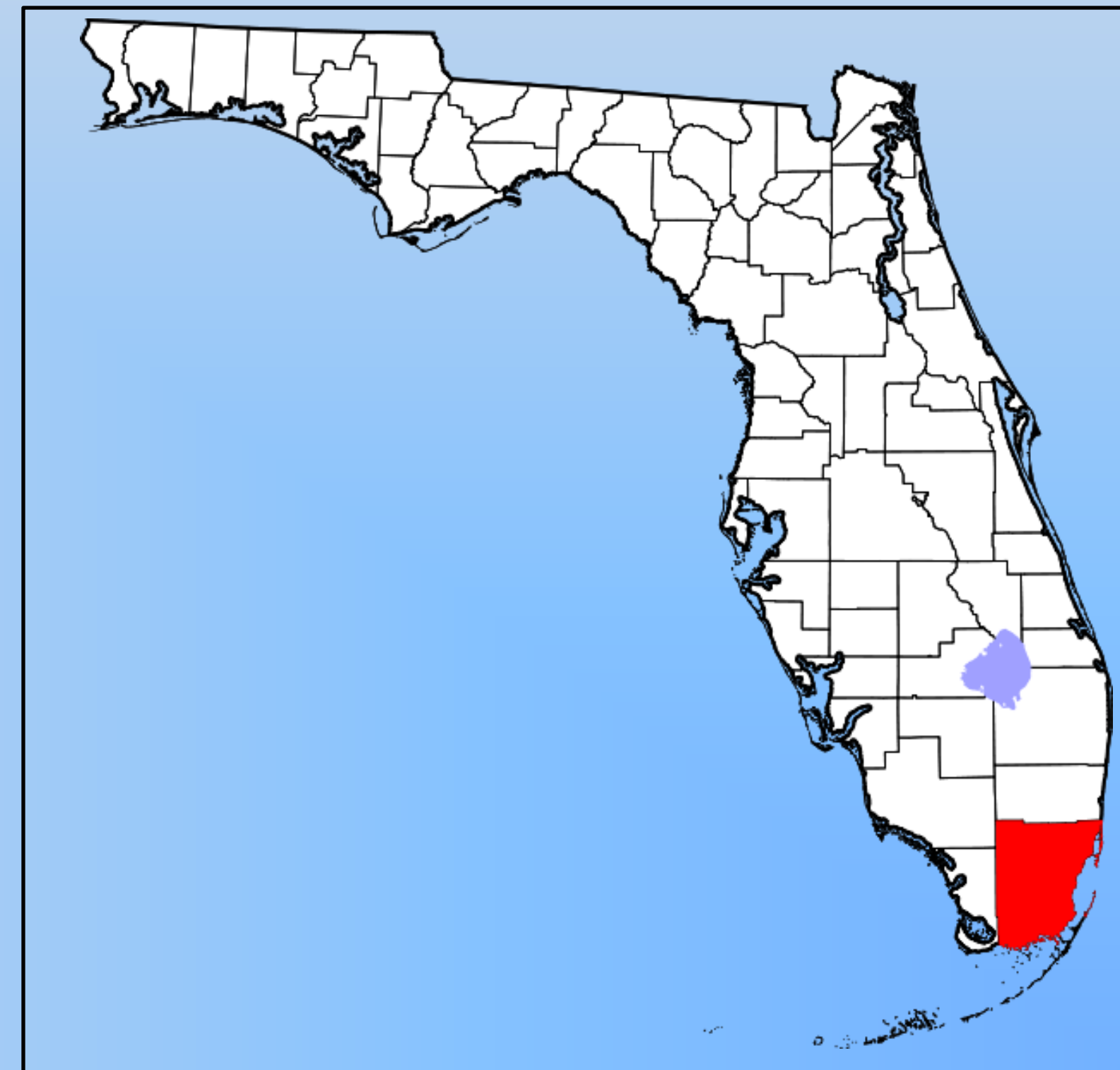
## Asthma Statistics Worldwide: A brief overview

# of people diagnosed: more than 150 M  
Europe: the # of cases has doubled  
USA: the # of cases has increased more than 60%  
India: between 15 and 20 M  
Africa: between 11 and 18% population  
# of deaths yearly: around 180,000  
**Miami Dade County** – 7.1% Middle and HS children were reported with asthma  
The # of hospitalizations due to asthma has doubled.  
The # 1 cause of school absences and 35 % of parents missed work

