The Impact of Asthma and Associated Factors on Health-Related Quality of Life in Adult Patients of Asthma in the United States

By

Raed Abdullah Alharbi

A Dissertation Submitted In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy in Biomedical Informatics

Department of Health Informatics

School of Health Professions (SHP)

Rutgers, The State University of New Jersey

November 2016

RUTGERS
School of Health Professions

Final Dissertation Approval Form

The Impact of Asthma and Associated Factors on Health-Related Quality of Life in Adult Patients of Asthma in the United States

BY

Raed Abdullah Alharbi

Dissertation Committee:

Dr. Frederick Coffman, PhD, Committee Chair

Dr. Syed Haque, PhD, PhD, Committee Member

Dr. Shankar Srinivisan, PhD, Committee Member

Approved by the Dissertation Committee:

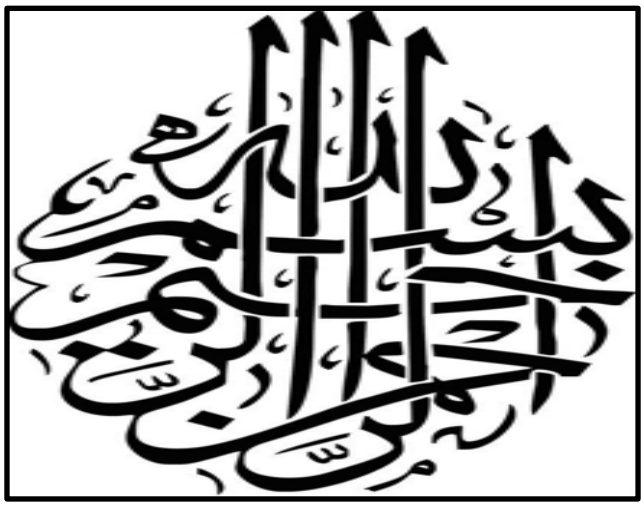
_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____

_____ Date: _____



In The Name Of God, The Most Gracious, The Most Merciful

ABSTRACT

Background: Asthma is one of the most common chronic diseases that affect the airways in the lungs causing inflammation due to reacting to any infection or trigger that stimulate the asthma attack. Such a disease might be able to affect the health-related quality of life (HRQoL) including: activity limitations, physical health, and mental health of these adult patients in certain ways.

Objectives: Since there is no clear research or study that gave an integrated comprehensive view of the impact of asthma along with different associated factors including: behavioral factors (smoking, frequency of smoking and quitting, exercise, health-routine checkup, and alcohol use), clinical factors (obesity, depressive disorder, diabetes, influenza and pneumonia vaccines), and socioeconomic factors (stress, healthcare coverage, income and education level) on HRQoL in adult patients in the United States, the overall goal of this research is designed to investigate this impact.

Methodology: Data of this research is obtained from Behavioral Risk Factor Surveillance System (BRFSS) 2014. Different statistical procedures and methods including: extracting data, descriptive analysis, inferential analysis, and predictive analysis would be preformed by using Statistical Analysis System Software (SAS) 9.4.

Results: adult patients of asthma have activity limitations by 64.90%, physical health problems by 163.40%, and mental health problems by 163.53% more than adult healthy people. Smoking limits activity by 116.18% as well as increases physical and mental health problems by 19.12% and 40.41%. Also, other behavioral factors play great roles in HRQoL in adult patients of asthma. Obesity limits activity by 73.57% as well as increases physical and mental health problems by 41.50% and 17.20%. Also, other

clinical factors play great roles in HRQoL in adult patients of asthma. Stress limits activity by 188.52% as well as increases physical and mental health problems by 90.17% and 157.20%. Also, other clinical factors play great roles in HRQoL in adult patients of asthma.

Conclusion: Even if there are few associated factors that improve HRQoL in adult patients of asthma, the majority of these factors worsen HRQoL. Finally, it can be confirmed that these associated factors along with asthma can lead to poorer HRQoL in adult patients of asthma in the United States.

ACKNOWLEDGEMENTS

First of all, from the bottom of my heart I would like to thank my advisors Dr. Frederick Coffman (Committee Chair) and Dr. Shankar Srinivasan as well as express my deepest gratitude to them for their essential guidance throughout my graduate studies and development of my skills as a scientist. Since appreciation is due to Dr. Syed Haque, Dr. Barbara Gladson, and Dr. Masayuki Shibata for their kindness, supportive, and useful advice as a graduate student as well as enlarging my sphere of understanding of Biomedical Informatics with their encyclopedic knowledge and fresh perspectives. Moreover, I would like to thank all the faculty and staff of the Department of Health Informatics for their kindness and support. Finally, I would like to thank my family for their support throughout my graduate studies.

TABLE OF CONTENTS

CHAPTER III: RESEARCH METHODOLOGY

CHAPTER V: RESEARCH RESULTS

LIST OF ABBREVIATIONS

ACTH	Adrenocorticotropin Hormone
ANOVA	Analysis of Variance
BRFSS	Behavioral Risk Factor Surveillance System
BMI	Body Mass Index
CSC	Centers for Disease Control and Prevention
CRH	Corticotropin Releasing Hormone
DF	Degree of Freedom.
EIA	Exercise Induced Asthma
EIB	Exercise Induced Bronchoconstriction
EKG	Electrocardiogram
GM	Geometric Mean
GR	Glucocorticoid Receptor
LDA	Linear Discriminant Analysis
HM	Harmonic Mean
HPA	Hypothalamic Pituitary Adrenal
HRQoL	Health-Related Quality of Life
ICSs	Inhaled Corticosteroids
IgE	Immunoglobulin E
IL	Interleukins
ODS	Output Delivery System
OR	Odds Ratio
P-value	Probability Value

PNS	Parasympathetic Autonomic Nervous System
PROC	Statistical Analysis Software Procedures
PROC ANOVA	Procedure Of Analysis Of Variance
PROC CORR	Procedure Of Correlation
PROC DISCRIM	Procedure of Discriminant Analysis
PROC GLM	Procedure of General Linear Models
PROC LOGISTIC	Procedure of Logistic Regression
PROC REG	Procedure of Linear Regression
PROC SGPLOT	Procedure of Creating Stand-Alone Graphs
SAM	Sympathetic Adrenal Medullary
SAS	Statistical Analysis System Software
SCHIP	State Children's Health Insurance Program
SD	Standard Deviation
SES	Socioeconomic Status
SNS	Sympathetic Autonomic Nervous System
Th	T-helper Cells (Th1 and Th2)

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1 Background:

Asthma is one of the most common chronic diseases that affect the lungs. In fact, it is known as a chronic inflammatory disorder that affects the airways of the lungs leading these airways to be narrowed [1,2,3]. According to Centers for Disease Control and Prevention (CDC), in 2013, in the United States, there were more than 34 million adult patients with asthma [1].

Symptoms of asthma include chest pain, tightness, wheezing, shortness of breath, and coughing [1,3]. These symptoms of asthma as well as different associated factors including: behavioral, clinical and socioeconomic status (SES) factors can cause the attack of asthma to be severe and stay for a longer period of time, which might affect the health-related quality of life (HRQoL) of patients in certain ways [2,4-8].

So, in order for adult patients of asthma to control this chronic disease and avoid its attack as well as its severe symptoms that can make their HRQoL worst, patients should understand the concept of HRQoL as well as have the knowledge of the different associated factors that affect their HRQoL [2,6-8].

The meaning of quality of life concept depends on the person's knowledge and understanding of experiences and situations that this person has been through in the life [2].

In fact, there are five domains that are referred as the main components of quality of life including: psychological status, social status, physical status, spiritual status, and economic status [2,6]. So, the concept of HRQoL is defined as the concept of quality of life with concentrating on health status including: physical health status, psychological health status, and limitations of health and activities [2,9].

Therefore, measuring HRQoL in adult patients of asthma is very important in order to get a complete knowledge and understanding of the impact of this disease on these adult patients [2]. In fact, measuring HRQoL can measure the impact of the disease and the impact of the different associated factors with this disease on patients' health status to describe and predict health outcomes, evaluate clinical management, instruct clinical policy, and assign resources of health [2]. Measuring HRQoL can give a complete indicator scale to indicate the impact of asthma and the different associated factors on adult patients leading to a better control of asthma [2]. Finally, features of measuring HRQoL include validity, reliability, sensitivity, responsiveness, and interpretability. Therefore, it is became very important to measure HRQoL in order to know the effects of asthma and the different associated factors on the life as well as the health status of asthma patients [2].

1.2 Goals and Objectives of the Research:

The overall goal of this research is to measure the impact of asthma and different associated factors on HRQoL of adult patients in the United States.

These different associated factors include behavioral factors (smoking, alcohol use, exercise, and health routine checkup), clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine), and socioeconomic status (stress,

income level, health care coverage, and education level) as well as asthma as a disease in general. However, HRQoL outcomes include activity limitations, physical health, and mental health.

Specifically the objectives of this research are designed for the following:

- Determination of the impact of asthma as a chronic disease on HRQoL in adult patients of asthma in the United States.
- Defining the relation between behavioral factors and HRQoL in adult patients in the United States.
- Evaluation of the impact of clinical factors on HRQoL in adult patients of asthma in the United States.
- Investigating the differences of socioeconomic statuses of the patients and the effects of these statuses on HRQoL in adult patients of asthma in the United States.
- Creating a measure scale that is valid, reliable, sensitive, responsive, and interpretable to monitor HRQoL in patients of asthma.

1.3 Significance of the Research:

This research is proposed to measure health-related quality of life (HRQoL) of adult patients of asthma in the United States by measuring the impact of asthma disease and different associated factors. This measuring would allow to get a complete knowledge and understanding of the impact of this disease as well as the impact of different associated factors on adult patients of asthma. Measuring HRQoL would be valid, reliable, sensitive, responsive, and interpretable to monitor HRQoL of adult patients of asthma.

The results of this research would provide the following:

- Increase the ability to describe and predict health outcomes regarding to the measure of the impact of asthma and associated factors on HRQoL in adult patients in the United States.
- Creation of successful understanding in purpose to manage socioeconomic status, behavioral, and clinical factors that are associated with asthma in adult patients.
- Evaluation of clinical management in order to instruct clinical policy and assign resources of health.
- Getting better knowledge and understanding of certain behavioral and clinical factors that affect HRQoL in purpose to control asthma to have a better life.

1.4 Hypotheses of the Research:

Hypotheses of this research include:

- Asthma as a chronic disease has statistically significant impact on the ability as well as health-related quality of life (HRQoL) (activity limitations, physical health, and mental health) in adult patients in the United States.
- There is a significant relation between behavioral activities that the patients practice (smoking, alcohol use, exercise, and health routine checkup) and HRQoL (activity limitations, physical health, and mental health) in adult patients in the United States.
- There is significant relation between clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine) on HRQoL (activity limitations, physical health, and mental health) in adult patients of asthma in the United States.
- Differences of socioeconomic statuses (SES) between adult patients of asthma (stress, income level, health care coverage, and education level) can result significantly in

different HRQoL (activity limitations, physical health, and mental health) in adult patients of asthma in the United States.

1.5 Data & Methods of the Research:

This research is planned to use the data obtained from Behavioral Risk Factor Surveillance System (BRFSS) from Centers for Disease Control and Prevention (CDC) in order to measure the impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients.

BRFSS is the first nation system of health surveys using the telephone in order to collect data from the United States residents in relation to their health and behaviors [10]. BRFSS was established in early 1980s. BRFSS collects data from all states of the United States and it interviews more than 400,000 adults each year leading BRFSS to be the biggest health survey system in the world [10].

BRFSS data includes more than 100 clinical and nonclinical data elements for each patient. These include:

- Record identification (interview date and state name).
- Chronic health conditions (adult asthma).
- Demographics (age, gender, and race).
- Behavioral factors (smoking, alcohol use, exercise, and health routine checkup).
- Clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine).
- Socioeconomic status (stress, income level, health care coverage, and education level).

- Health-related quality of life (HRQoL) (activity limitations, physical health, and mental health).

Finally, the final outcomes of the objectives and hypotheses of this research are measuring HRQoL of adult patients of asthma including: activity limitations, physical health, and mental health. Using the data obtained from BRFSS would result in creating an effective indicator scale to measure, predict, and describe the outcomes of proposed elements of HRQoL. In order to accomplish the overall goal of these objectives and hypotheses, Statistical Analysis System Software (SAS) 9.4 would be employed.

CHAPTER II

REVIEW OF LITERATURE

2.1 Introduction:

Asthma is one of the most common chronic diseases that affect the lungs. In fact, it is known as a chronic inflammatory disorder that affects the airways of the lungs leading these airways to be narrowed [1-3,11].

Symptoms of asthma include chest pain, tightness, wheezing, shortness of breath, and coughing [1,3]. These symptoms of asthma as well as different associated factors can cause the attack of asthma to be severe and stay for a longer period of time, which can affect the health-related quality of life (HRQoL) of patients in certain ways [2,4-8].

In fact, there are five domains that are referred as the main components of quality of life including: psychological status, social status, physical status, spiritual status, and economic status [2,6]. So, the concept of HRQoL can be different from person to other. However, it can be defined as the person's knowledge and understanding of experiences and situations that this person health status has been through [2,9].

So, in order for patients to control this chronic disease and avoid its attacks as well as its severe symptoms that can make their HRQoL worst, patients should know and understand the different factors that associate with this chronic disease leading to asthma attack. These different factors include behavioral, clinical and socioeconomic factors (figure 1) [2,6-8].

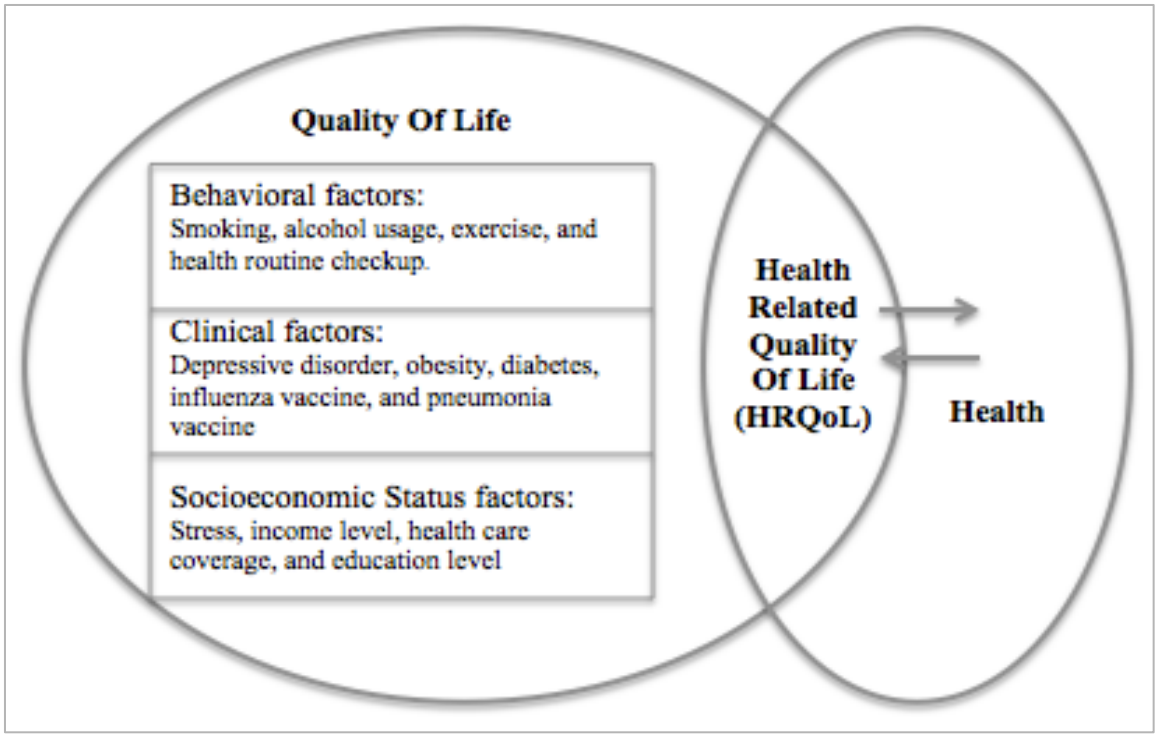


Figure 1. *Interrelationship between HRQoL of adult patients of asthma and different factors associated with asthma can affect HRQoL of these patients* [2].

There are several studies linked different behavioral factors to the asthma attack and bad control of asthma. These behavioral factors include smoking, alcohol use, exercise, and health routine checkup [12-16]. In addition, there are several studies linked different clinical factors to the asthma attack and bad control of asthma. These clinical factors include depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine [8,17-20]. Also, there are several studies linked different socioeconomic status factors to the asthma attack and bad control of asthma. These socioeconomic status factors include stress, income level, health care coverage, and education level [21-24].

2.2 Asthma:

Asthma is a common chronic disease that affects the airways in the lungs and causes inflammation in the airways by reacting to any infections or triggers that stimulate

the asthma attack [1,3,11]. According to Centers for Disease Control and Prevention (CDC), in 2013, in the United States, there were more than 34 million adult patients with asthma (figure 3) [1].

The reaction of the airways to these infections or triggers leads the airways to be swollen, narrowed, red, filled with mucus, and walls damage [11]. These reactions are blocking the airways as well as prohibiting them to be in the normal size leading to problems in the respiratory tract, which lead to difficulty of breathing as well as other symptoms [1,3,11]. These symptoms include chest pain, tightness, wheezing, shortness of breath, and coughing [1,3,11].

Asthma can be hereditary, which means if a person has a family history of asthma, there is a high risk for this person to develop asthma. Moreover, people, especially children, who have allergies to certain food or eczema are also in a high risk to develop asthma [11]. Although, children are in a high risk to develop asthma more than adults, there is no specific age that asthma start at. However, asthma symptoms can be severe in older patients [11].

Even if all groups of age, gender, and race are equally susceptible to develop asthma, CDC 2013 prevalence data in the United States showed that asthma prevalence in females is greater than asthma prevalence in males (table 1) [1]. Also, there are several studies showed that asthma is prevalent in females more than males [26].

Table 1.
Gender prevalence data for adult asthma patients in 2013 in the USA [1].