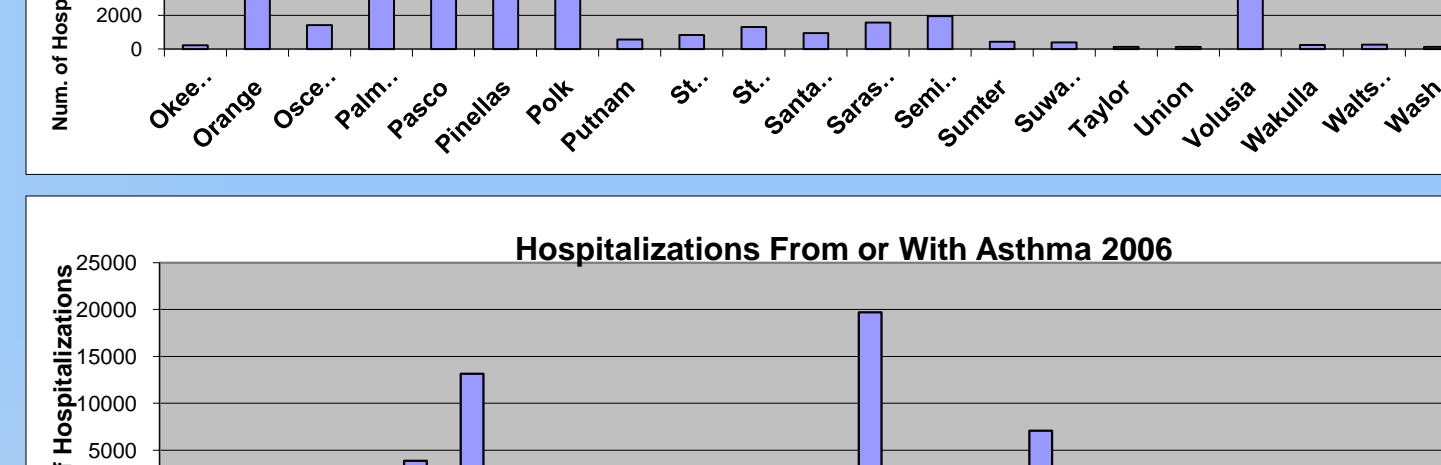
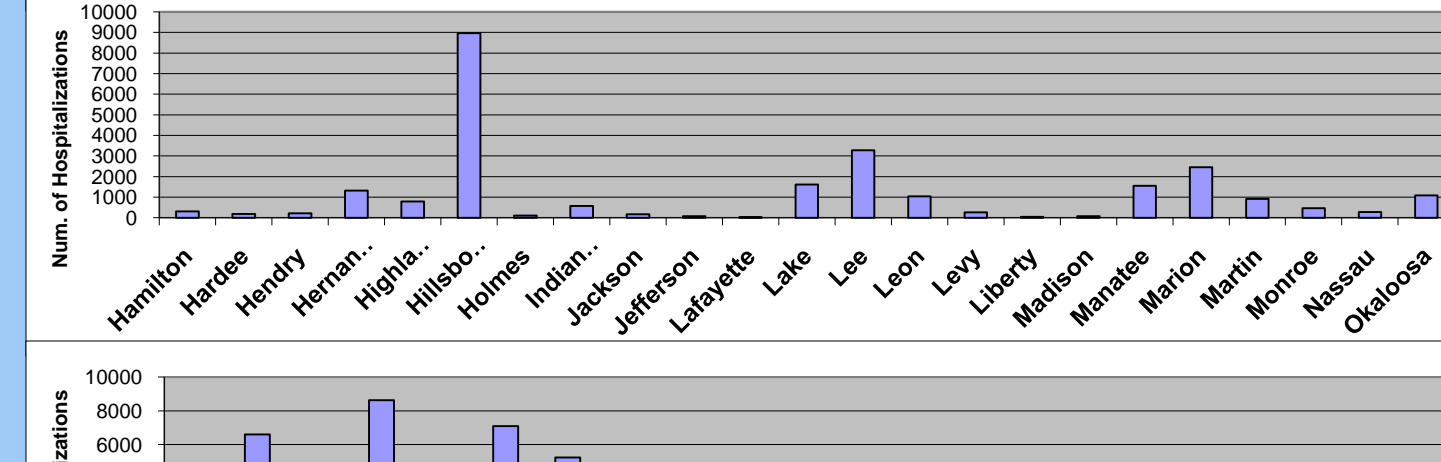
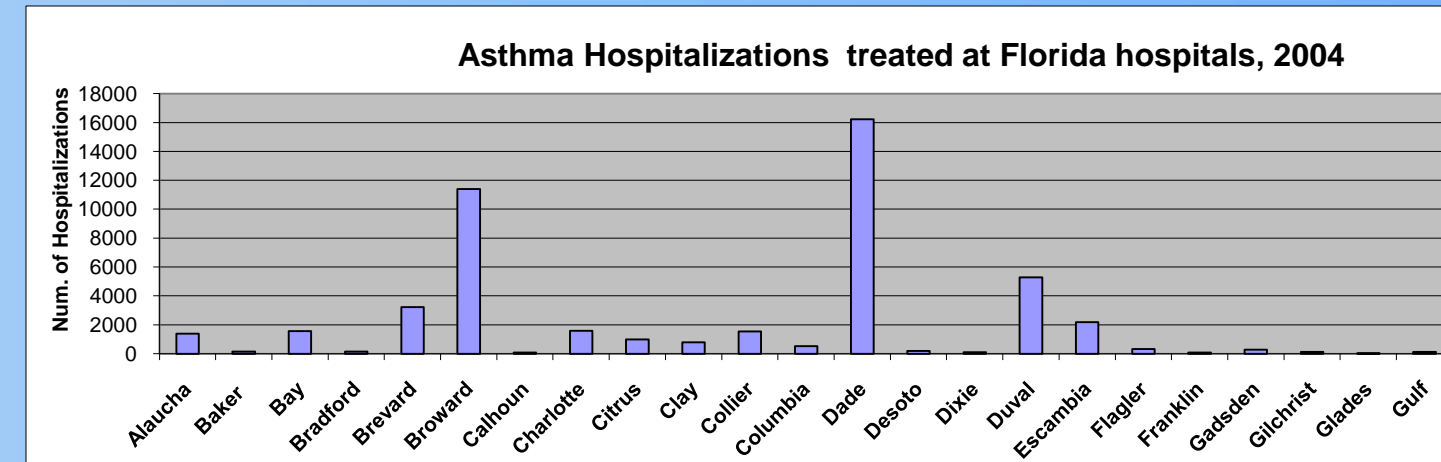