	Gender	Prevalence Number
U.S Total	Male	13,800,508
	Female	20,209,099

Also, CDC 2013 prevalence data in the United States showed that asthma prevalence in adults group of 25-34 years old, presents a high prevalence of asthma more than other groups (table 2) [1].

Table 2.
Age prevalence data for adult asthma patients in 2013 in the USA [1].

	Age Group	Prevalence Number
U.S Total	18-24	6,013,603
	25-34	6,278,309
	35-44	5,200,315
	45-54	5,749,277
	55-64	5,297,084
	65+	5,258,538

Moreover, CDC 2013 prevalence data in the United States showed that White non-Hispanic people have greater asthma prevalence than the other races (table 3) [1]. Also, there are several studies showed that asthma is prevalent in White non-Hispanic more than other races [27].

Table 3.
Racial Prevalence data for adult asthma patients in 2013 in the USA [1].

	Race	Prevalence Number
U.S Total	White non-Hispanic	21,753,903
	Black non-Hispanic	4,637,706
	Other non-Hispanic	1,727,194
	Multirace non-Hispanic	768,982
	Hispanic	4,417,656

There are causes of asthma. However, these causes are not yet fully understood [11]. Some of these causes were interpreted as hereditary causes while some of them were taken as environmental causes [1,11]. However, there are common triggers that stimulate asthma attack including: smoking, air pollution, dust mites, pets, cockroach allergen and mold [1,11].

Asthma is clinically classified based on the symptoms into four groups including: intermittent, mild persistent, moderate persistent, and severe persistent (table 4) [28].

Table 4.
Clinical classification of asthma [28].

Severity	Symptom frequency	Night time symptoms
Intermittent	≤ 2 days/week	≤2 days/month
Mild persistent	> 2 days/week but not daily	3–4 days/month
Moderate persistent	Daily	> 1 day/week
Severe persistent	Continuous (all day)	Frequent (7 days/week)

Pathophysiology of asthma is clear that when an infection or trigger stimulates asthma attack, the airways of the lungs are going to be swollen, narrowed, red, filled with mucus, and walls damage [3,11]. These reactions lead the airways to be blocked and prohibited to be in the normal size leading to problems in the respiratory system including: difficulty of breathing [1,3,11]. During the asthma attack, there are several immune system cells and other components would be involved in these reactions including: cytokines, macrophages, leukotrienes, T lymphocytes, histamine, neutrophils, and chemokines [29].

For asthma diagnosis, there is no specific accurate diagnostic test for asthma. However, physician always diagnose asthma with suspicion of asthma history of the patient's family, common symptoms for asthma, and allergies to asthma triggers [11,29,30]. Diagnosis of asthma in adult patients is easier than diagnosis of asthma in children [11]. After suspicion of asthma, there are several tests can be preformed to confirm the diagnosis of asthma including: spirometry, allergy testing, and airways sensitivity test [3,28]. In addition, chest x-ray and electrocardiogram (EKG) are used to rule out the possibility of other diseases such as heart failure or the presence of unwanted particles in the lungs [3].

While there is no treatment for asthma as well as there is no procedure to prevent asthma, the symptoms of asthma and asthma attack can be controlled and managed [11,31]. The most important rules to control symptoms of asthma and asthma attack is avoiding the infections and triggers that lead to asthma attack [11,28]. Moreover, it is very important to understand and have the knowledge of the different factors that can be associated with asthma and have impacts on the health-related quality of life (HRQoL). These factors include behavioral, clinical and socioeconomic factors [2,6-8].

There are several studies showed that asthma has an impact on HRQoL. They said that asthma in general can affect HRQoL in certain ways including psychological status, social status, physical status, spiritual status, and economic status [2,6]. In psychological status, asthma can lead to depression and anxiety. In social status, asthma can lead to restriction in several activities and relations. In physical status, asthma can lead to limitations in some activities [2]. However, there are still more deeply investigations needed to investigate the impact of the behavioral, clinical and socioeconomic factors associated with asthma on HRQoL in the adult patients of asthma.

Behavioral factors including: smoking, alcohol use, exercise, and health routine checkup can affect HRQoL [12-16]. Clinical factors including: depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine can affect HRQoL [8,17-20]. Also, status factors including stress, income level, health care coverage, and education level can affect HRQoL [21-24].

These different associated factors with asthma can cause side effects that can affect HRQoL including: activity limitations, physical health, and mental health.

Therefore, it is very important to measure the impact of behavioral, clinical and socioeconomic factors on HRQoL in adult patients of asthma.

2.3 Behavioral Factors:

There are many behaviors that some people practice even if these behaviors cause harmful reactions to these people. Some of these harmful reactions are diseases. Moreover, some of these diseases may be chronic. However, there are some people, who are already patients of a chronic disease such as asthma, practice some actions that can make their asthma symptoms to be worst or even life-threatening asthma. These behaviors may include smoking, alcohol use, exercise, and health routine check up [12-16].

2.3.1 Smoking:

In the United States, each year there are almost 440,000 people die because of smoking [32]. Smoking is considered as the main reason behind many chronic diseases including asthma [12,32-34]. Smoking is linked to severity of asthma and poor control of asthma. Also, smoking is linked to lung hyperinflation increasing as well as other lung dysfunctions [12,33,35-39]. Surprisingly, smoking can reduce the effectiveness of different medications of asthma such as inhaled corticosteroids (ICSs) [12,33,40,41].

However, during the asthma attack in patients of asthma, bronchial tubes are already inflamed leading them to produce mucus, which causes phlegm coughing [12,32]. Also, the bronchial tubes' muscles are already cramped and swollen during the asthma attack in patients of asthma leading difficulty of breathing as well as other asthma symptoms [1,11,32].

So, smoking in asthma patients can increase the mucus production by stimulating the mucous glands leading daily phlegm coughing [12,32]. Moreover, smoking in asthma

can increase the swelling of these bronchial tubes leading to more difficulty of breathing and make asthma symptoms worst. This difficulty of breathing caused by smoking in asthma patients can be developed to be irreversible spasm and swelling of the bronchial tubes leading to permanent difficulty of breathing and other chronic diseases including chronic bronchitis and emphysema [12,32].

There are several studies showed the association between smoking and asthma. Boulet et al. studied the impact of smoking on the control and management of asthma [33]. They found that patients of asthma, who are currently smokers, have poor control of asthma and they need health care more than non-smokers patients of asthma [33]. Moreover, Thomson et al. have done another study in the United Kingdom that supports the results of Boulet et al study. Thomson et al. studied the effect of smoking on the airway inflammation as well as the control of asthma in former smokers with asthma [34]. They found that smokers with asthma have severe symptoms, poor control of asthma, more emergency visits, and they have higher scores of depression and anxiety than non-smokers with asthma [34].

Also, there are two studies have been done in France and Spain respectively [42]. They found that smoking cannot cause asthma in general. However, both studies showed that the asthma attack in smokers is more aggressive than the asthma attack in non-smokers [42].

2.3.2 Alcoholic Use:

Drinking alcohol can stimulate or trigger the attack of asthma in some patients while it relieves the symptoms of asthma attack in other patients [13,43]. The reason behind this difference is that attack of asthma can be triggered by different substances in

different patients [43]. Also, some studies showed that high concentration of alcohol may complicate control and management of asthma and lead to severe symptoms of asthma [13].

Components of alcohol drinks such as ethanol and some natural food may contain histamine, which can be found in the body in allergic reaction. This histamine is a major trigger of asthma symptoms and attack in some patients [43]. Also, sulphites, which is used as a preservative substance in alcohol drinks, can trigger asthma attack in 3% to 10% of asthma patients and cause mild asthma symptoms ranging wheezing and coughing to life-threatening asthma attack [43].

Some studies showed that drinking alcohol is good for asthma patients in order to improve symptoms of asthma and avoid asthma attack. They said that drinking alcohol supports the function of mucociliary clearance and reduce the inflammation of the airways in patients of asthma [13]. However, other studies showed that the effect of alcohol drinking on the function of airways is based on the concentration of alcohol, duration of alcohol exposure, and route of alcohol exposure [13]. They said that high concentration of alcohol may complicate control and management of asthma and lead to severe symptoms of asthma [13].

Other ways that the scientists mentioned the effect of drinking alcohol on asthma attack is the feeling of stress, anxiety and depression [43]. Stress, anxiety and depression have been strongly linked to asthma attack and severity by several studies [8,21,43].

2.3.3 Exercise:

Exercise is one of the most important things that have benefits for health improving. Some of these benefits include reducing the risk of getting heart disease,

controlling body weight, lowering the level of cholesterol, and improving the image of the body [44]. However, in patients of asthma, exercise can trigger asthma attack causing asthma symptoms called exercise-induced asthma (EIA) [44-47].

EIA is also known as exercise-induced bronchoconstriction (EIB) [45-47]. In EIA, the airways become narrow leading the symptoms of asthma to be worst [45,47].

There are several studies studied the relation between exercise and asthma. These studies came up with two major hypotheses that explain the mechanisms of exercise leading asthma symptoms to be worst causing EIA [14]. First hypothesis said that during exercise, the ventilation of the respiratory tract would be increased causing water loss [14]. In contrast, second hypothesis, which is supported by majority of scientists, said that during exercise, the ventilation of the respiratory tract would be increased causing the airways of the lungs to be colder [14]. However, EIA can be treated by taking anti-inflammatory such as inhaled steroids before exercise [14].

2.3.4 Health Routine checkup:

Asthma is known as high changeable chronic disease that can change from time to time, from season to season, from different cases and patients [3]. Moreover, the response for asthma treatment, control, and management can be different from patient to patient [3]. Therefore, patients of asthma should have planned routine checkup in order for them to stay in the right way in controlling and managing their asthma [3,15,16]. There are several studies showed the association between routine checkup and controlling and managing asthma [15]. The researchers concluded that patients of asthma, who do not have a planned follow-up visits to checkup their asthma state, have poorer control of asthma as well as severe symptoms [15].

2.4 Clinical Factors:

There are many clinical factors associated with asthma can make asthma symptoms to be worst or even life-threatening asthma. These clinical factors include depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine. [8,17-20].

2.4.1 Depressive Disorders:

Although some people consider depression as a low mood only, scientists consider depression as a serious health condition that can lead to the action of harmful activities [48]. Depression has an impact on mental health as well as physical health leading to an impact on health related quality of life (HRQoL) [48].

There are closed relation between depression and asthma [49,50]. When patients of asthma are exposed to depression and terrible emotions, attack of asthma may occur and the symptoms of this asthma attack could be severe. Also, people of asthma are more sensitive than other people to develop depressive disorders [49,51,52].

It has been known that combination between asthma and depression give worse outcomes of health because depression leads the treatment of asthma patients to lose some of its affectivity or even not effective at all [48]. The reason behind that might be lack in the skills in solving problems, and poor memory that lead to low attention, low concentration, and low recognition requiring a medical help [48].

In fact, studies on adult patients of asthma with depression showed that these patients have high rates of mental disorders that associated with asthma leading to worse outcomes of HRQoL [7,50,53-60]. Moreover, There are studies showed that there is an association among poor control of asthma, asthma-related morbidity, as well as asthma-related mortality [7,50,58-63].

2.4.2 Obesity:

It has been well know that one of the common medical issues in the United States is obesity because it has been linked to several diseases such as diabetes, heart disease, and other diseases [25]. Also, scientists said that asthma can be considered as one of the diseases that have been linked to obesity [25]. In fact, there are several studies showed a strong relation between asthma and obesity [17,25]. According to Centers for Disease Control and Prevention (CDC), obesity has been significantly connected to develop asthma [64]. In 2010, CDC released statistics showed that 38.8% of obese adults are patients of asthma while 26.8% of obese adults are not patients of asthma [64].

While the exact relation between obesity and asthma is not fully understood, scientists came up with several interpretations [17,25]. Obesity is able to lack pulmonary compliance, reduce the volumes of the lungs, and tight the diameter of the airways [17]. Also, it is able to affect ventilation in respiratory tract and the blood volume in the lungs [17]. Moreover, adipose tissues cause systemic pro-inflammatory states leading to produce high concentrated levels of chemokines and cytokines in the serum [17].

There are several studies proved that getting weight is one of the risk factors that are responsible for developing asthma while losing weight is one of the factors that are responsible for improving illness course of asthma [17]. Also, several studies showed the relation between body mass index (BMI), lower volume of the lungs, and the course of asthma [50,65,66].

Finally, even if the effect of being obese on asthma development is moderate, several studies showed that obesity has the ability to increase prevalence and incidence of asthma suggesting the enrolling obese asthmatics in a weight control program [17].

2.4.3 Diabetes:

Although diabetes and asthma are totally different diseases, several studies suggested that patients with diabetes are in high risk to develop asthma [67]

Diabetes as a chronic disease has chronic complications that affect the pathological characteristics of blood vessels, certain nerves, eye retina, and the skin [67]. Also, several studies showed that diabetes has an effect on the lung functions leading them to be functionally reduced [67-76]. This reducing in the lung function leading to diffusion of carbon monoxide has been believed as a reason to develop asthma [67,75,77]. Ehrlich et al. studied patients with diabetes and the risk of developing asthma and they found that patients with diabetes are in high risk to develop asthma [67].

2.4.4 Influenza and Pneumococcal Vaccines:

As patients of asthma are considered at a high risk in getting influenza and developing intensive pneumococcal disease, Centers for Disease Control and Prevention (CDC) highly recommend patients of asthma to have both influenza vaccine and pneumococcal vaccine [19,78].

There is a statistics study in Australia showed that popular influenza or cold that infects respiratory tract usually in the winter leads to more than 80% of reported asthma attacks [79]. In addition, patients of asthma that get influenza virus are in high risk to develop several complications including: pneumonia, bronchitis, and ear infections [79]. Public Health Agency of Canada emphasizes that patients of asthma must take pneumococcal vaccine in order to avoid severe diseases caused by pneumococcal infection [20].

2.5 Socioeconomic Factors:

Although some people do not believe the existence of the relations between socioeconomic factors and asthma, there are several studies proved the impact of several socioeconomic factors and poorer control and management of asthma. These socioeconomic factors include stress, income level, health care coverage, and education level [21-24].

2.5.1 Stress:

Stress is a hard term to define because it is a highly subjective phenomenon [80]. However, in order to measure the stress, it has to be defined. Therefore, some scientists came up with different definitions [21,80]. An individual ability to adapt has limitations in somewhere. Also, there are some life challenges, as well as environmental challenges that individuals cannot control. Under these conditions, stress can occur when an individual cannot control these environmental and life challenges as well as cannot adapt with them [21,81].

There are several studies showed the relation between stress and asthma attack, severe symptoms of asthma, and poorer control of asthma [82]. However, Chen and Miller came up with a model that describes the pathways and immune mechanisms that stress leads to asthma attack and severe asthma symptoms [21].

The model of Chen and Miller describes the interaction between stress, outdoor, indoor environmental triggers, and the deterioration of asthma [21]. The basic idea of the model is that stress can multiply the inflammatory response of airways against triggers including: infections, allergens, and irritants in patients of asthma [21]. This operation of stress can be accomplished by relevant biological pathways including: the hypothalamic-

pituitary-adrenal (HPA) axis, the sympathetic-adrenal-medullary (SAM) axis, the sympathetic autonomic nervous system (SNS), and the parasympathetic autonomic nervous system (PNS) [21]. So, this model include immune cells and responses, as well as outdoor and indoor environmental triggers [21].

In the immune system, there are T helper (Th) cells including two phenotypes Th1 and Th2. Th cells produce cytokines called interleukins (IL) including: IL-4, IL-5, and IL-13. Th1 releases IL-4 and IL-13 bind to B cells leading a type of immunoglobulin to be released called IgE [21]. This IgE binds to mast cells in the airways. When this IgE recognizes any of the environmental triggers, mast cell would be degranulated and produce allergic mediators including: leukotrienes and histamines [21]. These allergic mediators lead to shrinking of muscles and mucus leading to asthma symptoms. This immune action is the early response of the pathway [21].

In the late response, IL-5 would be released from Th2 cells leading eosinophil cells to be recruited in the airways leading to the release of several mediators including: eosinophil cationic protein [21]. These mediators can cause the damage for airway cells, which can cause edema, mucus, and bronchial shrinking causing asthma symptoms to be severer [21].

So, in the model of Chen and Miller, stress stimulates immune mechanisms to strongly recognize outdoor and indoor environmental triggers [21]. Elements of stress cause this stimulation called stressors. When these stressors including negative emotions are presented, there are more influences on the inflammatory response in the airways [21].

Exposure to stressors can increase the level of cortisol hormone and epinephrine hormone by the activation of HPA axis and SAM axis. Corticotropin- releasing hormone

(CRH) is the responsible for HPA activation as well as the secretion of adrenocorticotropin hormone (ACTH) [21]. This ACTH is responsible for the release of cortisol hormone and epinephrine hormone leading them to bind into glucocorticoid receptor (GR), which regulates IL-4, IL-5, and IL-13. These then go to the early and late responses of the immune system leading the reactions and symptoms to be more sever [21].

2.5.2 Income Level:

Income level has been linked to poor control and management of asthma. According to CDC prevalence data of adult patients of asthma in 2013 in the USA, lower income level is linked to high prevalence percentage of asthma among adults (table 5) [1].

Table 5.
Income level prevalence data for adult asthma patients in 2013 in the USA [1].

	Income Level	Prevalence Percentage
U.S Total	< $15,000	19.9
	$15,000 - $24,999	15.4
	$25,000 - $49,999	12.8
	$50,000 - $74,999	12.5
	>=$75,000	12.0

There are several logical reasons that lead to the connection among low-income level, poor control of asthma, and higher prevalence of asthma [83]. Exposure to asthma triggers in low-income households is greater than in high-income households. Also, low income areas have triggers of asthma more than high income areas including: cockroaches, gas, air pollution, lack of air conditioning, smoking, and other chemical substances [83].

Moreover, health care facilities in low-income areas are not enough for population as they are in high-income areas. In low-income areas, there is a lack in physicians, transportation, and medications [83]. Also, health care facilities in high-income areas

would be expensive for people who have low income. That leads these poor people to not follow their case by visiting physicians as well as buying their medications. All that leads to poor control of asthma, and higher prevalence of asthma [83].