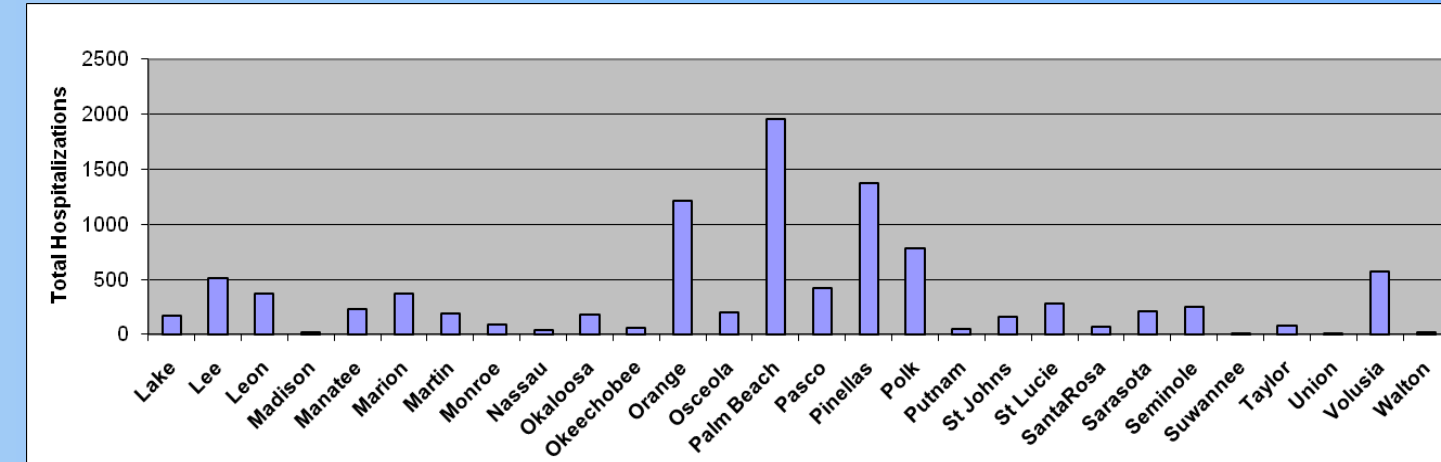
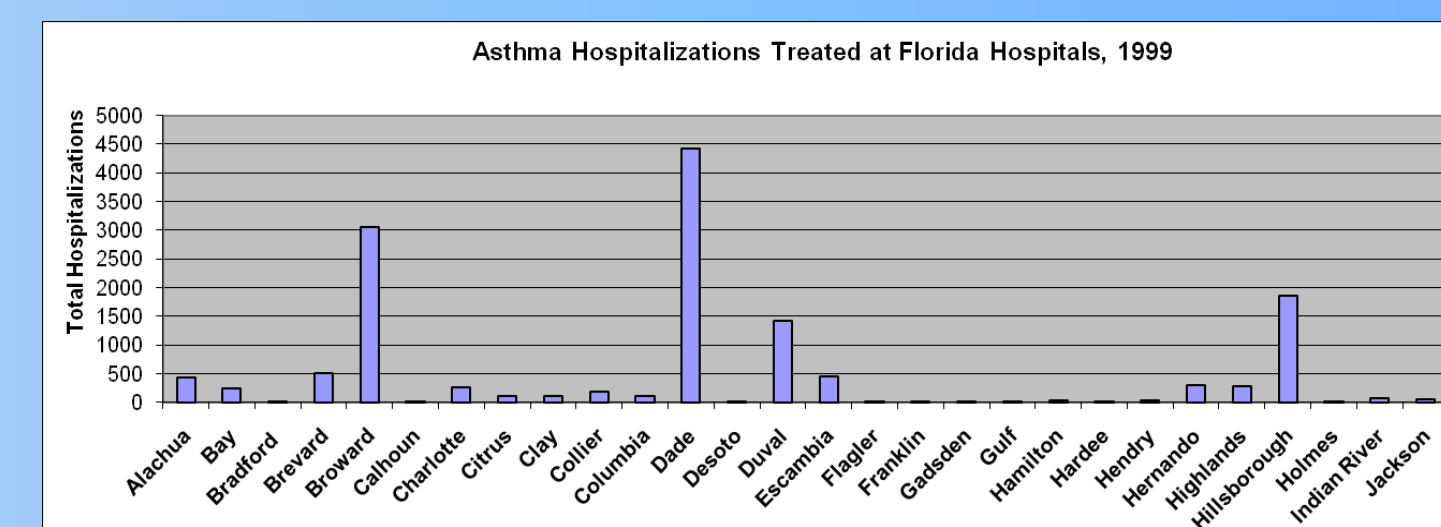
Asthma Prevalence by Age  
United States, 1980-1994