There are several studies showed that low-income level is associated with poorer control and management of asthma [22,84]. They concluded that low-income level has complex interaction for developing asthma. However, low-income living and environment is a high risk that can lead to develop asthma. Also, there are some patients got better control and management of asthma when their families moved out of poverty [22,84].

2.5.3 Health Care Coverage:

Health care coverage is very important for asthma patients. There are several studies showed that patients of asthma without health care coverage are more likely to visit the emergency room than patients of asthma with health care coverage [85]. According to Centers for Disease Control and Prevention (CDC) in the period between 2006 and 2010, prevalence of asthma among people without health care coverage or partial health care coverage is greater than prevalence of asthma among people with fully health care coverage [1].

Moreover, there is a study in New York studied the impact of New York's State Children's Health Insurance Program (SCHIP) on health care for children with asthma [23]. They noticed improvements in asthma outcomes, better control of asthma, and good management of asthma. They also found that this health insurance program is the main reason behind these improvements [23].

2.5.4 Education Level:

Education level has been considered as a very important risk factor for asthma control and management [24, 86]. According to CDC prevalence data of adult patients of asthma in 2013 in the USA, low-education level is linked to high prevalence percentage of asthma among adult patients (table 6) [1].

Table 6.
Educational level prevalence data for adult asthma patients in 2013 in the USA [1].

	Education Level	Prevalence Percentage
U.S Total	High School Nongraduate	15.2
	High School Graduate	13.7
	Some College	15.1
	College Graduate	12.5

There are several studies showed that low-education level is associated with high risk of developing asthma as well as poor asthma control and management [24, 86, 87]. Also, areas with low-educational people have high prevalence of asthma [87].

2.6 Health-Related Quality of Life (HRQoL):

Although it has been a little hard to define the concept of health-related quality of life (HRQoL), in order for patients of asthma to avoid attack of asthma and its severe symptoms that can make their HRQoL worst, patients should understand the concept of HRQoL and have the knowledge of the different factors that affect their HRQoL including: behavioral, clinical and socioeconomic factors [2,6-8,88,89].

So, in order to have the knowledge of HRQoL, the concept of quality of life has to be defined first [2]. The meaning of quality of life concept depends on the person's knowledge and understanding of experiences and situations that this person has been through in the life [2].

In fact, there are five domains that are referred as the main components of quality of life including: psychological status, social status, physical status, spiritual status, and

economic status [2,6,89]. So, the concept of HRQoL is defined as the concept of quality of life with concentrating on health status including: physical health status, psychological health status, and limitations of health and activities [2,9].

Therefore, measuring HRQoL in adult patients of asthma is very important in order to get a complete knowledge and understanding of the impact of this disease on these adult patients [2]. In fact, measuring HRQoL can measure the impact of the disease and the impact of the different associated factors with this disease on patients' health status to describe and predict health outcomes, evaluate clinical management, instruct clinical policy, and assign resources of health [2,90-92]. So, in general, purposes of measuring HRQoL include: discrimination between populations that are differ from each other in having asthma impacts on their HRQoL, evaluation the impact of involving other risk factors, and prediction of the measurement results and future outcomes [2,93,94].

Measuring HRQoL can give a complete indicator scale to indicate the impact of asthma and different associated factors on adult patients leading to better asthma control [2]. Features of measuring HRQoL include: validity, reliability, sensitivity, responsiveness, and interpretability. Therefore, it is became very important to measure HRQoL in order to know the effects of asthma on the life as well as the health status of asthma patients [2,90-92].

There are three main types of HRQoL measures including: generic HRQoL measures, specific HRQoL measures, and Utility-based measures of HRQoL [2,95-99]. Generic HRQoL measures are used to estimate HRQoL in all persons in the population [2,95,96]. Specific HRQoL measures are used to estimate HRQoL in particular diagnostic disease or particular [2,97]. Utility-based measures of HRQoL are different from others

types of HRQoL measure that because Utility-based measures are used to estimate and describe the health status [2,98,99].

There are several studies showed that asthma has an impact on HRQoL. They said that asthma in general can affect HRQoL in certain ways including psychological status, social status, physical status, spiritual status, and economic status [2,6]. In psychological status, asthma can lead to depression and anxiety. In social status, asthma can lead to restriction in several activities and relations. In physical status, asthma can lead to limitations in some activities [2]. However, there are still more deeply investigations needed to investigate the impact of the behavioral, clinical and socioeconomic factors associated with asthma on HRQoL in the adult patients of asthma.

2.7 Research Gap in Literature:

Although there are several traditional measures of health that measure prevalence, incidence, hospitalization, and mortality of asthma among adults, these traditional measures of health do not explain the impact of asthma on health-related quality of life (HRQoL) of these adults. Also, there are several studies that studied generally the impact of asthma, as a chronic disease, on HRQoL without including different associated factors and the impact of these factors on HRQoL among adult patients of asthma.

Moreover, there are several studies that studied the impact of some different associated factors with asthma on HRQoL of adult patients of asthma without comparing the outcomes of these factors among these asthma patients in order to know the significance of these factors.

Even if there are several researches and studies, as detailed earlier in this chapter, studied the impact of asthma on HRQoL without including associated factors or with few

associated factors, there is no research or study gave a full-measure scale or comprehensive view of the impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients. Also, there are still more deeply investigations needed to investigate the impact of different factors associated with asthma on HRQoL in the adult patients of asthma.

Using the data obtained from Behavioral Risk Factor Surveillance System (BRFSS) in measuring HRQoL of adult patients of asthma by measuring the impact of asthma disease, behavioral factors, clinical factors, and socioeconomic status would give a full-measure scale, comprehensive view, and deep investigations of the impact of asthma and other different associated factors on HRQoL of adult patients of asthma. Therefore, this research is proposed to measure impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Overview:

Measuring health related quality of life (HRQoL) including: activity limitations, physical health, and mental health in adult patients of asthma is very important to know and understand the impact of asthma and different associated factors on the health status of these adult patients. So, measuring the impact of asthma and different associated factors on individuals' health gives us the ability to describe and predict health outcomes, evaluate clinical management, instruct clinical policy, and assign resources of health. Moreover, features of measuring HRQoL include validity, reliability, sensitivity, responsiveness, and interpretability.

Since that there is no clear research or study gave a full-measure scale, comprehensive view, or deep investigations of the impact of asthma and different associated factors on HRQoL of adult patients of asthma in the United States, the overall goal of this research is to measure the impact of asthma and the different associated factors on HRQoL in adult patients of asthma in the United States.

These different associated factors include behavioral factors (smoking, alcohol use, exercise, and health routine checkup), clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine), and socioeconomic status (stress, income level, health care coverage, and education level) (figure 2).

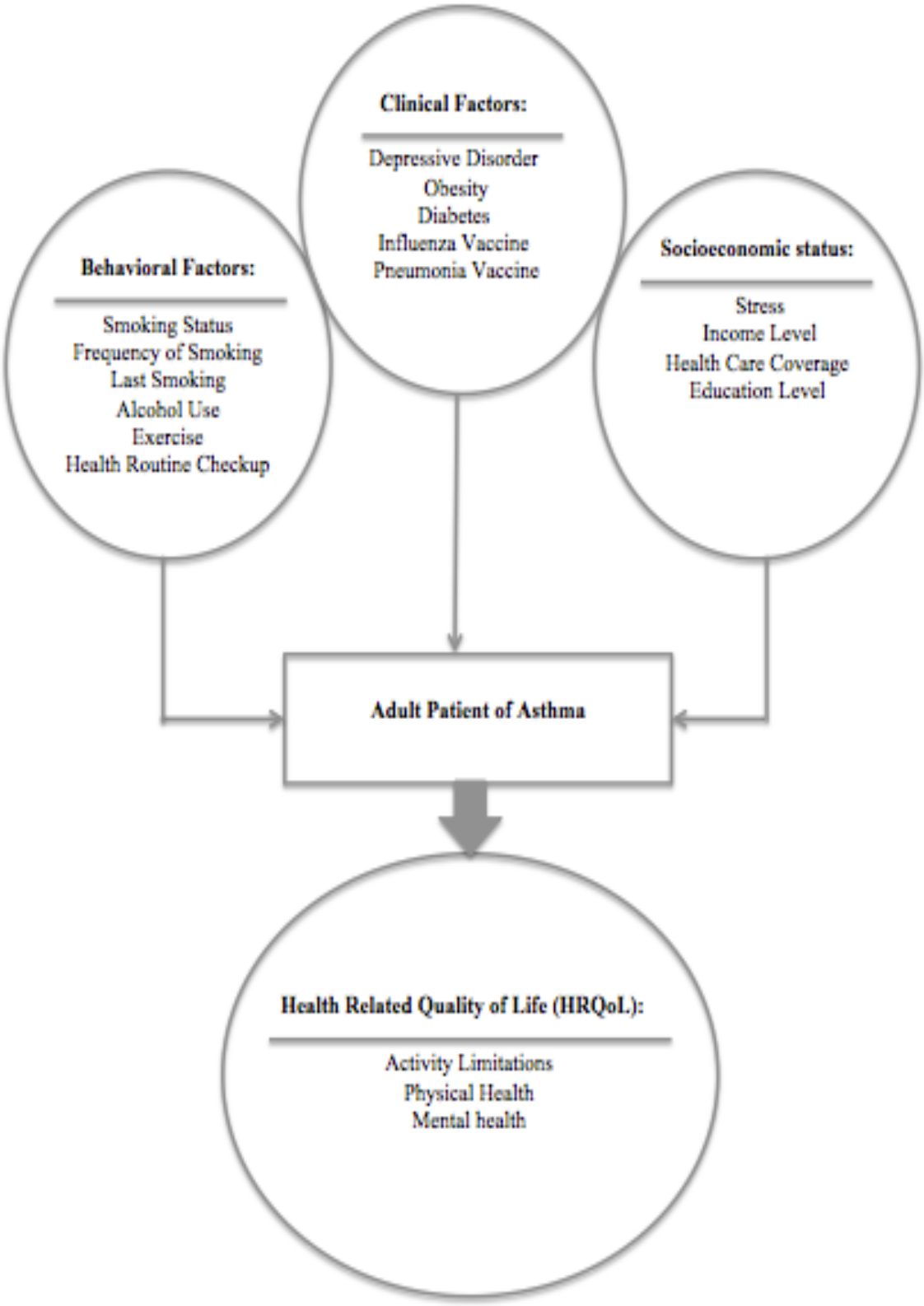


Figure 2. *Conceptual model for the impact of behavioral, clinical, and socioeconomic factors on health-related quality of life (HRQoL) in adult patients of asthma.*

Specifically the objectives of this research are designed for the following:

- Determination of the impact of asthma as a chronic disease on HRQoL of adult patients in the United States.
- Defining the relation between behavioral factors and HRQoL in adult patients of asthma in the United States.
- Evaluation of the impact of clinical factors on HRQoL in adult patients of asthma in the United States.
- Investigating the differences of socioeconomic statuses in the patients and the effects of these statuses on HRQoL of adult patients of asthma in the United States.
- Creating a measure scale that is valid, reliable, sensitive, responsive, and interpretable to monitor HRQoL of patients of asthma.

Finally, the results of this research would provide the following:

- Increase the ability to describe and predict health outcomes regarding to the measure of the impact of asthma and associated factors on HRQoL in adult patients of asthma.
- Creation of successful understanding in purpose to manage socioeconomic status, behavioral and clinical factors that are associated with asthma in adult patients.
- Evaluation of clinical management in order to instruct clinical policy and assign resources of health.
- Getting better knowledge and understanding of certain behavioral and clinical factors that affect HRQoL in purpose to control asthma.

3.2 Data Sources and Variables:

This research is planned to use the data of 2014 that were obtained from Behavioral Risk Factor Surveillance System (BRFSS) from Centers for Disease Control

and Prevention (CDC) in order to measure the impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients.

Data of BRFSS is about collected questionnaires regarding to health and behaviors of residents in the United States. BRFSS uses the telephone in order to collect these data from the United States residents.

BRFSS data includes more than 100 clinical and nonclinical data elements for each patient. However, the variables that are needed to measure HRQoL as this research is planned include (table 7):

- Record identification (interview date and state name).
- Chronic health conditions (adult asthma).
- Demographics (age, gender, and race).
- Behavioral factors (current smoking, frequency of days now smoking, interval since last smoked, alcohol use, exercise, and health routine checkup).
- Clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine).
- Socioeconomic status (stress, income level, and education level).
- Health-related quality of life (HRQoL) (activity limitations, physical health, and mental health

Table 7:
Data variables of the research.

Study Variable	Variable Name in BRFSS Data	Variable Description Or Variable Question
ASTHMA DISEASE		
Still Have Asthma	ASTHNOW	Do You Still Have Asthma? Categorical Variable (Binary). 1=YES. 2=NO.
DEMOGRAPHICS		
Gender	Sex	Indicate sex of respondent. Categorical Variable (Binary). 1=Male. 2=Female.
Age	_AGEG5YR	How old are you? Categorical Variable. Thirteen-level age category. 1=Age 18 to 24. 2=Age 25 to 29. 3=Age 30 to 34. 4=Age 35 to 39. 5=Age 40 to 44. 6=Age 45 to 49. 7=Age 50 to 54. 8=Age 55 to 59. 9=Age 60 to 64. 10=Age 65 to 69. 11=Age 70 to 74. 12=Age 75 to 79. 13=Age 80 or older.
Race	_RACE	Indicate race of respondent. Categorical Variable. Eight groups Race-Ethnicity category. 1=White non-Hispanic 2=Black non-Hispanic 3=American Indian or Alaskan Native Non-Hispanic 4=Asian non-Hispanic 5=Native Hawaiian or other Pacific Islander Non-Hispanic 6=Other race non-Hispanic 7=Multiracial non-Hispanic 8=Hispanic.
BEHAVIORAL FACTORS		
Current Smoking Status	_RFSMOK3	Are you a smoker? Categorical Variable (Binary). 1=Yes. 2=No.
Frequency Of Days Now Smoking	SMOKDAY2	Do you now smoke cigarettes every day, some days, or not at all? Categorical Variable. Three-groups smoking levels. 1=Every day. 2=Some days. 3=Not at all.

Interval Since Last Smoked	LASTSMK2	How long has it been since you last smoked a cigarette, even one or two puffs? Categorical Variable. Eight-groups quitting smoking levels. 1=Within the past month. 2=Within the past 3 months. 3=Within the past 6 months. 4=Within the past year. 5=Within the past 5 years. 6=Within the past 10 years. 7=10 years or more. 8=Never smoked regularly.
Alcohol Use	AVEDRNK2	Average alcoholic drinks per day in past 30 days? 1-76= 76 drink category. 88=None.
Exercise	EXERANY2	Exercise in Past 30 Days. Categorical Variable (Binary). 1=Yes. 2=No.
Health Routine Checkup	CHECKUP1	Length of time since last routine checkup. Categorical Variable. Five-groups routine checkup levels. 1=Within past year. 2=Within past 2 years. 3=Within past 5 years 4=Within 5 years or more. 8=Never
CLINICAL FACTORS		
Depressive Disorder	ADDEPEV2	Have you ever told you have a depressive disorder, including: depression, major depression, dysthymia, or minor depression? Categorical Variable (Binary). 1=Yes. 2=No.
Obesity	_BMI5CAT	Four-groups of Body Mass Index (BMI). Categorical Variable. Four-groups BMI levels. 1=Underweight. 2=Normal Weight. 3=Overweight. 4=Obese.
Diabetes	DIABETE3	Have you ever had told you have diabetes? Categorical Variable. 1=Yes. 2=No.
Influenza Vaccine	FLUSHOT6	Have you had Adult flu shot/spray within the past 12 months? Categorical Variable (Binary). 1=Yes. 2=No.
Pneumonia Vaccine	PNEUVAC3	Have you ever had a pneumonia shot? Categorical Variable (Binary). 1=Yes. 2=No.

SOCIOECONOMIC FACTORS		
Stress	SCNTMEL1	- How much you feel stressed. Categorical Variable. Five-groups stress levels. 1=Always. 2=Usually. 3=Sometimes. 4=Rarely. 5=Never.
Income Level	INCOME2	How much is your annual household income from all sources? Categorical Variable. Eight-groups income level levels. 1=$1 - $9,999. 2=$10,000 - $14,999. 3=$15,000 - $19,999. 4=$20,000 - $24,999. 5=$25,000 - $34,999. 6=$35,000 - $49,999. 7=$50,000 - $74,999. 8=$75,000 or more.
Health Care Coverage	HLTHPLN1	Do you have a health care coverage? Categorical Variable (Binary). 1=Yes. 2=No.
Education Level	EDUCA	What is the highest grade or year of school you completed? Categorical Variable. Six-groups education level levels. 1=Never attended school 2=Grades 1 through 8. 3=Grades 9 through 11. 4=Grade 12 or GED. 5=College 1 year to 3 years. 6=College 4 years or more.
HEALTH-REALATED QUALITY OF LIFE (HRQOL)		
Activity Limitations	QLACTLM2	Are you limited in any way in any activities because of physical, mental, or emotional problems? Categorical Variable (Binary). 1=Yes. 2=No.
Physical Health	PHYSHLTH	How many days during the past 30 days was your physical health not good including physical illness and injury? Categorical Variable. 1-30= 30 days each day represents one category. 88=None.
Mental Health	MENTHLTH	How many days during the past 30 days was your mental health not good including stress, depression, and problems with emotions? Categorical Variable. 1-30= 30 days each day represents one category. 88=None.

3.3 Hypotheses of the Research:

3.3.1 First Hypothesis of The Research:

Table 8.
First hypothesis of the Research.

Hypothesis	Asthma as a chronic disease has statistically significant impact on HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.
Predictor Variables	• ASTHNOW
Outcome Variables	• QLACTLM2 • PHYSHLTH • MENTHLTH
Descriptive Analyses	Frequency distribution for ASTHNOW, QLACTLM2, PHYSHLTH, and MENTHLTH.
Inferential Analyses	Chi-square test (ASTHNOW vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH.
Predictive Models	Logistic regression (ASTHNOW vs each one of QLACTLM2, PHYSHLTH, MENTHLTH).

3.3.2 Second Hypothesis of The Research:

Table 9.
Second hypothesis of the Research.

Hypothesis	There is a significant relation between several behavioral activities that adult patients practice including: smoking, alcohol use, exercise, and health routine checkup and HRQoL including: activity limitations, physical health, and mental health of these adult patients of asthma in the United States.
Predictor Variables	• _RFSMOK3 • LASTSMK2 • EXERANY2 • SMOKDAY2 • AVEDRNK2 • CHECKUP1
Outcome Variables	• QLACTLM2 • PHYSHLTH • MENTHLTH
Descriptive Analyses	Frequency distribution for _RFSMOK3, SMOKDAY2, LASTSMK2, AVEDRNK2, EXERANY2, CHECKUP1, QLACTLM2, PHYSHLTH, and MENTHLTH.
Inferential Analyses	Chi-square test (each one of _RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2 vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH.
Predictive Models	Logistic regression (each one of _RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2 vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH).

3.3.3 Third Hypothesis of The Research:

Table 10.
Third hypothesis of the Research.

Hypothesis	There is significant relation between several clinical factors including: depressive disorder, obesity, diabetes, influenza vaccine and pneumonia vaccine and HRQoL including: activity limitations, physical health, and mental health of adult patients of asthma in the United States.
Predictor Variables	• ADDEPEV2 • DIABETE3 • PNEUVAC3 • _BMI5CAT • FLUSHOT6
Outcome Variables	• QLACTLM2 • PHYSHLTH • MENTHLTH
Descriptive Analyses	Frequency distribution for ADDEPEV2, _BMI5CAT, DIABETE3, FLUSHOT6, PNEUVAC3, QLACTLM2, PHYSHLTH, and MENTHLTH.
Inferential Analyses	Chi-square test (each one of ADDEPEV2, _BMI5CAT, DIABETE3, FLUSHOT6, and PNEUVAC3 vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH).
Predictive Models	Logistic regression (each one of ADDEPEV2, DIABETE3, FLUSHOT6, and PNEUVAC3, and _BMI5CAT vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH.

3.3.4 Fourth Hypothesis of The Research:

Table 11.
Fourth hypothesis of the Research.

Hypothesis	Differences of socioeconomic statuses (SES) factors including: stress, income level, health care coverage, and education level between adult patients of asthma can result significantly in different HRQoL including: activity limitations, physical health, and mental health, in adult patients of asthma in the United States.
Predictor Variables	• SCNTMEL1 • HLTHPLN1 • INCOME2 • EDUCA
Outcome Variables	• QLACTLM2 • PHYSHLTH • MENTHLTH
Descriptive Analyses	Central tendency, variation, or frequency distribution for SCNTMEL1, INCOME2, HLTHPLN1, EDUCA, QLACTLM2, PHYSHLTH, and MENTHLTH.
Inferential Analyses	Chi-square test (each one of SCNTMEL1, INCOME2, HLTHPLN1, and EDUCA vs each one of QLACTLM2, PHYSHLTH, and MENTHLTH.
Predictive Models	Logistic regression (each one of SCNTMEL1, INCOME2, EDUCA, and HLTHPLN1 vs each one of QLACTLM2, PHYSHLTH, MENTHLTH).

3.4 Research Methods:

There are different types of statistical methods and models would be performed to analyze data in this research including: descriptive analysis methods, inferential analysis methods, and predictive analysis models. Also, Statistical Analysis System Software (SAS) 9.4 would be employed to extract the data and perform the appropriate analyses in order to accomplish the over all goal of this research. Therefore, it is very important to understand the statistical analysis methods and models as well as SAS procedures that would be used to perform the analyses of data in this research.

3.4.1 Descriptive Analysis:

There are different descriptive analysis methods that can be used to describe different variables including: central tendency, variation (dispersion), and frequency distributions. However, in this research, frequency distributions would be the best method to describe the variables because all the variables in this research are categorical variables.

3.4.1.1 Central Tendency:

Central tendency is a summary or set of measures that aim to describe the entire set of data with one value representing the center of this data set distribution [100-103]. There are three major measures of central tendency including: the mode, the median and the mean. Each one of these measures has different significance in detecting single values that represent the center of the data set distribution [100-103].

The mode is the value that is occurring commonly in the data distribution [100-102]. Some data set have values that just occur once, this data sets do not have a mode while some other data sets have more that a mode because of their values that occur more that

once [102]. There are advantages and disadvantages of the mode. Advantages of the mode include easiness in calculation and use in quantitative and qualitative data. On the other hand, disadvantages of the mode include reflection of the center of the data distribution can be not accurate [100-102].

The median is the value that takes the middle place in data distribution when the data set is ordered whether ascending order or descending order [100-102]. That means the median separates the distribution of data into two halves, which 50% of data is above the median and 50% of data is below the median [100-102]. Therefore, the median is known as 50th percentile and positional average [102]. The median is given by this formula [103]

$$\text{Median} = \text{lower limit of the interval} + i(0.50n - cf)$$

While:
i = the width of the interval.
n = sample size.
cf = the cumulative frequency below the interval that contains the median.

There are advantages and disadvantages of the median. Advantages of the median include: no distortion by skewed data and outliers, easiness in computation and understanding, and determination of different scales. On the other hand, disadvantages of the median include: no applicability for categorical data, no capability further mathematical calculation [100-102].

The mean is the most commonly used measure among central tendency measures [104]. There are several types of the mean including: arithmetic mean, weighted mean, harmonic mean (HM), and geometric mean (GM) [104]. The most commonly used of mean types is arithmetic mean. In a simple way, arithmetic mean is the average. It is the sum of

all observation values of the data set divided by the numbers of these observations [100,101,104]. Arithmetic mean is given by this formula [103]

$$X = \Sigma X_i / n$$

While:
x: The mean.
Σ: (Sigma). The summation.
X: The observation values
n: The numbers of the observations

There are advantages and disadvantages of the mean. Advantages of the mean include giving good representation of the data, and close relation to standard deviation (SD). On the other hand, disadvantages of the median include distortion by skewed data and outliers, and no applicability for categorical and ordinal data, [100,101,104].

3.4.1.2 Variation (Dispersion):

To have a full summary of a set of data distribution, variation (dispersion) measures must be completed in addition to central tendency because measures of central tendency is not enough to summarize a set data distribution [100]. There are three major types of variation including: range, standard deviation (SD), and variance [100,105,106].

The range is simply defined as the difference between the smallest observed value and the largest observed value [100,105]. There are advantages and disadvantages of the range. The advantage of the range is the easiness in calculation. On the other hand, disadvantages of the range include sensitivity to outliers and no observations for all set of data [100,105]. The range is given by this formula [103]

$$d = X_n - X_1$$

While:
d: the range.
X_n: The highest value
X_1: The lowest value

Standard deviation (SD) measures the spread of the data around the mean. It is the square root of the total of the squared deviation of the mean that would be divided by the number of observations [100,105]. SD is given by this formula [103]

$$S = \sqrt{\Sigma (X_i - X)^2 / n - 1}$$

While:
S: The standard deviation.
X: The observation values
X: The mean.
Σ: (Sigma). The summation.
n: The numbers of the observations

In fact, the most commonly measure that is used to measure variation is standard deviation (SD) [105]. There are advantages and disadvantages of SD. The advantage of SD with the mean is the detection of skewed data. On the other hand, the disadvantage of SD includes: improper variation measure for skewed data [100,105].

The variance can measure the dispersion around the central region of data set distribution [100,106]. In fact, it is the squared deviation average of the observed values from their mean value [100,106]. The variance is given by this formula [103]

$$S^2 = \Sigma (X_i - X)^2 / n - 1$$

While:
S^2 = Variance
Σ = (Sigma). The summation.
X: The observation values
x = The mean.
n: The numbers of the observations

3.4.1.3 Frequency Distributions:

Frequency distribution enables the researcher to get a quick look to the entire data set. In fact, it is about organized tables or graphs that show the examined categories on the measure scale including each number of individuals of these categories [100,107]. There are many goals to perform frequency distribution including: organization of data interpretation, providing charts and graphs to make the understanding of the data easier, comparing different sets of data, and defining the shape distribution of each data set [108]. Frequency distribution can be showed by frequency distribution tables or frequency distribution graphs that are used in visualizing the data [107,108].

3.4.1.4 Visualizing The Data:

There are several types of graphs that visualize the data. Some of these graphs show the distributions of the data set while some of them show the association between the variables of this data set [109]. These graphs are known as ODS graphics, which is an extension of Output Delivery System [109]. Bar charts, histograms, and box plots are graphs that show the distribution of a data set. Bar charts and histograms are used to show the distribution of categorical data while histograms and box plots are used to show the distribution of continuous data [109]. Scatter plots and series plots are graphs that show the association between two continuous variables [109].

3.4.2 Inferential Analysis:

There are different inferential analysis methods that can be used to infer and detect the association among different variables. These inferential analysis methods include parametric and non-parametric methods. Parametric methods include one-way analysis of variance (one-way ANOVA), linear discriminant analysis, and Pearson's

product moment correlation coefficient. Non-parametric methods include Chi-square test, Kruskal Wallis test, and Spearman's rank correlation coefficient. However, in this research, Chi-square test would be the best method to infer and detect the association among variables because all the variables in this research are categorical variables.

3.4.2.1 One-Way Analysis Of Variance (One-Way ANOVA):

Analysis of variance (ANOVA) is a method that is used to analyze the mean and other different factors as well as comparing between these different factors that can affect the mean [103,110]. There are many types of ANOVA. In fact, it depends on factorial designs. For example, one-way ANOVA has one factorial design while N-way ANOVA has N of factorial designs [103]. One-way ANOVA is given by this formula [103]

$$X_{ij} = \mu j + \varepsilon_{ij}$$

While:
$X_{ij:}$ One-way ANOVA.
i: The ith observation from the jth group j.
j: is the group label.
μj: The mean for group j.
$\varepsilon_{ij:}$ An predictor error term.

For an appropriate use of a one-way ANOVA, there are several assumptions have to be considered including: indicator variables that are tested should be normally distributed continuous variables, predictor variable should be categorical, and μ_j should equal μ for all j [103,110]. Also, there is two-way ANOVA that would be used if there are two predictor variable or more.

3.4.2.2 Linear Discriminant Analysis (LDA):

Linear discriminant analysis (LDA) is related to one-way ANOVA except that one-way ANOVA is used to examine the association between categorical predictor variable and normally distributed numerical indicator variable while LDA is used to examine the association between a normally distributed numerical predictor variable and a categorical indicator variable [111,112]. However, the over all goal of LDA is the classification of the observations of two or more groups in a data set into one group based on some features of these observations [112]. LDA is given by this formula (called Bayes' formula) [112]

$$p(c/x) = \pi_c \, p(c/x) / p(x)$$

While:
p(c/x): The conditional probability.
π_c : A prior probability.
c: The conditional on the class.
p(x/c): The observed probability of x.
p(x): The probability of x.

3.4.2.3 Pearson's Product Moment Correlation Coefficient:

Correlation is used to examine the association between two variables [111,113]. There are two major types of correlation including: Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient [113]. Pearson's product moment correlation coefficient is used to examine the association between a normally distributed continuous predictor variable and other distributed continuous indicator variable [113]. So, it is between two normally distributed continuous variables [111,113]. Correlation is measured by correlation coefficient. This correlation coefficient takes a range from -1 to

+1 [113]. If the correlation coefficient is 0, it means there is no association or correlation between these variables. However, if the correlation coefficient is −1 or +1, it means there is linear association or correlation between these variables [113]. Moreover, if the correlation coefficient is +1, it means these variables have direct association or correlation. If the correlation coefficient is -1, it means these variables have inverse association or correlation [113]. Pearson's product moment correlation coefficient is given by this formula [113]

$$r = \Sigma (x_i - x) (y_i - y) / \sqrt{[\Sigma (x_i - x)^2] [\Sigma (y_i - y)^2]}$$

While:
r: Pearson correlation coefficient.
x: The first variable.
xi: The values of x for the ith individual.
y: The second variable values.
yi: The values of y for the ith individual.
n: Total number of values

3.4.2.4 Chi-Square Test:

The Chi-square test is a useful inferential test that can examine the association between two categorical variables [114]. The Chi-square ($\chi 2$) gives significant information about any observed differences as well as significant information about the categories that make these differences [114]. For an appropriate use of a Chi-square test, there are several assumptions that have to be considered including: the data in the cells should not be just transferred data or percentages, they should be frequencies, categories of the variable should be exclusive, and there are just two categorical variables (categorical predictor and categorical indicator) [114]. The Chi-square ($\chi 2$) is given by this formula [114]

$$\Sigma X^2_{i-j} = (O - E)^2 / E$$

While:
O: The observed value.
E: The expected value.
x^2: The cell Chi-square value.
Σx^2: The formula instruction to sum the entire cell Chi-square values.
i–j: The correct notation to represent all the cells, from the first cell (i) to the last cell (j).

3.4.2.5 Kruskal-Wallis Test:

The Kruskal-Wallis test is the non-parametric test of the one-way ANOVA that is used in comparing the medians between more than two predictor variables [115,116]. The Kruskal-Wallis test is also used when there are one ordinal indicator variable and two levels or more of a predictor variable [111]. The Kruskal-Wallis test is given by this formula [116]

$$H = [(12 / N (N+1)) \Sigma (R^2_j / n_j)] - 3 (N+1)$$

While:
k: The number of comparison groups.
N: The total sample size.
n_j: The sample size in the jth group.
R_j: The sum of the ranks in the jth group.

3.4.2.6 Spearman's Rank Correlation Coefficient:

Correlation is used to examine the association between two variables [111,113]. There are two types of correlation including: Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient [113]. Spearman's rank correlation

coefficient is used when there are non-normally distributed continuous predictor variable or ordinal predictor variable [111,113]. Correlation is measured by correlation coefficient. This correlation coefficient takes a range from -1 to +1 [113]. If the correlation coefficient is 0, it means there is no association or correlation between these variables. However, if the correlation coefficient is −1 or +1, it means there is linear association or correlation between these variables [113]. Moreover, if the correlation coefficient is +1, it means these variables have direct association or correlation. If the correlation coefficient is -1, it means these variables have inverse association or correlation [113]. Spearman's rank correlation coefficient is given by this formula [113]

$$r_s = 1 - ((6 \Sigma d^2_i) / n (n^2 - 1))$$

While:
n: Total number of values.
di: The difference in ranks for x and y.

3.4.3 Predictive Analysis:

There are different predictive models that are used to predict and determine the relation among different variables. These predictive models include simple linear regression, multiple linear regression, simple (binary) logistic regression, and ordinal (ordered) logistic regression. However, in this research, logistic regression would be the best model predict and determine the relation among variables because all the variables in this research are categorical variables.

3.4.3.1 Linear Regression:

Linear regression is a predictive model that determines the relationships between two variables or more [117,118]. There are two major types of linear regression including:

simple linear regression and multiple linear regression [117,118]. Simple linear regression is used to predict a linear relationship between one predictor variable and one indicator variable [117]. Simple linear regression is given by this formula [117]

$$z = kx + c$$

While:
k: The coefficient for the predictor variable.
c: The constant.

For an appropriate use of simple linear regression, there are several assumptions that have to be considered including: there are association between one predictor variable and one indicator variable, the is independency of deviation between each point of the data from the regression line and other data points, the variation around the regression line must be stable, as well as the variation of the data around the regression line must be normally distributed for all values of the predictor variable [117].

Multiple linear regression has the same principle of simple linear regression except that in multiple linear regression there is two or more predictor variables and one indicator variable [118]. Multiple linear regression is given by this formula [118]

$$z = k_1x_1 + k_2x_2 + k_3x_3 + \ldots\ldots\ldots + k_nx_n + c$$

While:
k: The coefficient for the predictor variables from 1 to n.
c: The constant.

For an appropriate use of multiple linear regression, there are several assumptions that have to be considered including: there are association between two or more predictor

variables and one indicator variable, the is independency of deviation between each point of the data from the regression line and other data points, the variation around the regression line must be stable, as well as the variation of the data around the regression line must be normally distributed for all values of the predictor variable [117,118].

3.4.3.2 Logistic Regression:

There is a measure that is called odds ratio (OR). This measure is used to measure the association between a predictor variable and an indicator variable [119]. In fact, odds ratio has the ability to measure and compare the relative odds of the occurrence of a predictor variable and give exposure to an indicator variable [119]. When OR equals 1 that means odds of the outcome cannot be affected by the exposure of the predictor. When OR is greater than 1 that means higher odds of the outcome is associated with the exposure of the predictor. When OR is lower than 1 that means lower odds of the outcome is associated with the exposure of the predictor [119]. The odds ratio (OR) is given by this formula [119]

$$OR = ((a/b) / (c/d)) = (ad/bs)$$

While:
a = Number of exposed cases.
b = Number of exposed non-cases.
c = Number of unexposed cases.
d = Number of unexposed non-cases.

So, when logistic regression is calculated, the coefficient of the regression, which is the rated raise in the log odds of the outcome per unit, increases in the value of the exposure of the predictor [119].

Logistic regression is a predictive model that can be used to get odds ratio [120]. Logistic regression is predictive model that can be used to predict the relation between an predictor variable and a categorical or ordinal indicator variable [111,121]. There are many subtypes of logistic regression such as: simple (binary) logistic regression, and ordinal (ordered) logistic regression [111]. The simple (binary) logistic regression is used when the indicator variable is binary. The ordinal (ordered) logistic regression is used when the indicator variable is ordered [111]. There are no assumptions of using logistic regression except that correlation should not be high between variables because that can cause estimation problems [121]. Logistic regression is given by this formula [120]

$$\log (\pi / 1 - \pi) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_m x_m$$

While:
π: The probability of an event.
βi: The regression coefficients associated with reference group and *xi* explanatory variables.