Source: National Health Survey, 1980-1994



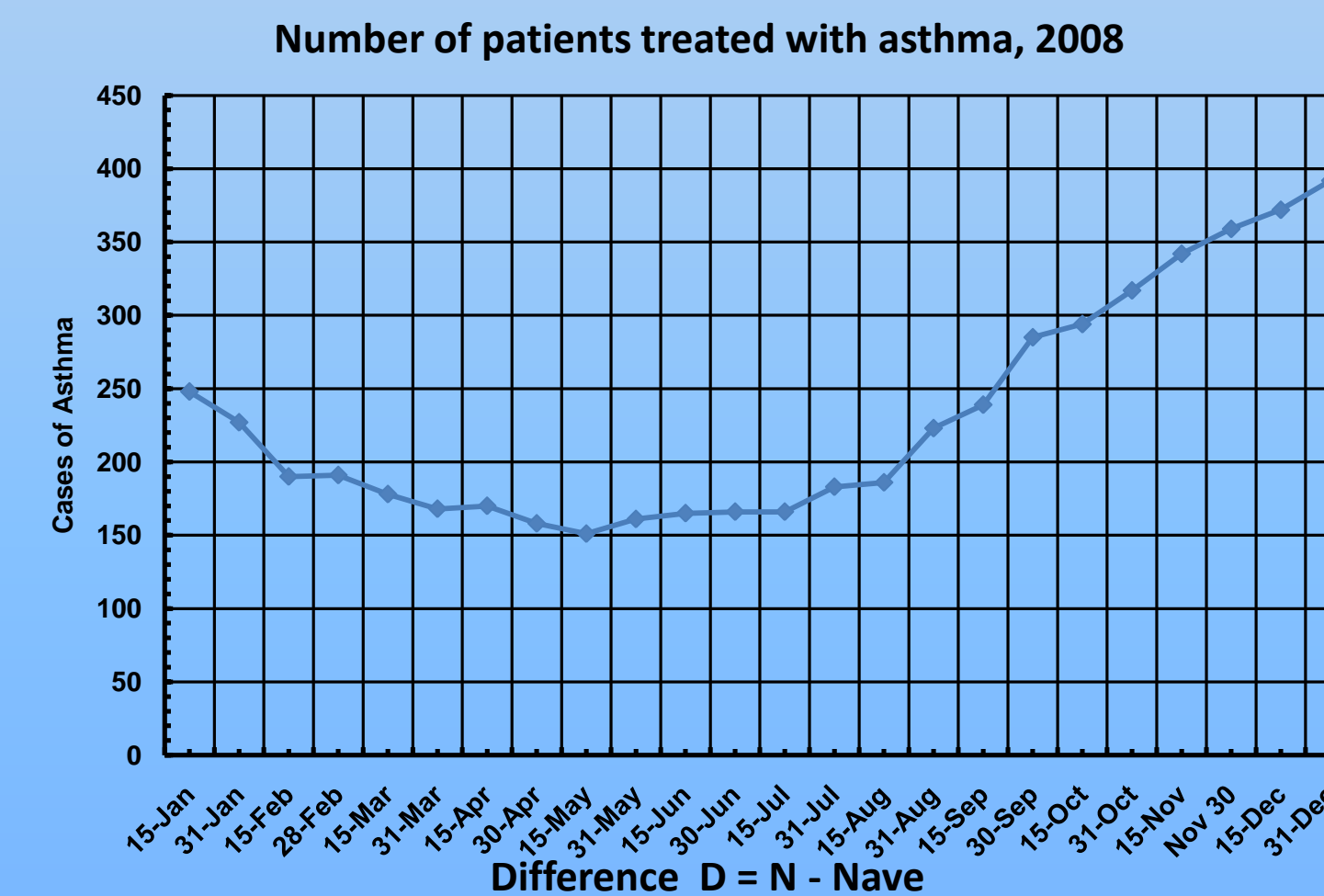
## Surveillance of Asthma in Florida



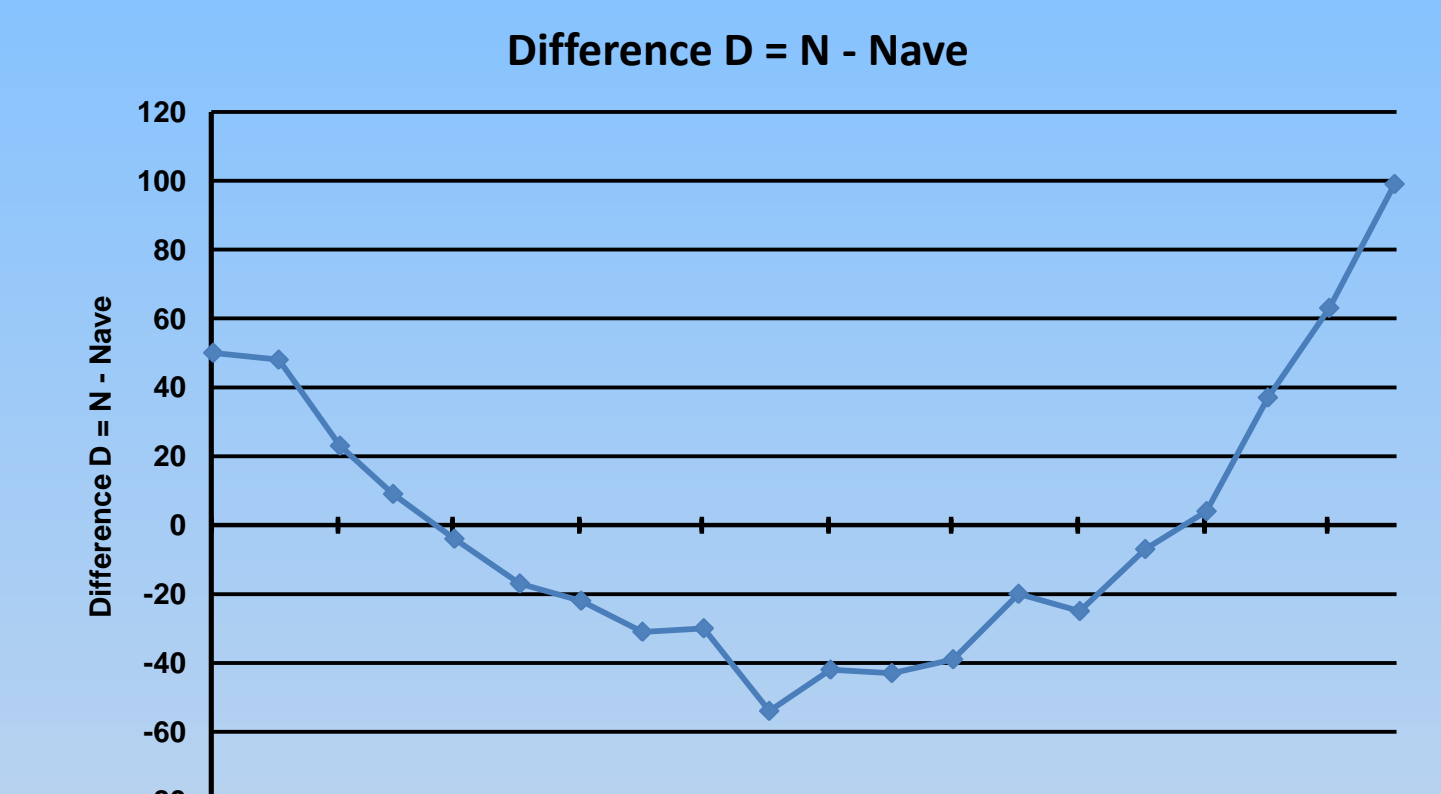
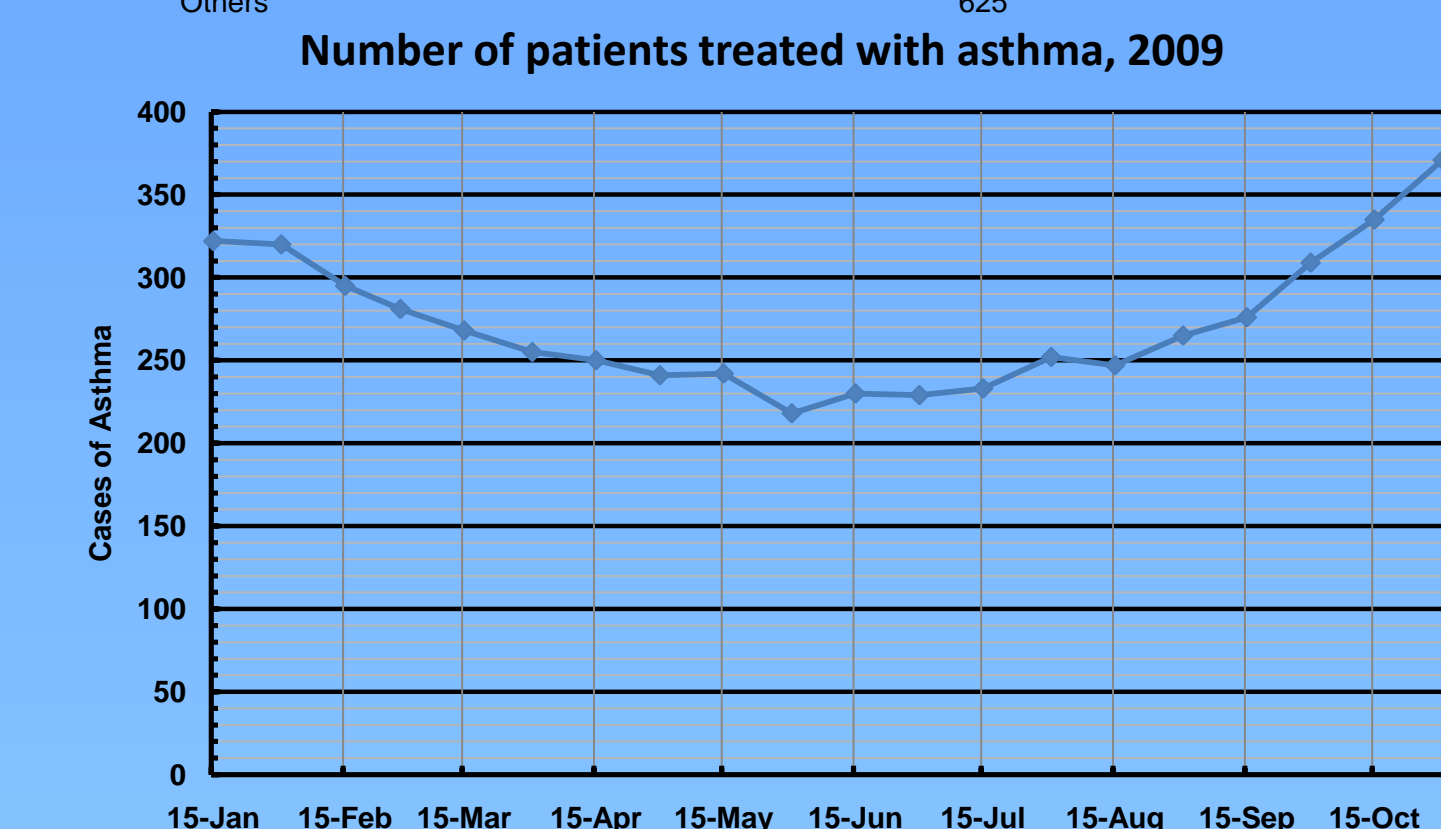
## Acknowledgments