3.4.4 Statistical Analysis System Software (SAS) Procedures:

Statistical Analysis System Software (SAS) has various procedures (PROC) that are divided into four categories including: reporting procedures, statistical procedures, scoring procedures, and utility procedures [109,122]. Each procedure of these procedures has different characteristics and elements [122]. Each procedure has a keyword, one statement or more, and options [122]. Then, end with RUN statement telling SAS to end current PROC before going to next step [122]. SAS procedures that would be used to perform the analyses in this research include PROC FREQ, PROC UNIVARIATE,

PROC SGPLOT, PROC CORR, PROC GLM, PROC ANOVA, PROC NPAR1WAY, PROC DISCRIM, PROC LOGISTIC, PROC REG [109].

3.5 Research Design:

Literary reviews were directed and focused on the impact of asthma and different associated factors on health-related quality of life (HRQoL) of adult patients of asthma. Search subjects for literary reviews included:

- Asthma as a chronic disease.
- Impact of asthma on HRQoL including: activity limitations, physical health, and mental health.
- Impact of behavioral factors including: current smoking, frequency of days now smoking, interval since last smoked, alcohol use, exercise, and health routine checkup on asthma disease as well as HRQoL.
- Impact of clinical factors including: depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine on asthma disease as well as HRQoL.
- Impact of socioeconomic status including: stress, income level, health care coverage, and education level on asthma disease as well as HRQoL.
- Statistical studies and researches that have been done under impact of asthma and associated factors on HRQoL of adult patients.

These literary reviews were conducted on several databases including: Rutgers University Library, Science Direct, PubMed, Google Scholar, and various Websites of Science. The findings from the search showed that there is no clear research or study gave a full-measure scale, comprehensive view, or deep investigations of the impact of asthma and different associated factors on HRQoL of adult patients of asthma in the

United States. Therefore, the overall goal of this research is to measure the impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients.

This research is planned to use the data of 2014 that were obtained from Behavioral Risk Factor Surveillance System (BRFSS) from Centers for Disease Control and Prevention (CDC) in order to measure the impact of asthma, behavioral, clinical, and socioeconomic status factors on health-related quality of life (HRQoL) in adult patients of asthma in the United States.

This data is an open source data and publicly available. Also, this data is already in Statistical Analysis System Software (SAS) files. SAS would be employed to extract the data and perform the appropriate analyses in order to accomplish the hypotheses of this research.

So, data would be cleaned and then different types of statistical analysis methods and models would be performed to analyze data including: descriptive analysis, inferential analysis, and predictive analysis. Cleaning the data is necessary to obtain the appropriate variables for this research. Extracting the needed variables and deleting other variables that do not have relation to the hypotheses of this research can help to clean the data. Also, SAS statements and procedures such as IF-THEN statement, PROC FORMAT, and PROC FREQ would be used to clean the data.

BRFSS data includes more than 100 clinical and nonclinical data elements for each patient. However, needed variables in the research include:

- Record identification (interview date and state name).

- Chronic health conditions (adult asthma).
- Demographics (age, gender, and race).
- Behavioral factors (current smoking, frequency of days now smoking, interval since last smoked, alcohol use, exercise, and health routine checkup).
- Clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine).
- Socioeconomic status (stress, income level, health care coverage, and education level).
- Health-related quality of life (HRQoL) (activity limitations, physical health, and mental health).

In fact, this data include the appropriate behavioral, clinical, and socioeconomic data variables that are hypothesized to affect the research outcome (HRQoL).

Selecting appropriate methods or models to perform descriptive analyses, inferential analyses, and predictive analyses is based on the dependency, nature, and normality of the distribution of the variables. So, it is really important to know the nature of indicator variables, and predictor variables of the research. Dependent variables are called indicator variables and independent variables are called predictor variables.

All indicator variables in this research are categorical variables including: activity limitations, physical health, and mental health. All predictor variable in this research are categorical variables in this research include asthma, gender, age, race, current smoking, frequency of smoking, last smoked, exercise, alcohol use, health routine checkup, depressive disorder, obesity, diabetes, influenza vaccine, pneumonia vaccine, stress, income level, health care coverage, and education level.

For demographics variables such as age, gender, and race would be used to show prevalence of asthma among these variables. This prevalence can be done by frequency tabulation through PROC FREQ in SAS and then visualizing the results by Output Delivery System (ODS) graphics through PROC SGPLOT in SAS.

After cleaning the data and knowing the dependency, nature, and normality of distribution of the variables, appropriate methods or models descriptive analyses, inferential analyses, and predictive analyses would be preformed.

The descriptive analysis method that is used to describe the variables in this research is frequency distribution. Describing the distributions by using frequency distributions would be through PROC FREQ in SAS to show the distributions.

The inferential analysis method that is used to infer and detect the association among variables in this research is Chi-square test. Dividing the variables based on the hypotheses of this research would make the design of this research easier.

So, the first hypothesis proposed that asthma as a chronic disease has statistically significant impact on HRQoL. Asthma has one categorical variable (ASTHNOW) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the association between ASTHNOW and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using Chi-square test through PROC FREQ in SAS with CHISQ option.

The second hypothesis proposed that there is a significant relation between several behavioral activities that adult patients practice and HRQoL. Behavioral factors have six categorical variables (_RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2) while HRQoL has three categorical variables

(QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the association between each one of _RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using Chi-square test through PROC FREQ in SAS with CHISQ option.

The third hypothesis proposed that there is significant relation between several clinical factors and HRQoL. Clinical factors have five categorical variables (_BMI5CAT, ADDEPEV2, DIABETE3, FLUSHOT6, and PNEUVAC3) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the association between each one of _BMI5CAT, ADDEPEV2, DIABETE3, FLUSHOT6, and PNEUVAC3 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using Chi-square test through PROC FREQ in SAS with CHISQ option.

The fourth hypothesis proposed Differences of socioeconomic statuses (SES) factors between adult patients of asthma can result significantly in different HRQoL. Socioeconomic factors have four categorical variables (SCNTMEL1, INCOME2, EDUCA, and HLTHPLN1) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the association between each one of SCNTMEL1, INCOME2, EDUCA, and HLTHPLN1 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using Chi-square test through PROC FREQ in SAS with CHISQ option.

Before starting predictive analyses, making sure that are predictor variables have association with indicator variables. Predictive models that that is used to predict and

determine the relation among variables in this research is logistic regression. Dividing the variables based on the hypotheses of this research would make the design of this research easier.

So, the first hypothesis proposed that asthma as a chronic disease has statistically significant impact on HRQoL. Asthma has one categorical variable (ASTHNOW) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the predictive relation between ASTHNOW and each one of GENHLTH, QLACTLM2, PHYSHLTH, and MENTHLTH would be by using logistic regression through PROC LOGISTIC in SAS.

The second hypothesis proposed that there is a significant relation between several behavioral activities that adult patients practice and HRQoL. Behavioral factors have six categorical variables (_RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the predictive relation between each one of _RFSMOK3, EXERANY2, SMOKDAY2, LASTSMK2, CHECKUP1, and AVEDRNK2 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using would be by using logistic regression through PROC LOGISTIC in SAS.

The third hypothesis proposed that there is significant relation between several clinical factors and HRQoL. Clinical factors have five categorical variable _BMI5CAT, ADDEPEV2, DIABETE3, FLUSHOT6, and PNEUVAC3 while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the predictive relation between each one of _BMI5CAT, ADDEPEV2,

DIABETE3, FLUSHOT6, and PNEUVAC3 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using would be by using logistic regression through PROC LOGISTIC in SAS.

The fourth hypothesis proposed Differences of socioeconomic statuses (SES) factors between adult patients of asthma can result significantly in different HRQoL. Socioeconomic factors have four categorical variables (SCNTMEL1, INCOME2, EDUCA, and HLTHPLN1) while HRQoL has three categorical variables (QLACTLM2, PHYSHLTH, and MENTHLTH). Therefore, examining the predictive relation between each one of SCNTMEL1, INCOME2, EDUCA, and HLTHPLN1 and each one of QLACTLM2, PHYSHLTH, and MENTHLTH would be by using would be by using logistic regression through PROC LOGISTIC in SAS.

CHAPTER V

RESEARCH RESULTS

4.1 Introduction:

BRFSS 2014 data consists of 461,436 patients. 59,749 of these patients had been told that they had asthma (table 12) (figure 3). Have you ever told you had asthma variable (ASTHMA3) is a binary variable: Yes and No.

Table 12.
Distribution of adult patients that have been told they had asthma.

Had you ever told have asthma?	No.	Weighted %
Yes	59749	12.95
No	401687	87.05

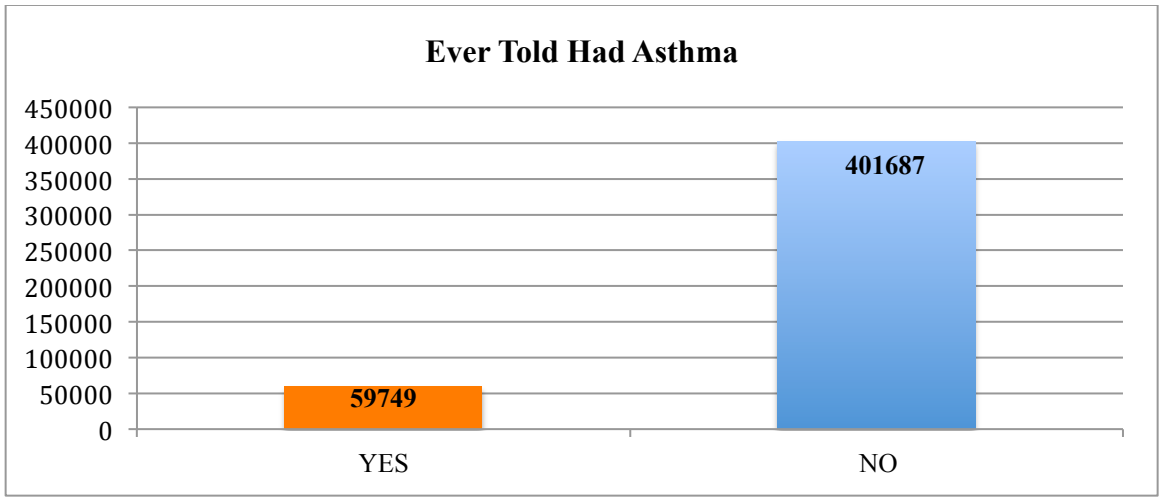


Figure 3. *Distribution of adult patients that have been told they had asthma.*

However, 42,875 of patients that have been told they had asthma still have asthma (table 13) (figure 4). Still have asthma variable is a binary variable: Yes and No.

Table 13.
Distribution of adult patients that still have asthma.

Do you still have asthma?	No.	Weighted %
Yes	42875	71.67
No	16874	28.24

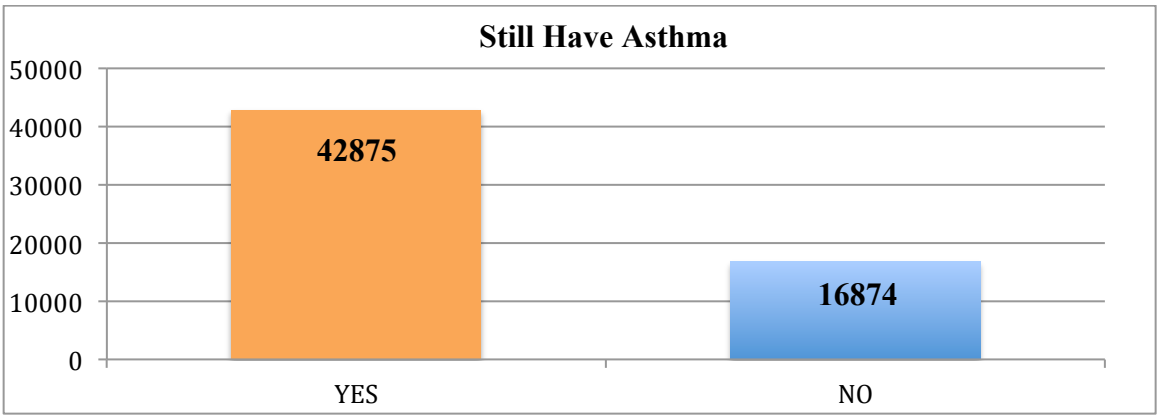


Figure 4. *Distribution of adult patients that still have asthma.*

According to the distribution of adult patients of asthma by sex, asthma in females (50.84%) is more prevalent than asthma in males (20.90%) (table 14) (figure 5). Sex variable is a binary variable: Male and Female.

Table 14.
Distribution of adult patients of asthma by sex.

SEX	Do You Still Have Asthma?		
	Yes	No	Total
	No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Male	11739 (20.90)	6681 (11.90)	18420 (32.80)
Female	28550 (50.84)	9189 (16.36)	37739 (67.20)
Total	40289 (71.74)	15870 (28.26)	56159 (100.00)

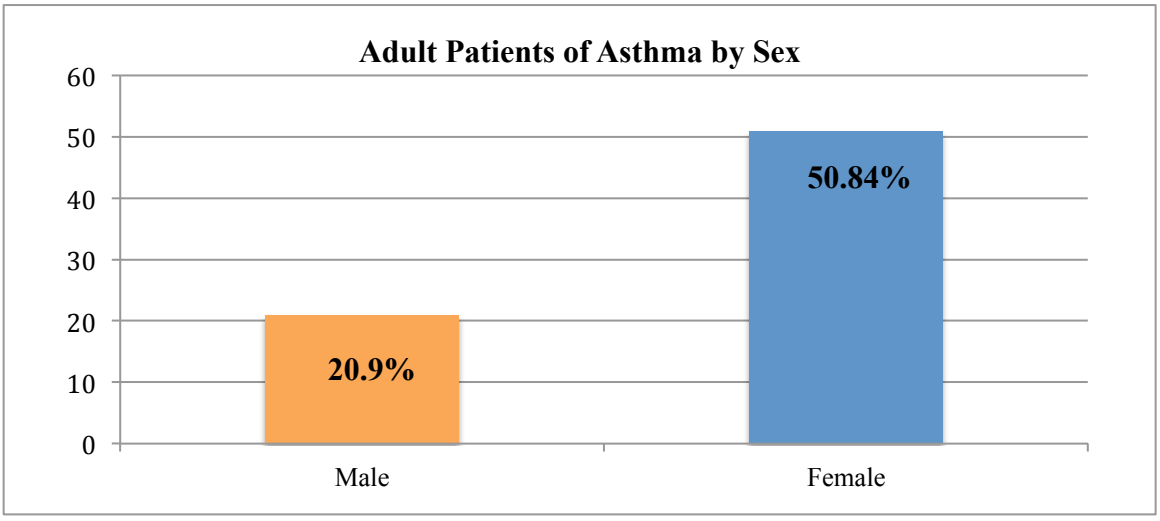


Figure 5. *Distribution of adult patients of asthma by sex.*

Also, sex-adjusted distribution for adult patients of asthma 2011-2013 shows that asthma in females is more prevalent than asthma in males (table 15) (figure 6).

Table 15.
Sex-adjusted distribution for adult patients of asthma (2011-2013).

SEX	Do You Still Have Asthma?		
	YES	NO	Total
	No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Male	37319 (20.19)	22269 (12.14)	59588 (32.33)
Female	94720 (51.23)	30973 (16.55)	125693 (67.78)
Total	132039 (71.42)	53242 (28.69)	185281 (100.00)

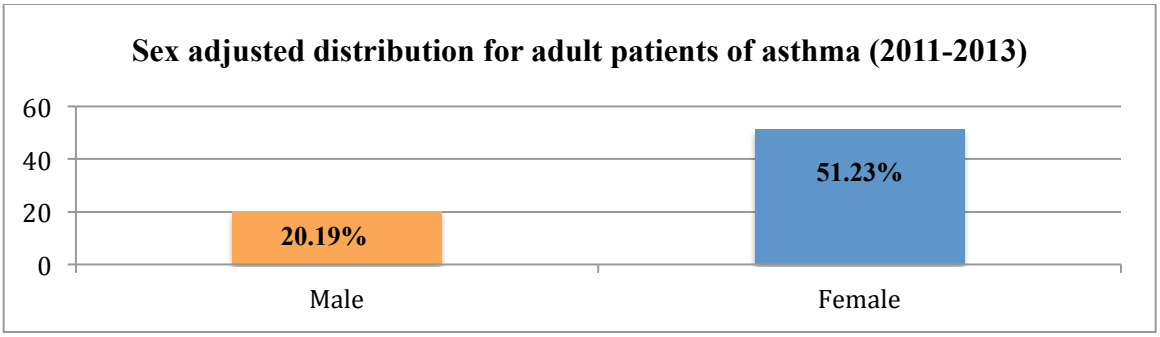


Figure 6. *Sex-adjusted distribution for adult patients of asthma (2011-2013).*

According to the distribution of adult patients of asthma by race (_RACE), asthma is more prevalent in white non-Hispanic patients (54.76%) than other race groups (table 16) (figure 7). Race variable is a categorical variable consists of eight race groups: White non-Hispanic, Black non-Hispanic, American Indian or Alaskan Native Non-Hispanic, Asian non-Hispanic, Native Hawaiian or other Pacific Islander Non-Hispanic, Other race non-Hispanic, Multiracial non-Hispanic, and Hispanic.

Table 16.
Distribution of adult patients of asthma by race.

Race	Do You Still Have Asthma?		
	Yes	No	Total
	No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
White non-Hispanic	30744 (54.76)	11758 (20.94)	42502 (75.70)
Black non-Hispanic	3691 (6.75)	1301 (2.32)	4992 (8.89)
American Indian or Alaskan Native Non-Hispanic	937 (1.67)	280 (0.50)	1217 (2.17)
Asian non-Hispanic	453 (0.81)	323 (0.58)	776 (1.38)
Native Hawaiian or other Pacific Islander Non-Hispanic	125 (0.22)	96 (0.17)	221 (0.39)
Other race non-Hispanic	184 (0.33)	69 (0.12)	253 (0.45)
Multiracial non-Hispanic	1253 (2.23)	496 (0.88)	1749 (3.12)
Hispanic	2892 (5.15)	1545 (2.75)	4437 (7.90)
Total	40279 (71.74)	15686 (28.26)	56147 (100.00)

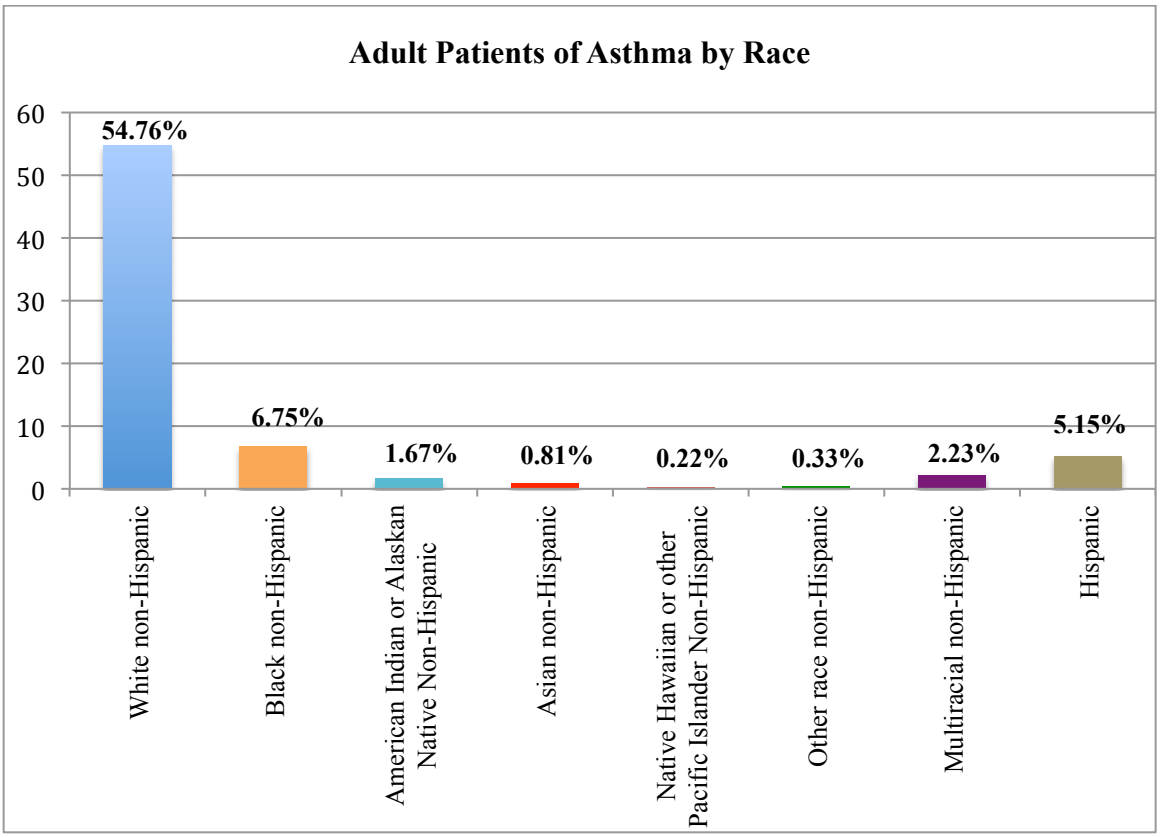


Figure 7. *Distribution of adult patients of asthma by race.*

Also, race-adjusted distribution for adult patients of asthma 2011-2013 shows that asthma is more prevalent in White non-Hispanic more than other race groups (table 17) (figure 8).

Table 17.

Race-adjusted distribution for adult patients of asthma (2011-2013).

Race	Do You Still Have Asthma?		
	YES	NO	Total
	No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
White non-Hispanic	98726 (53.63)	38945 (21.1)	137671 (74.73)
Black non-Hispanic	13183 (7.17)	4443 (2.41)	17626 (9.58)
American Indian or Alaskan Native Non-Hispanic	1930 (1.04)	1003 (0.54)	2933 (1.58)
Asian non-Hispanic	792 (0.42)	560 (0.29)	1352 (0.71)
Native Hawaiian or other Pacific Islander Non-Hispanic	1895 (1.04)	643 (0.35)	2538 (1.39)
Other race non-Hispanic	909 (0.49)	328 (0.18)	1237 (0.67)
Multiracial non-Hispanic	4177 (2.27)	1686 (0.91)	5863 (3.18)
Hispanic	9828 (5.34)	5136 (2.78)	14964 (8.12)
Total	131440 (71.4)	52744 (28.56)	184184 (100.00)

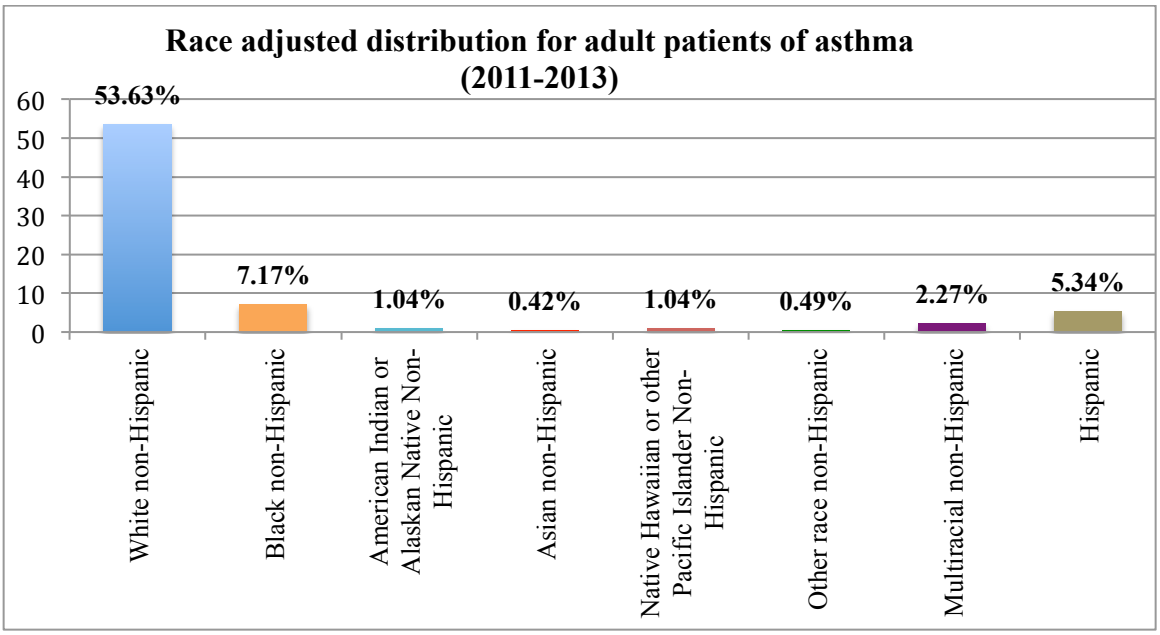


Figure 8. *Race-adjusted distribution for adult patients of asthma (2011-2013).*

According to the distribution of adult patients of asthma by age (_AGEG5YR), asthma is more prevalent in age 60 to 64 (8.78 %) more than other age groups (table 18) (figure 9). Age variable is a categorical variable consists of thirteen age groups including: age 18 to 24, age 25 to 29, age 30 to 34, age 35 to 39, age 40 to 44, age 45 to 49, age 50 to 54, age 55 to 59, age 60 to 64, age 65 to 69, age 70 to 74, age 75 to 79, and age + 80.

Table 18.
Distribution of adult patients of asthma by age.

Age	Do You Still Have Asthma?					
	Yes		No		Total	
	No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Age 18 to 24	2306	(4.11)	1600	(2.85)	3906	(6.96)
Age 25 to 29	1740	(3.10)	1174	(2.09)	2914	(5.19)
Age 30 to 34	1953	(3.48)	1198	(2.13)	3151	(5.61)
Age 35 to 39	2257	(4.02)	1071	(1.91)	3328	(5.93)
Age 40 to 44	2593	(4.62)	1013	(1.80)	3606	(6.42)
Age 45 to 49	3065	(5.46)	1034	(1.84)	4099	(7.30)
Age 50 to 54	4103	(7.31)	1362	(2.43)	5465	(9.73)
Age 55 to 59	4664	(8.30)	1525	(2.72)	6189	(11.02)
Age 60 to 64	4933	(8.78)	1618	(2.88)	6551	(11.67)
Age 65 to 69	4497	(8.01)	1512	(2.69)	6009	(10.70)
Age 70 to 74	3414	(6.08)	1134	(2.02)	4548	(8.10)
Age 75 to 79	2300	(4.10)	748	(1.33)	3048	(5.43)
Age 80 or older	2464	(4.39)	881	(1.57)	3345	(5.96)
Total	40289	(71.74)	15870	(28.26)	56159	(100.00)

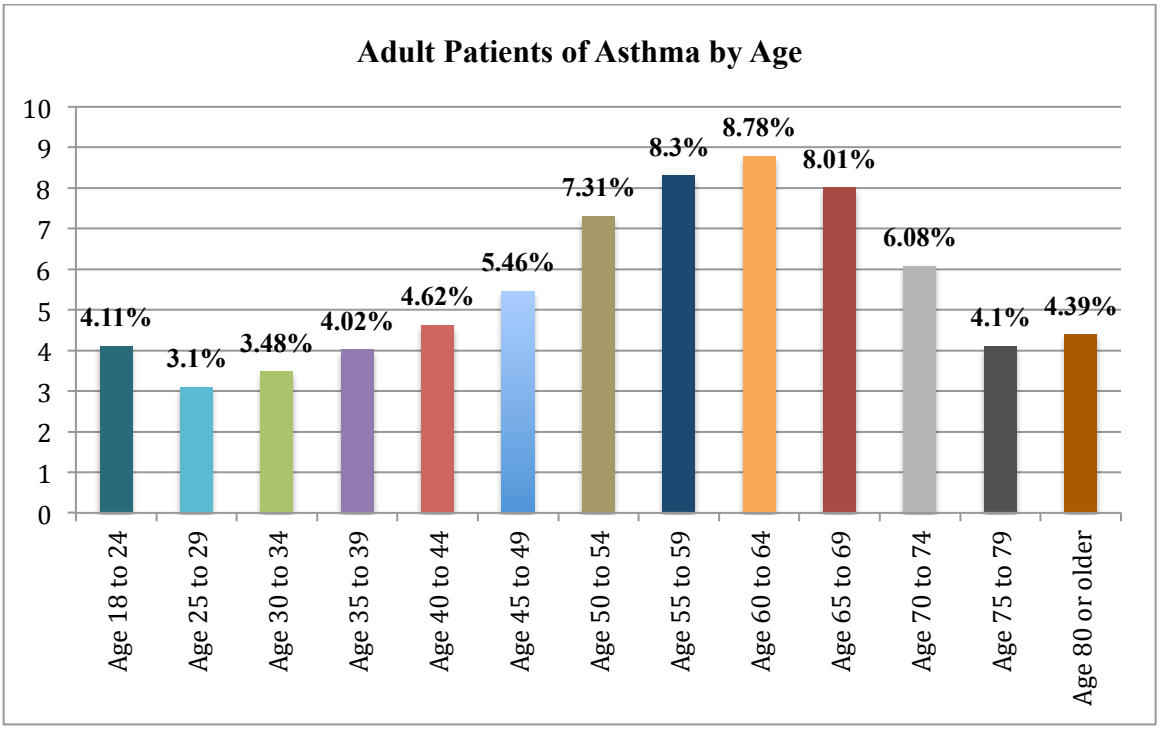


Figure 9. *Distribution of adult patients of asthma by age.*

Also, age-adjusted distribution for adult patients of asthma 2011-2013 shows that asthma is more prevalent in age 60 to 64 more than other age groups (table 19) (figure 10).

Table 19.
Age-adjusted distribution for adult patients of asthma (2011-2013).

Age	Do You Still Have Asthma?					
	YES		NO		Total	
	No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Age 18 to 24	7571	(4.1)	5547	(3.00)	13118	(7.1)
Age 25 to 29	5865	(3.18)	3865	(2.09)	9730	(5.27)
Age 30 to 34	7078	(3.83)	4087	(2.21)	11165	(6.04)
Age 35 to 39	7723	(4.18)	3620	(1.95)	11343	(6.13)
Age 40 to 44	9178	(4.97)	3472	(1.87)	12650	(6.84)
Age 45 to 49	10855	(5.88)	3688	(4.76)	14543	(10.64)
Age 50 to 54	13842	(7.50)	4700	(2.54)	18542	(10.04)
Age 55 to 59	15401	(8.35)	5161	(2.79)	20562	(11.14)
Age 60 to 64	15505	(8.41)	5411	(3.92)	20916	(12.33)
Age 65 to 69	13420	(7.27)	4557	(2.46)	17977	(9.73)
Age 70 to 74	10128	(5.48)	3267	(1.76)	13395	(7.24)
Age 75 to 79	7192	(3.9)	2397	(1.29)	9589	(5.19)
Age 80 or older	7976	(4.32)	3057	(1.65)	11033	(5.97)
Total	131734	(70.07)	52829	(29.03)	184563	(100.00)

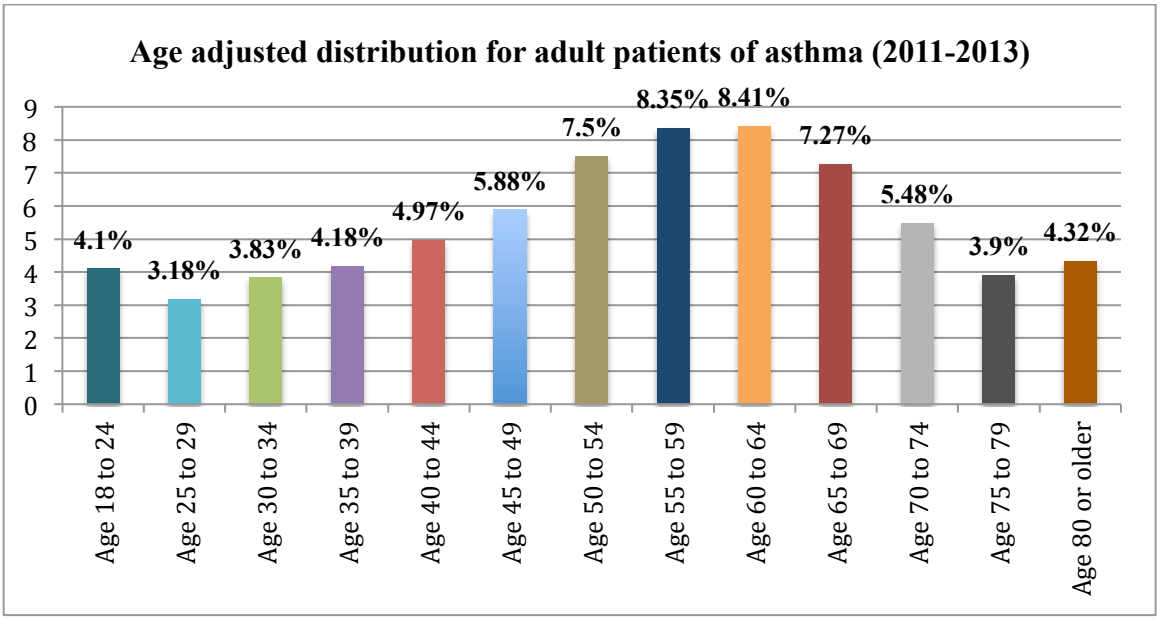


Figure 10. *Age-adjusted distribution for adult patients of asthma (2011-2013).*

4.2 Descriptive Analysis:

There are different descriptive analysis methods that can be used to describe different variables. However, in this research, frequency distributions would be the best method to describe the variables because all the variables in this research are categorical variables.

4.2.1 Descriptive Analysis of Indicator Variables:

Indicator variables, which are HRQoL variables in current adult patient of asthma (ASTHNOW) including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH).

QLACTLM2 indicator variable in HRQoL refers to activity limitations. It is a binary variable: YES and NO. In adult patients of asthma, percentage of having activity limitations (32.74%) is more than percentage of activity limitations (8.01%) in patients with no asthma (table 20) (figure 11).

Table 20.
Distribution of adult patients of asthma by activity limitations.

Indicator variables of health related quality of life (HRQoL)		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Activity limitations	Yes	14226 (32.74)	3481 (8.01)	17707 (40.75)
	No	17391 (40.03)	8352 (19.22)	25743 (59.25)

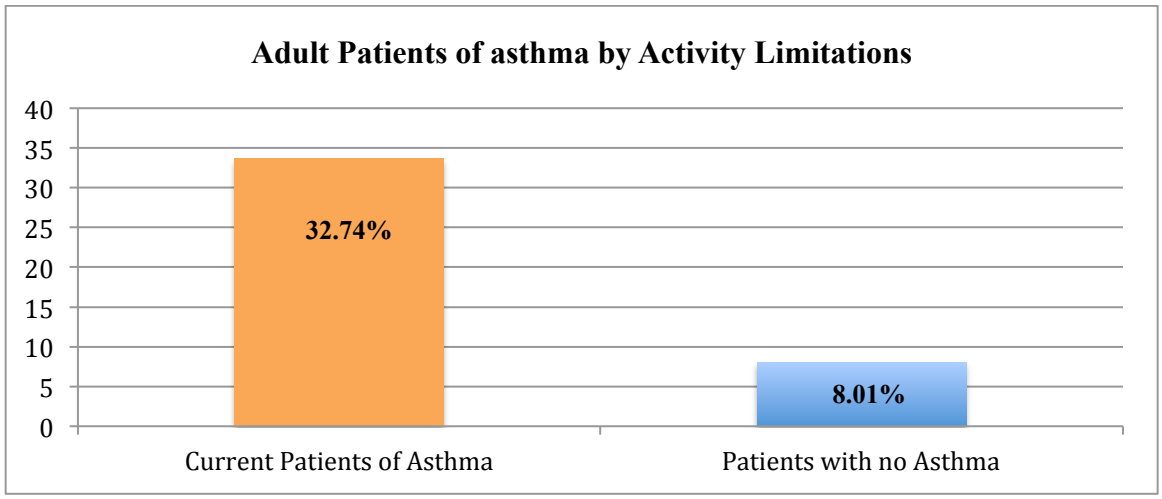


Figure 11. *Distribution of adult patients of asthma by activity limitations.*

PHYSHLTH indicator variable in HRQoL refers to numbers of days during the past 30 days that physical health is not good. It a categorical variable 1-30= 30 days each day represents one category and 88=None. In adult patients of asthma, percentage of physical health is not good during some or all past 30 days (41.62%) is more than percentage of physical health is not good during some or all past 30 days for patients with no asthma (11.62 %) (table 21) (figure 12).