Kendall Medical Group for sharing medical data about Asthma.  
Science Fellow Program at St. Thomas University .

## Seasonal variations in asthma reported cases: Preliminary results

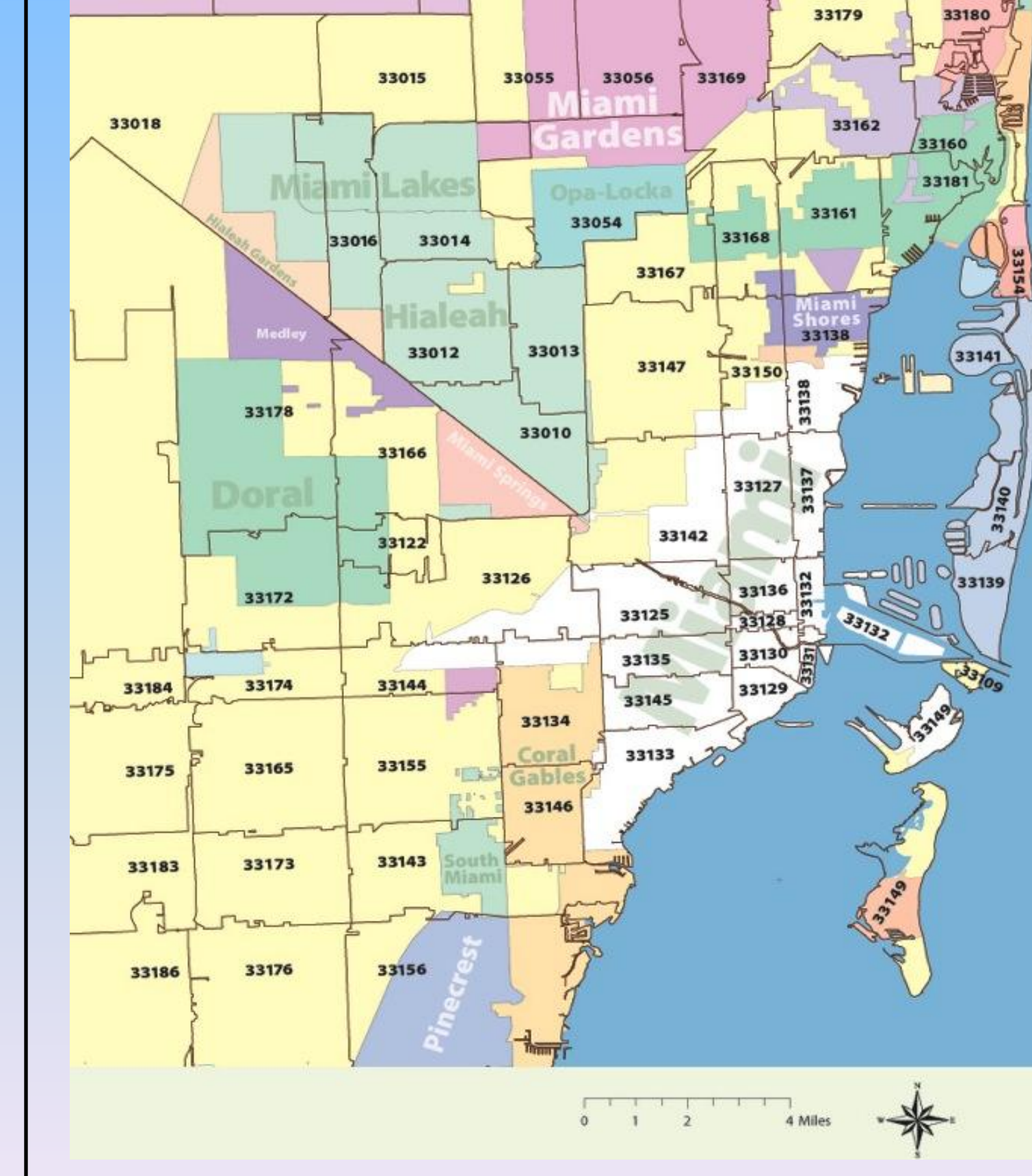
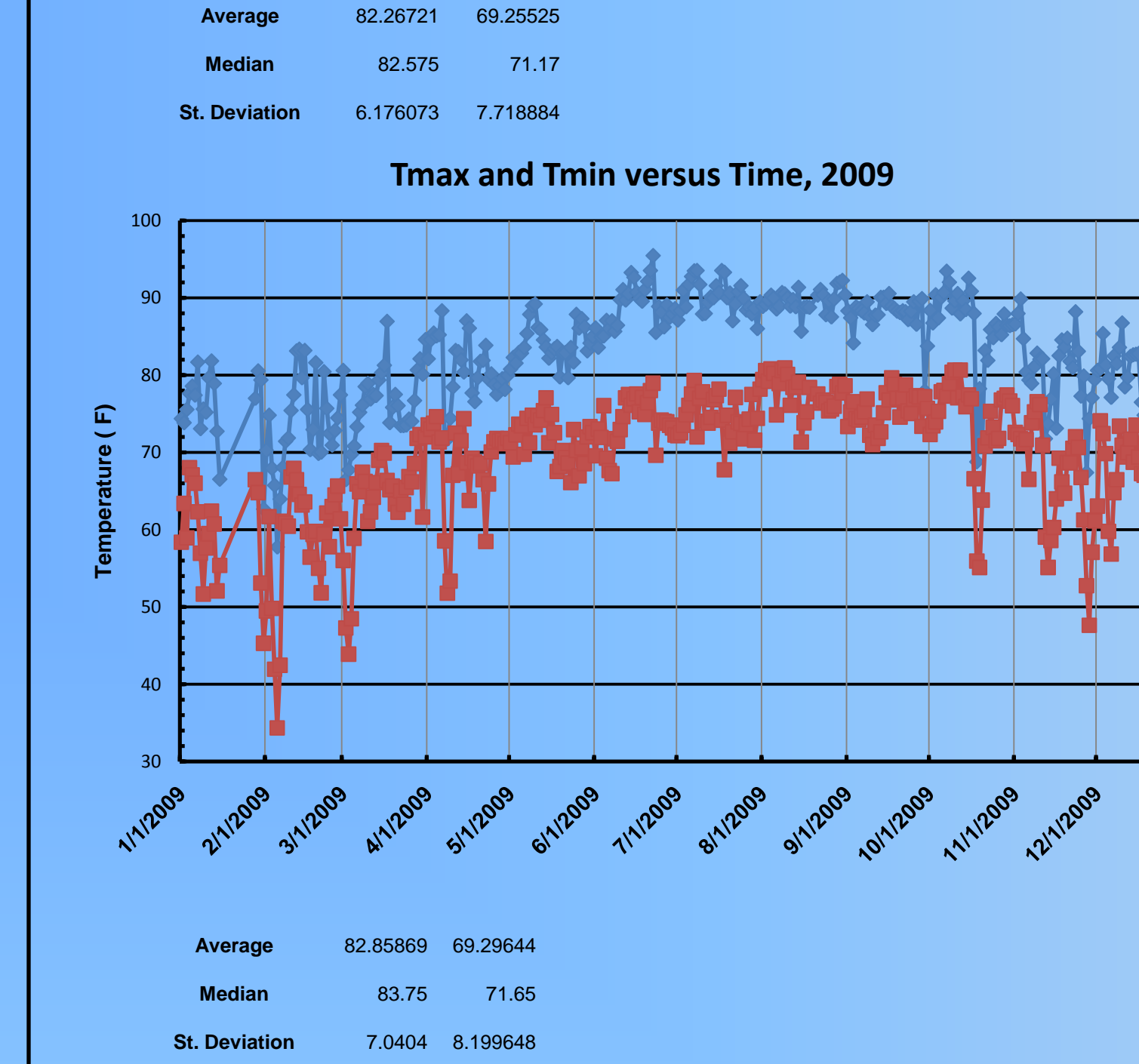
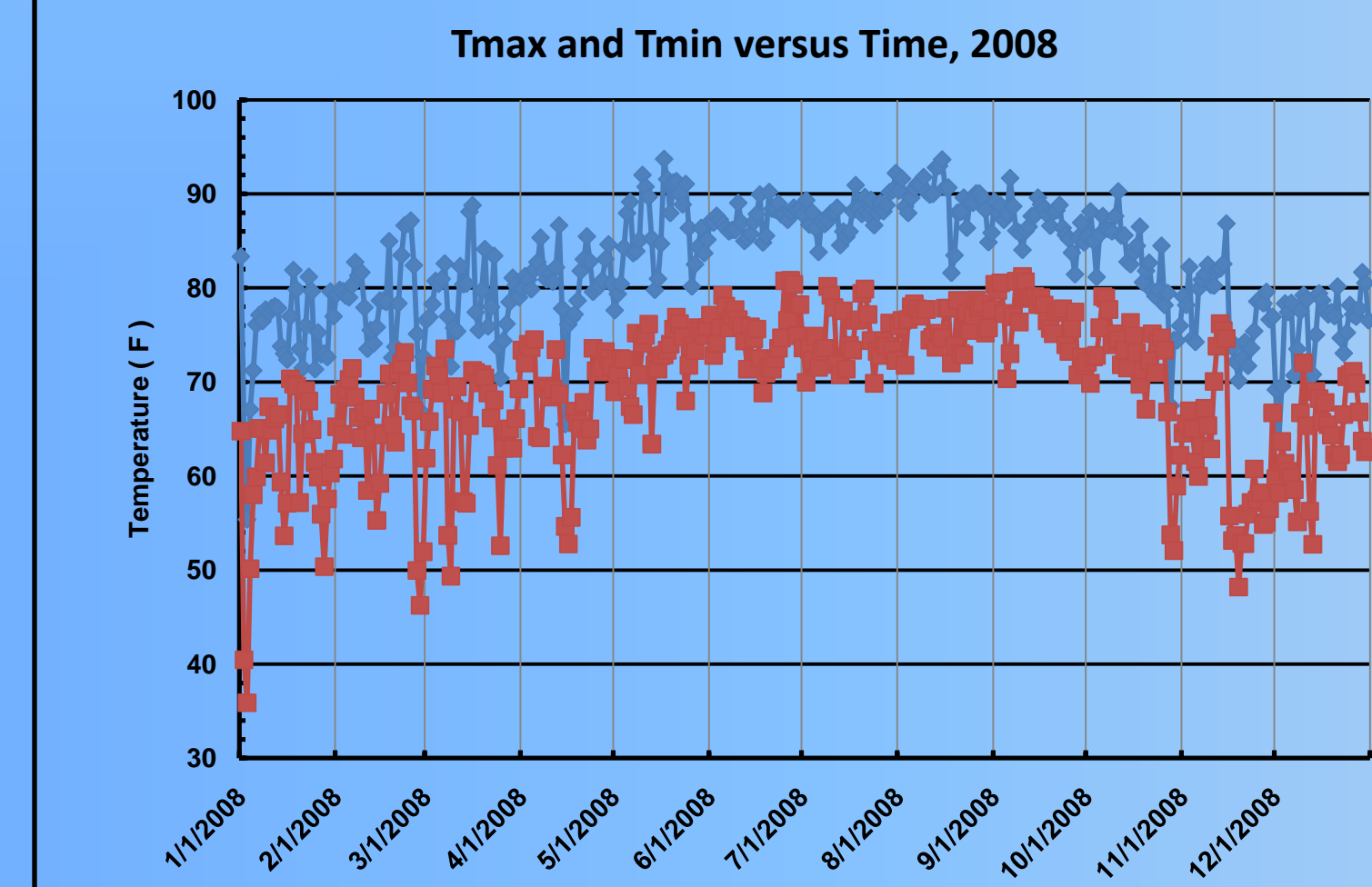
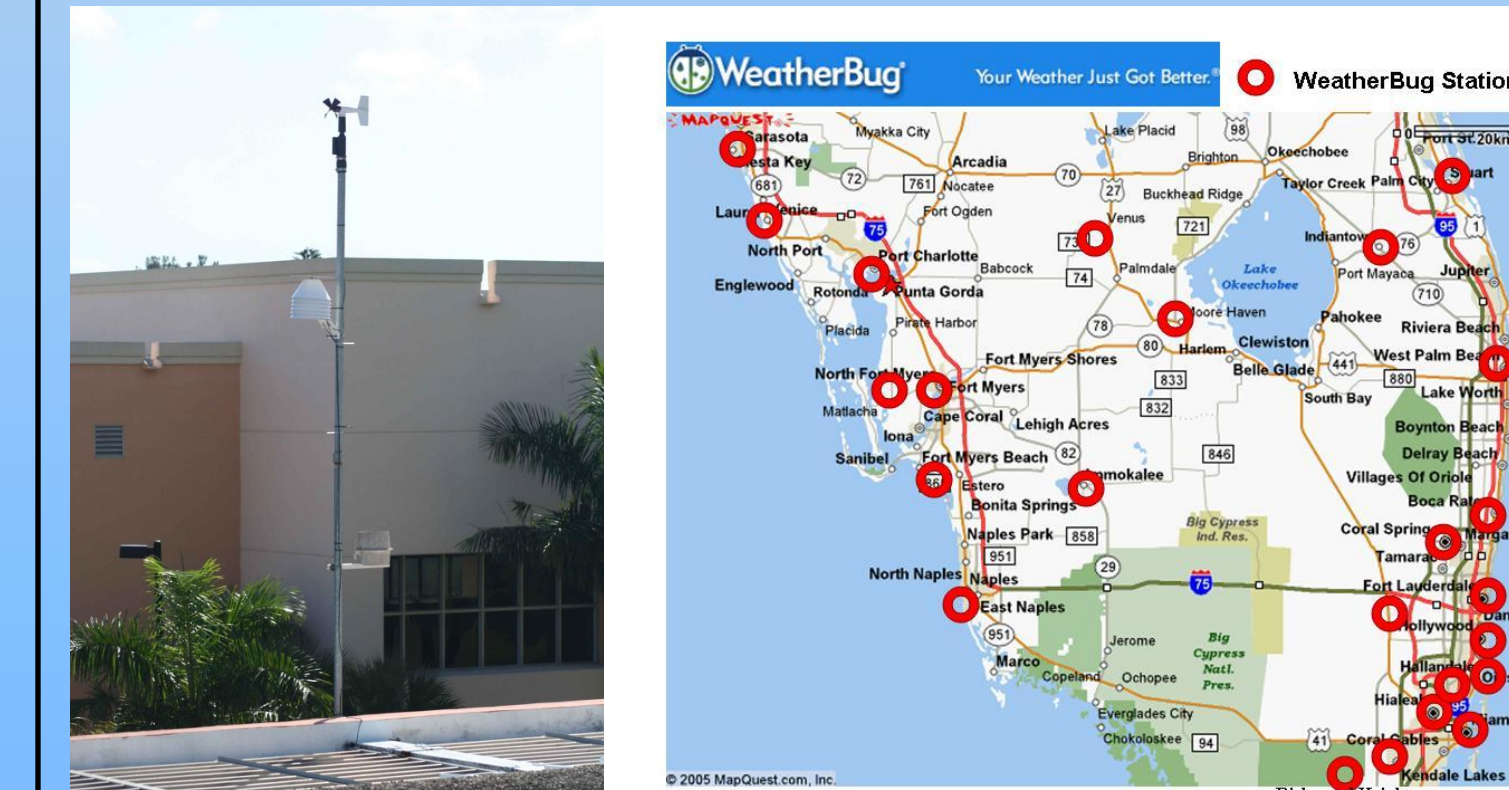