Table 21.
Distribution of adult patients of asthma by physical health problems.

Indicator variables of health related quality of life (HRQoL)		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Physical health problems	Some or all	17470 (41.62)	4878 (11.62)	22348 (53.24)
	None	13007 (30.99)	6620 (15.77)	19627 (46.76)

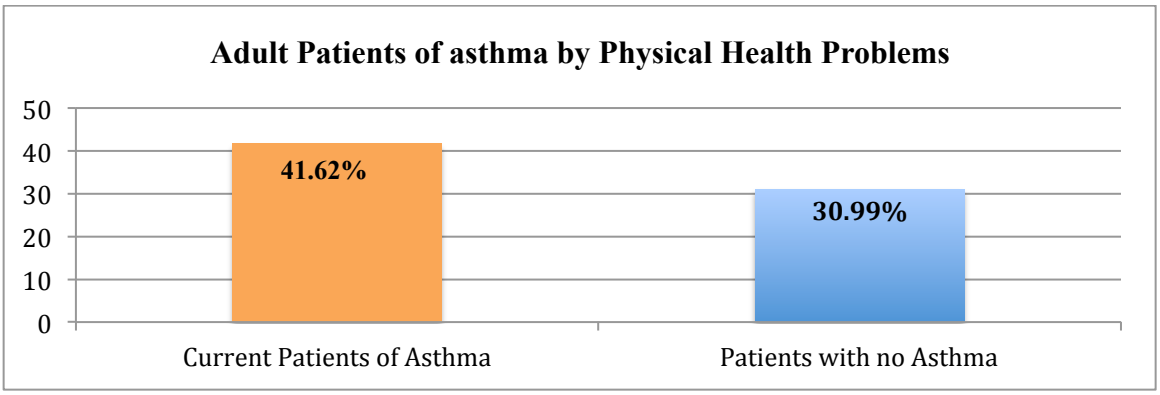


Figure 12. *Distribution of adult patients of asthma by physical health problems.*

MENTHLTH indicator variable in HRQoL refers to numbers of days during the past 30 days that mental health is not good. It is a categorical variable: 1-30= 30 days each day represents one category and 88=None. In adult patients of asthma, percentage of mental health is not good during some or all past 30 days (32.58%) is more than percentage of mental health is not good during some or all past 30 days for patients with no asthma (10.59%) (table 22) (figure 13).

Table 22.

Distribution of adult patients of asthma by mental health problems.

Indicator variables of health related quality of life (HRQoL)		Do you still have asthma?					
Variable	Category	YES		NO		Total	
		No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Mental health problems	Some or all	13675	(32.58)	4447	(10.59)	18104	(43.17)
	None	16803	(40.03)	7051	(16.80)	23854	(56.83)

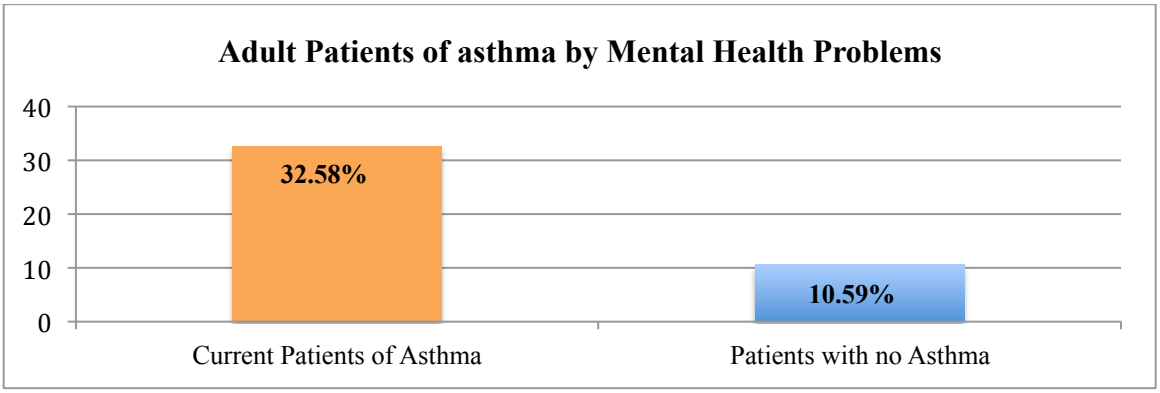


Figure 13. *Distribution of adult patients of asthma by mental health problems.*

4.2.2 Descriptive Analysis of Behavioral Predictor Variables:

_RFSMOK3 is a behavioral predictor variable refers to current smoking. It is a binary variable: Yes and No. In adult patients of asthma, percentage of smokers (57.93%) is more than percentage of smokers (23.70%) with no asthma (table 23) (figure 14).

Table 23.
Distribution of adult patients of asthma by current smoking status.

Predictor variables of behavioral factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Current smoking status	Yes	32531 (57.93)	13307 (23.70)	45838 (81.62)
	No	7758 (13.81)	2563 (4.56)	10321 (18.36)

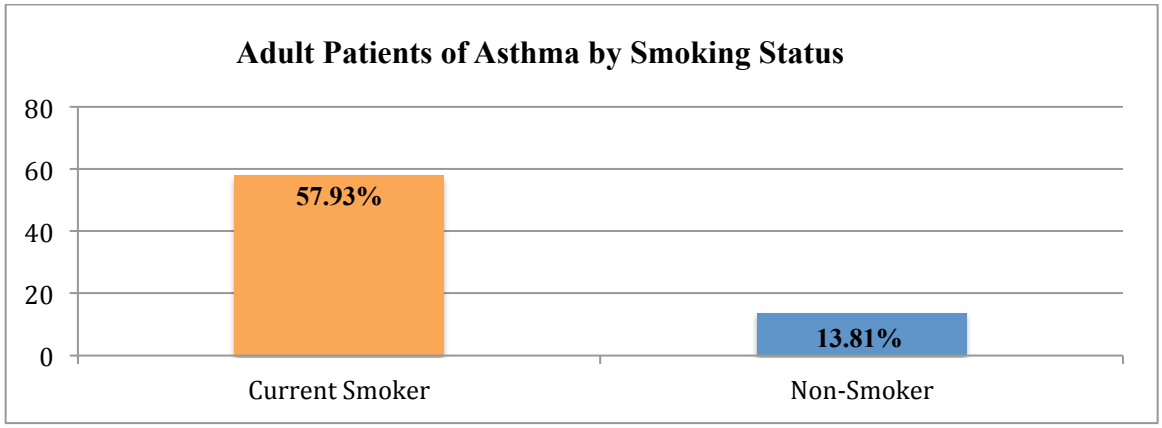


Figure 14. *Distribution of adult patients of asthma by current smoking status.*

SMOKDAY2 is a behavioral predictor variable refers to frequency of smoking. It is a categorical variable that consists of three categories including: every day, some days, or not at all. In adult patients of asthma, percentage of patients smoke every day (20.26%) is more than percentage of patients smoke some days (8.45%) (table 24) (figure 15).

Table 24.
Distribution of adult patients of asthma by frequency of days now smoking.

Predictor variables of behavioral factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Frequency of smoking	Every day	5474 (20.26)	1755 (6.49)	7229 (26.75)
	Some days	2284 (8.45)	808 (2.99)	3092 (11.44)
	Not at all	12181 (45.08)	4521 (16.73)	16702 (61.81)

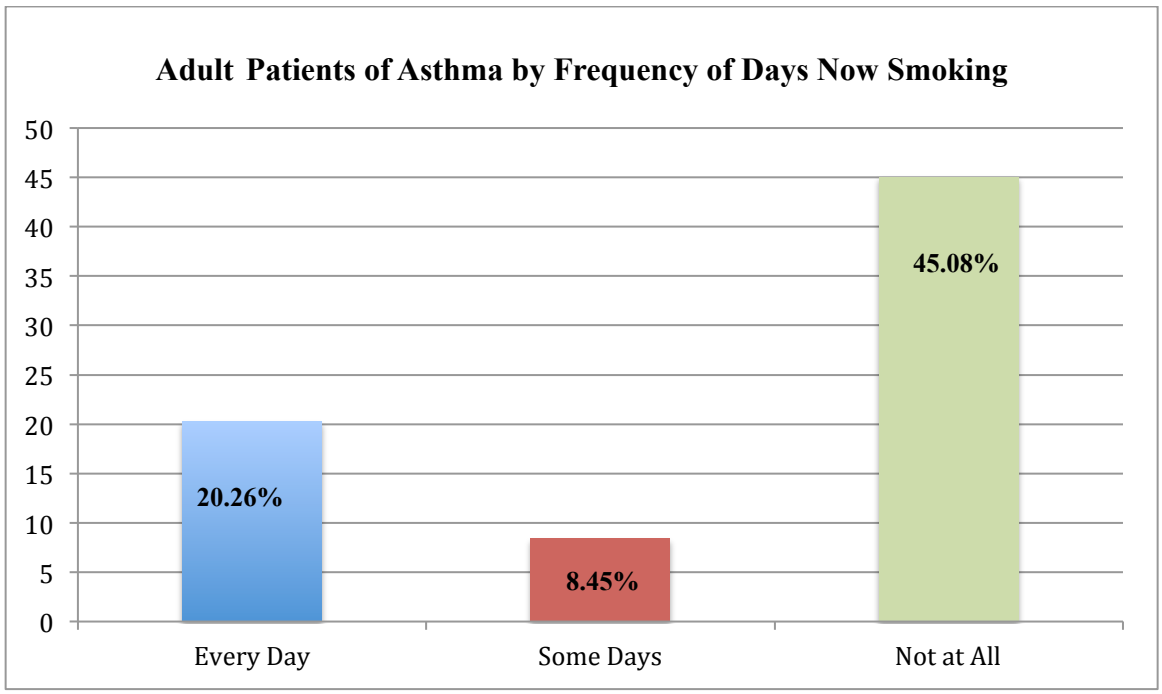


Figure 15. *Distribution of adult patients of asthma by frequency of days now smoking.*

LASTSMK2 is a behavioral predictor variable refers to last smoked. It is a categorical variable that consists of eight categories including: within a month, within 3 months, within 6 months, within a year, within 5 years, within 10 years, within more than 10 years, and Never. In adult patients of asthma, percentage of patients quitted smoking in a month (1.77%) is more than percentage of patients quitted smoking in a month in patients with no asthma (0.83%) (table 25) (figure 16).

Table 25.
Distribution of adult patients of asthma by last smoked.

Predictor variables of behavioral factors		Do you still have asthma?					
Variable	Category	YES		NO		Total	
		No. (Weighted %)		No. (Weighted %)		No. (Weighted %)	
Last smoked	In a month	288	(1.77)	136	(0.83)	424	(2.60)
	In 3 months	230	(1.41)	114	(0.70)	344	(2.11)
	In 6 months	294	(1.80)	113	(0.69)	407	(2.49)
	In a year	436	(2.67)	186	(1.14)	622	(3.81)
	In 5 years	1584	(9.71)	605	(3.71)	2189	(13.42)
	In 10 years	1309	(8.02)	463	(2.84)	1772	(10.86)
	In +10 years	7682	(47.08)	2787	(17.08)	10469	(64.16)
	Never	69	(0.42)	21	(0.13)	90	(0.55)

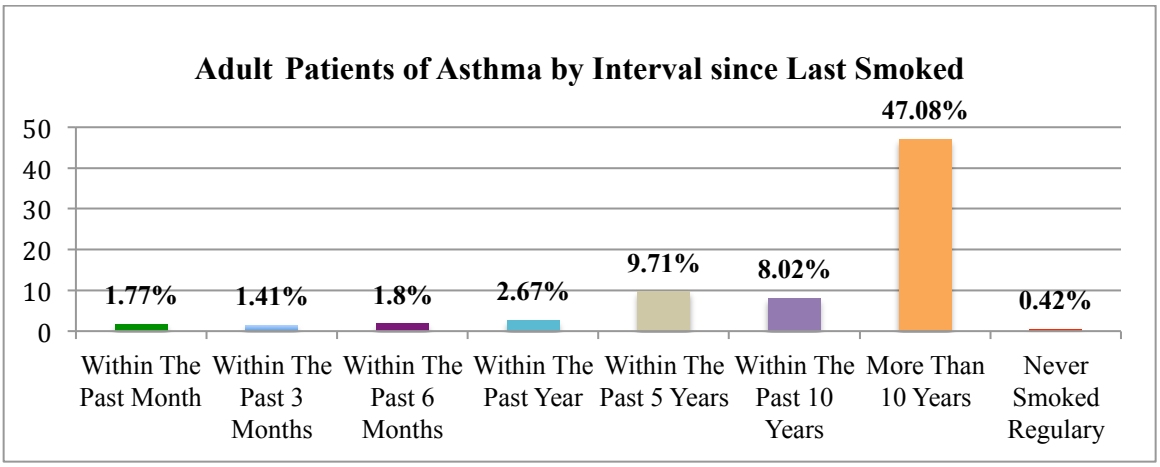


Figure 16. *Distribution of adult patients of asthma by last smoked.*

EXERANY2 is a behavioral predictor variable refers to exercise. It is a binary variable: Yes and No. In adult patients of asthma, percentage of patients exercise (48.69%) is more than percentage of patients exercise (23.02%) in patients with no asthma (table 26) (figure 17).

Table 26.
Distribution of adult patients of asthma by exercise.

Predictor variables of behavioral factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Exercise	Yes	26847 (48.69)	12096 (21.94)	38943 (70.62)
	No	12695 (23.02)	3503 (6.35)	16198 (29.38)

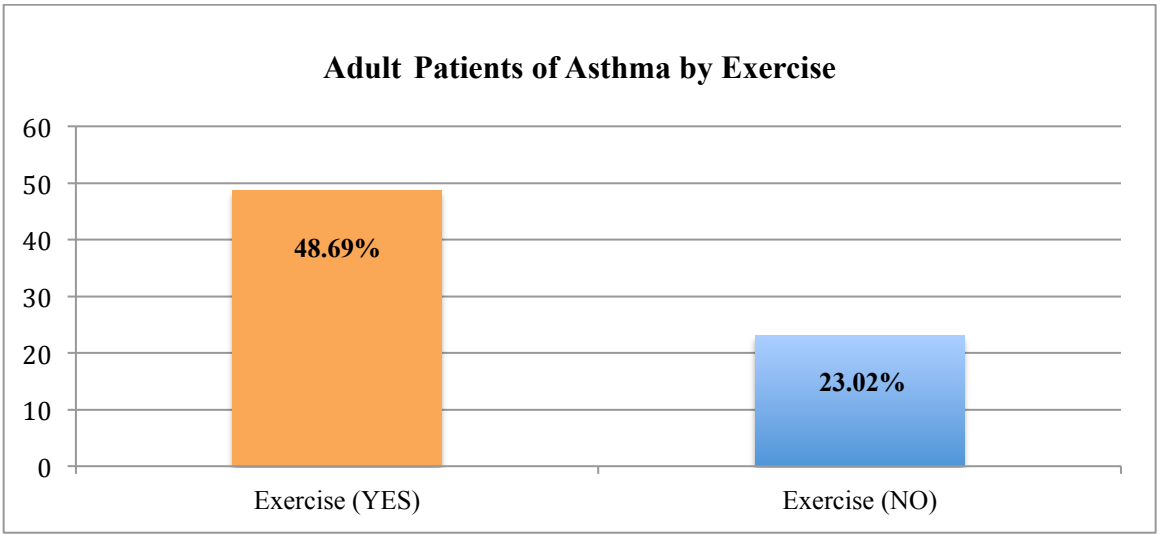


Figure 17. *Distribution of adult patients of asthma by exercise.*

CHECKUP1 is a behavioral predictor variable refers to health routine checkup. It is a categorical variable that consists of five categories including: within year, within 2 years, within 5 years, within more than 5 years, and Never. In adult patients of asthma, percentage of patients had health routine checkup within a year (56.37%) is more than percentage of patients had health routine checkup within a year in patients with no asthma (19.95%) (table 27) (figure 18).

Table 27.
Distribution of adult patients of asthma by health routine checkup.

Predictor variables of behavioral factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Health routine checkup	In year	31082 (56.37)	10999 (19.95)	42081 (76.32)
	In 2 years	4123 (7.48)	2135 (3.87)	6258 (11.35)
	In 5 years	2190 (3.97)	1235 (2.24)	3425 (6.21)
	In + 5 years	1927 (3.49)	1120 (2.03)	3047 (5.53)
	Never	219 (0.40)	110 (0.20)	329 (0.60)

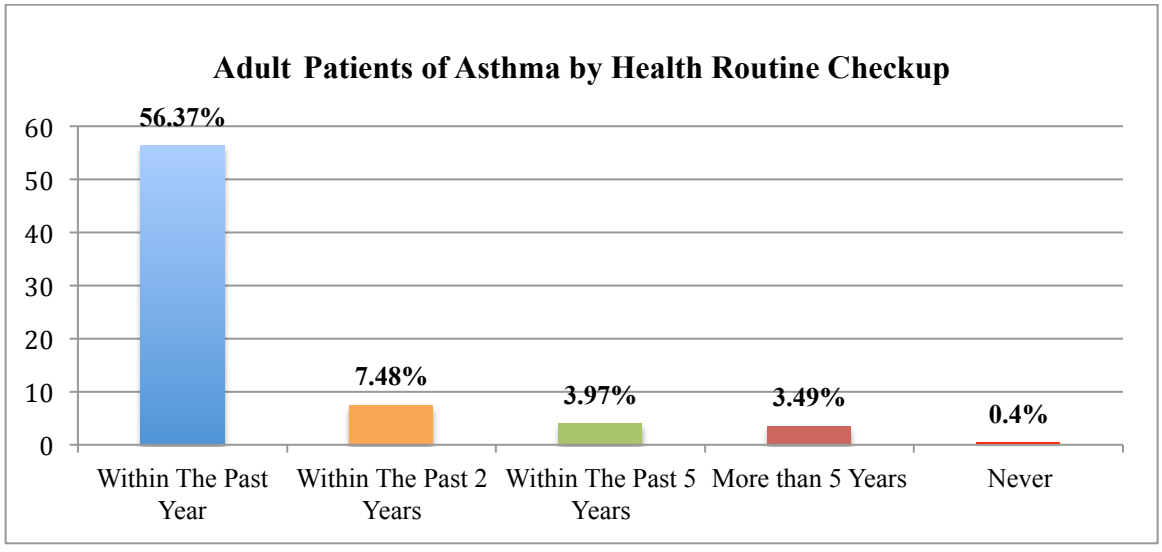


Figure 18. *Distribution of adult patients of asthma by health routine checkup.*

AVEDRNK2 is a behavioral predictor variable refers to alcohol use during the past 30 days. It is a categorical variable: 1 - 78 of alcohol glasses during past 30 days. In adult patients of asthma, percentage of alcohol use in some or all past 30 days (68.66%)

is more than percentage of alcohol use in some or all past 30 days in patients with no asthma (10.59%) (table 28) (figure 19).