Age distribution (only for asthma)			
0 - 5 years old	530		
6 - 11 years old	380		
12 - 17 years old	480	Average, Nave	230.46
18 - 23 years old	350		
24 - 29 years old	280		
30 - 35 years old	270	Median	190.5
36 - 41 years old	215		
42 - 47 years old	210		
48 - 53 years old	225	St. Deviation	77.11
above 54 years old			
Ethnicity (only for asthma)			
White	490		
White Hispanic	505		
Non White Hispanic	820		
African American	510		
Chinese			
Native Indians			
Others	625		



Age distribution (only for asthma)			
0 - 5 years old	365		
6 - 11 years old	290		
12 - 17 years old	190		
18 - 23 years old	205	Average	271.95
24 - 29 years old	180		
30 - 35 years old	150	Median	260
36 - 41 years old	160		
42 - 47 years old	190	St. Deviation	41.25846006
48 - 53 years old	215		
above 54 years old			
Ethnicity (only for asthma)			
White	350		
White Hispanic	256		
Non White Hispanic	650		
African American	525		
Chinese			
Native Indians			
Others	169		

## Time Series of Weather Parameters for Miami Dade County Metropolitan Area

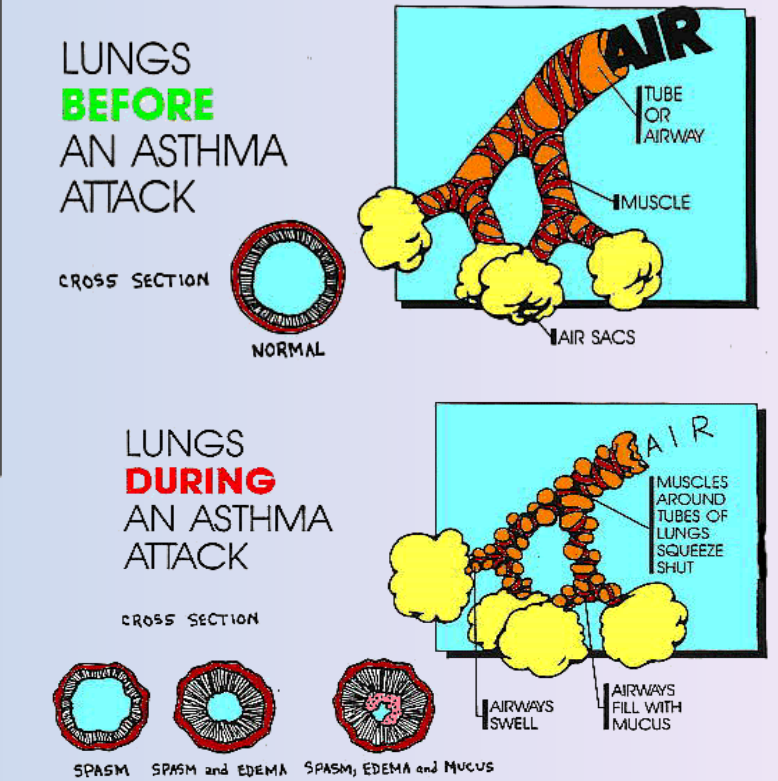
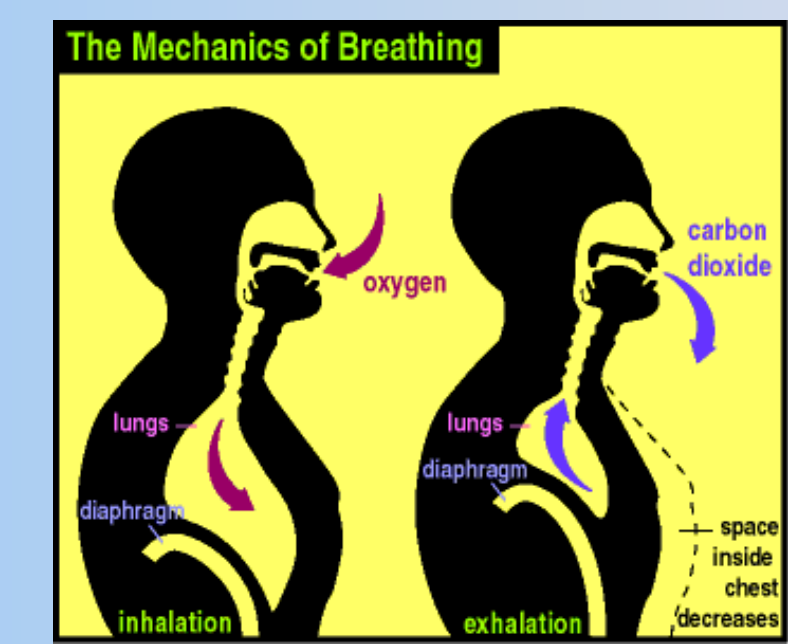


## IESARA – Intelligent Expert System for Asthma Risk Analysis

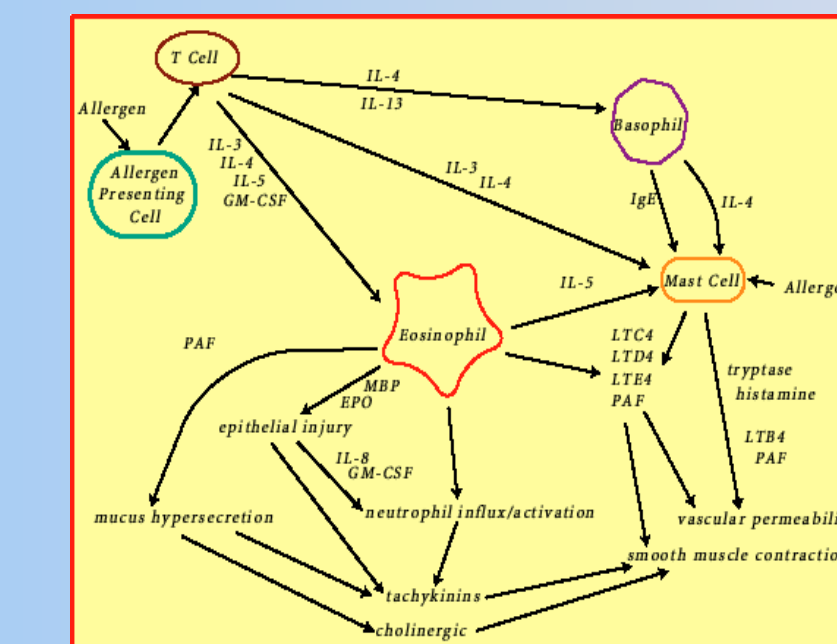
An integrated system for risk analysis which includes:  
1. Geospatial analysis of weather and health information (GIS).  
2. Modeling of the urban weather in surrounding communities.  
3. Mathematical modeling of the weather – asthma connection.  
3. Application of techniques of fuzzy logics for decision making.  
4. Determination of risk indexes.

## Mathematical Modeling of the Asthma – Weather Connection

### Macroscopic Mechanical Description of Breathing



### Mesoscopic description of the immune response during an asthma episode



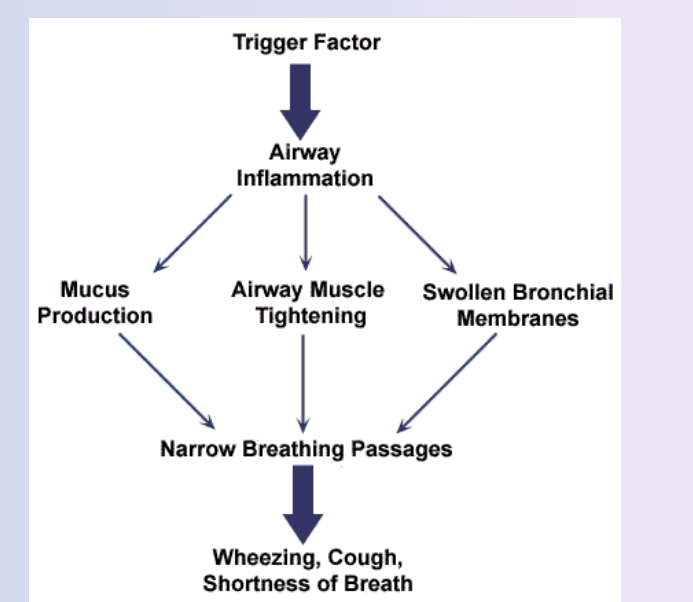
A system of differential equations describes the population dynamics of each one of the cells involved in an asthma episode.

In asthmatic individuals, antigen presentation is thought to result in the polarization of T-cells towards a  $T_H2$  patterns whereas T cells from non atopic, non-asthmatic individuals show the opposing  $T_H1$  (interferon- $\gamma$  and  $I_L2$ ) pattern of cytokine secretion.

A very complicated Network of cells (IL4, IL3, IL5, IL13- Cytokines, IgE – Immunoglobulin) Interacting and Competing.

### Microscopic genetic of asthma - Bio-informatics of Asthma

The **multigenic** nature of asthma has greatly hampered efforts to identify the specific genes involved. **Genetic heterogeneity** across populations, variability in disease expression, **phenocopies** and uncontrolled environmental influences confound the analysis of asthma and other complex genetic disorders.



## Conclusions

1. There is a clear seasonal pattern in asthma reported cases.
2. The major incidence seems to occur in highly populated cities in Florida.
3. There are direct and indirect forms on how the weather seems to affect people with asthma.
4. A mathematical model of the weather – breathing mechanism is needed to fully understand the obtained results.