Table 28.
Distribution of adult patients of asthma by alcohol use.

Predictor variables of behavioral factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Alcohol use	Some or all	13238 (68.66)	6043 (31.34)	19281 (100.00)

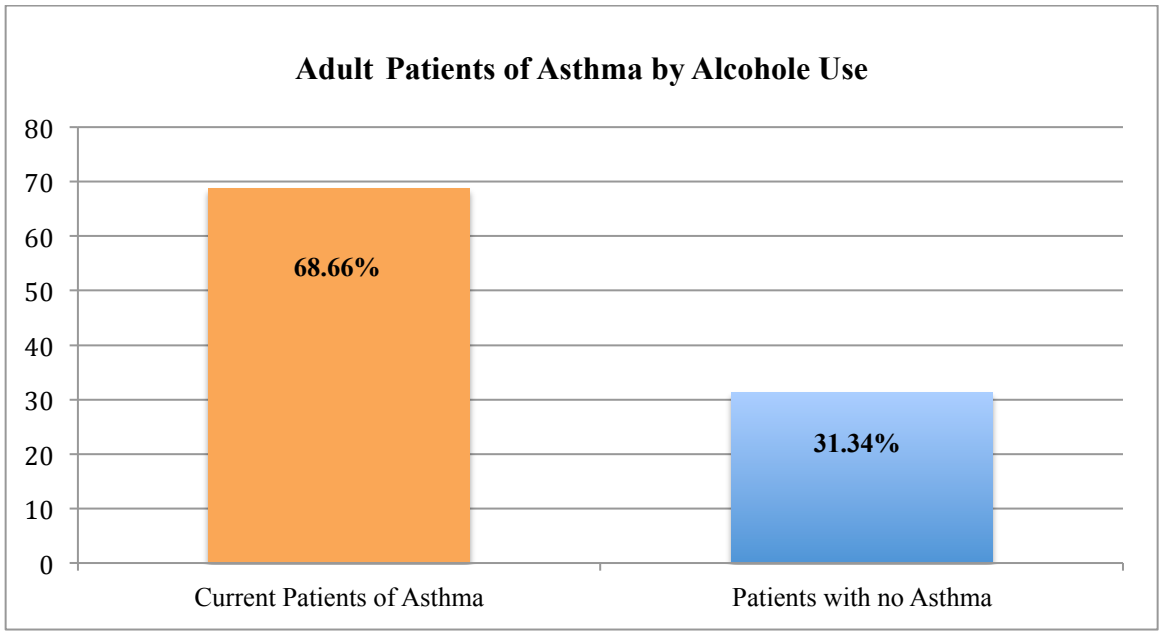


Figure 19. *Distribution of adult patients of asthma by alcohol use.*

4.2.3 Descriptive Analysis of Clinical Predictor Variables:

Clinical predictor variables of current adult patient of asthma include depressive disorder (ADDEPEV2), body mass index (BMI) (_BMI5CAT), diabetes (DIABETE3), influenza vaccine (FLUSHOT6), and pneumonia vaccine (PNEUVAC3).

ADDEPEV2 is a clinical predictor variable refers to depressive disorder. It is a binary variable: Yes and No. In adult patients of asthma, percentage of having depressive disorder (25.68%) is more than percentage of having depressive disorder (7.78%) in patients with no asthma (table 29) (figure 20).

Table 29.
Distribution of adult patients of asthma by having a depressive disorder.

Predictor variables of clinical factors		Do you still have asthma?					
Variable	Category	YES		NO		Total	
		No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Depressive disorder	Yes	14095	(25.68)	4270	(7.78)	18365	(33.46)
	No	25257	(46.02)	11261	(20.52)	35618	(66.54)

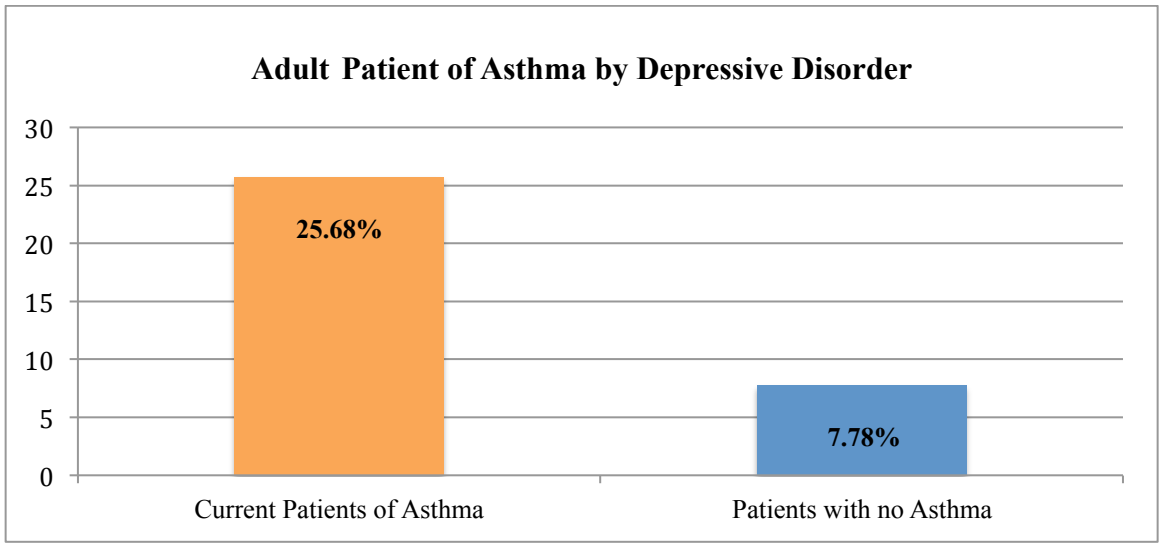


Figure 20. *Distribution of adult patients of asthma by having a depressive disorder.*

_BMI5CAT is a clinical predictor variable refers to body mass index (BMI). It is a categorical variable that consists of four categories including: Underweight, Normal weight, Overweight, and Obese. In adult patients of asthma, percentage of obesity (30.85%) is more than percentage of obesity (9.41%) in patients with no asthma (table 30) (figure 21).

Table 30.
Distribution of adult patients of asthma by body mass index (BMI).

Predictor variables of clinical factors		Do you still have asthma?					
Variable	Category	YES		NO		Total	
		No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Body Mass Index (BMI)	Underweight	583	(1.22)	207	(0.43)	790	(1.65)
	Normal weight	8565	(17.92)	3948	(8.26)	12513	(26.17)
	Overweight	10795	(22.58)	4461	(9.33)	15256	(31.91)
	Obese	14749	(30.85)	4499	(9.41)	18248	(40.26)

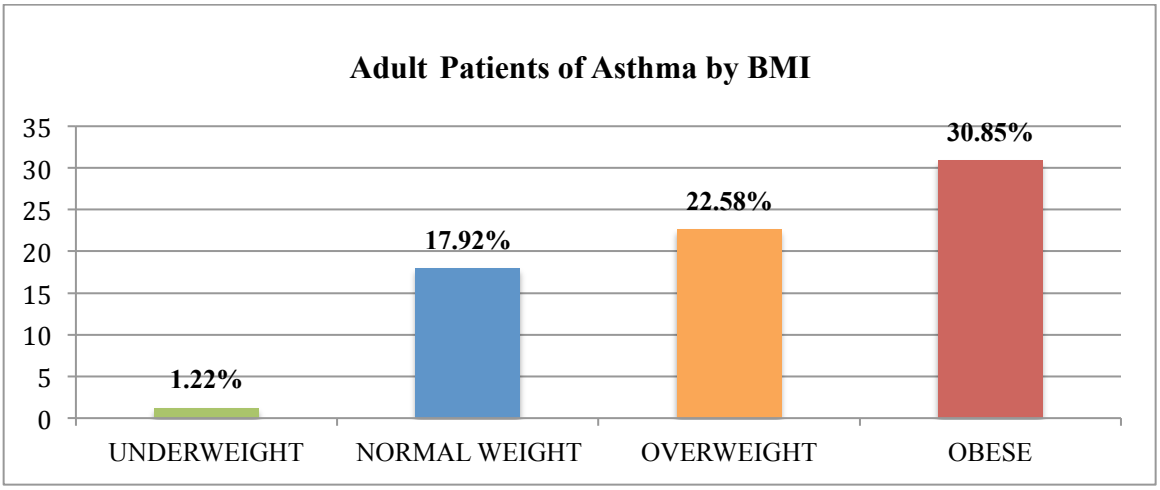


Figure 21. *Distribution of adult patients of asthma by body mass index (BMI).*

DIABETE3 is a clinical predictor variable refers to diabetes. It is a binary variable: Yes and No. In adult patients of asthma, percentage of having diabetes (14.70%) is more than percentage of having diabetes (4.10%) in patients with no asthma (table 31) (figure 22).

Table 31.
Distribution of adult patients of asthma by having diabetes.

Predictor variables of clinical factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Diabetes	Yes	7392 (14.70)	2063 (4.10)	9455 (18.80)
	No	27963 (55.61)	11230 (22.33)	39193 (77.94)

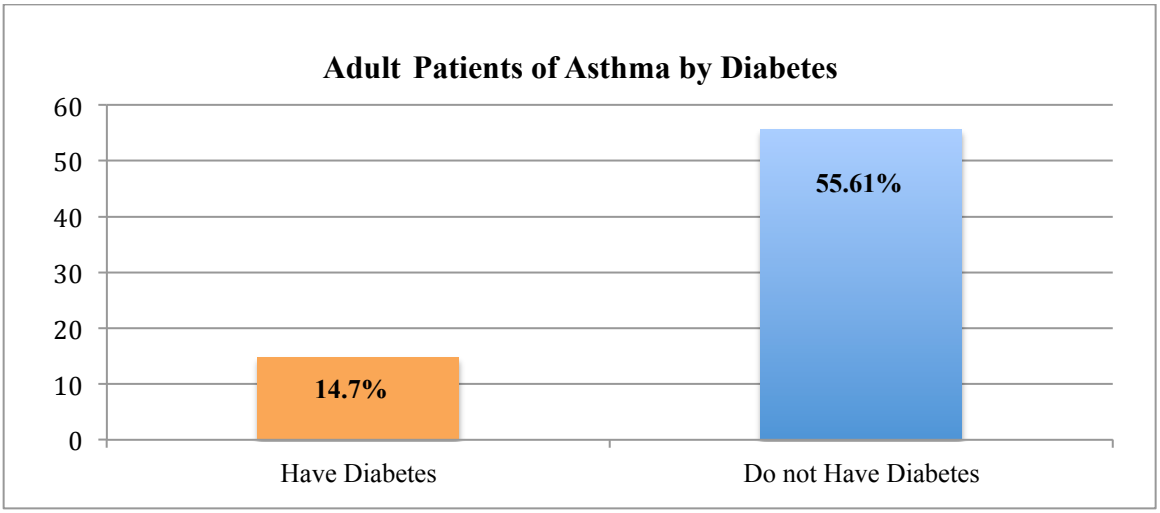


Figure 22. *Distribution of adult patients of asthma by having diabetes.*

FLUSHOT6 is a clinical predictor variable refers to influenza vaccine. It is a binary variable: Yes and No. In adult patients of asthma, percentage of patients had influenza vaccine (39.02%) is more than percentage patients had influenza vaccine (12.41%) in patients with no asthma (table 32) (figure 23).

Table 32.
Distribution of adult patients of asthma by having influenza vaccine.

Predictor variables of clinical factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Influenza	Yes	19449 (39.02)	6184 (12.41)	25633 (51.43)
Vaccine	No	16793 (33.69)	7416 (14.88)	24209 (48.57)

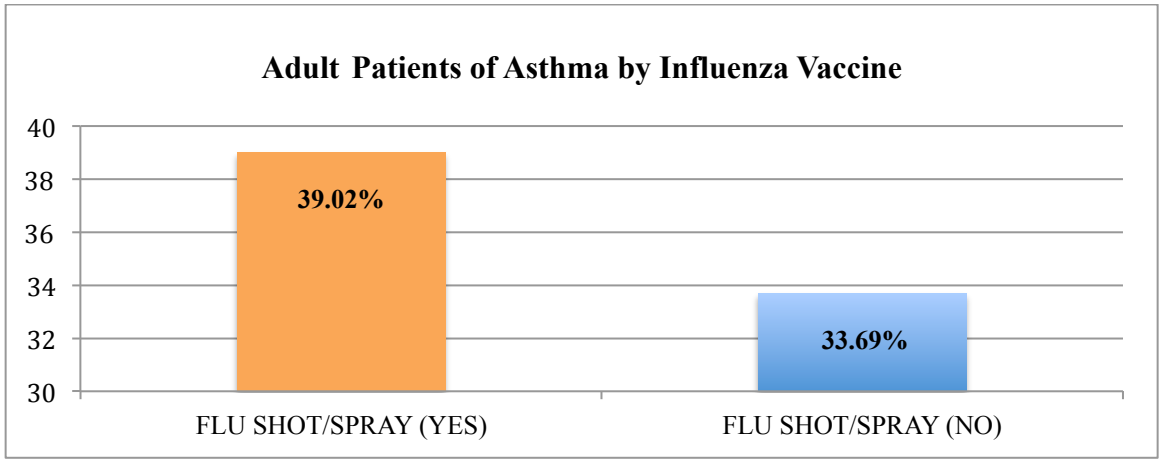


Figure 23. *Distribution of adult patients of asthma by having influenza vaccine.*

PNEUVAC3 is a clinical predictor variable refers to pneumonia vaccine. It is a binary variable: Yes and No. In adult patients of asthma, percentage of patients had pneumonia vaccine (41.81%) is more than percentage patients had pneumonia vaccine (11.65%) in patients with no asthma (table 33) (figure 24).

Table 33.
Distribution of adult patients of asthma by having pneumonia vaccine.

Predictor variables of clinical factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Pneumonia	Yes	20794 (41.81)	5796 (11.65)	26590 (53.46)
Vaccine	No	15373 (30.91)	7777 (15.64)	23150 (46.54)

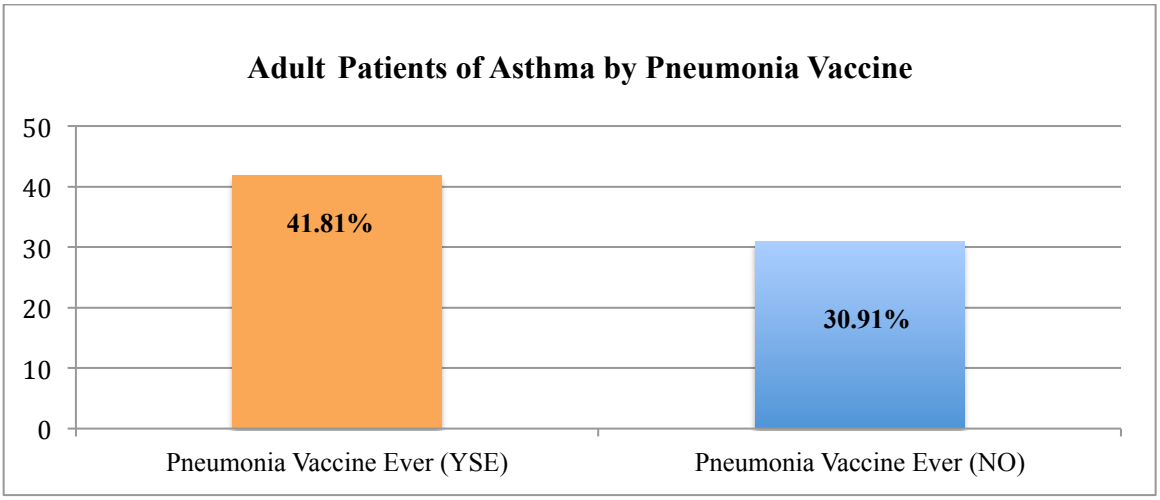


Figure 24. *Distribution of adult patients of asthma by having pneumonia vaccine.*

4.2.4 Descriptive Analysis of Socioeconomic Predictor Variables:

Socioeconomic predictor variables of current adult patient of asthma include stress (SCNTMEL1), income level (INCOME2), health coverage (HLTHPLN1), and education level (EDUCA).

SCNTMEL1 is a socioeconomic predictor variable refers to stressed about having enough money for nutrition. It is a categorical variable that consists of five categories including: always, usually, sometimes, rarely, and never. In adult patients of asthma, percentage of always stressed about having enough money for nutrition (11.09%) is more than percentage of rarely stressed about having enough money for nutrition (7.20%) (table 34) (figure 25).

Table 34.
Distribution of adult patients of asthma by having stress.

Predictor variables of socioeconomic factors		Do you still have asthma?					
Variable	Category	YES		NO		Total	
		No.	(Weighted %)	No.	(Weighted %)	No.	(Weighted %)
Stress	Always	191	(11.09)	26	(1.51)	217	(12.60)
	Usually	67	(3.89)	20	(1.16)	87	(5.05)
	Sometimes	215	(12.49)	66	(3.83)	281	(16.32)
	Rarely	124	(7.20)	54	(3.14)	178	(10.34)
	Never	650	(37.75)	309	(17.94)	959	(55.69)

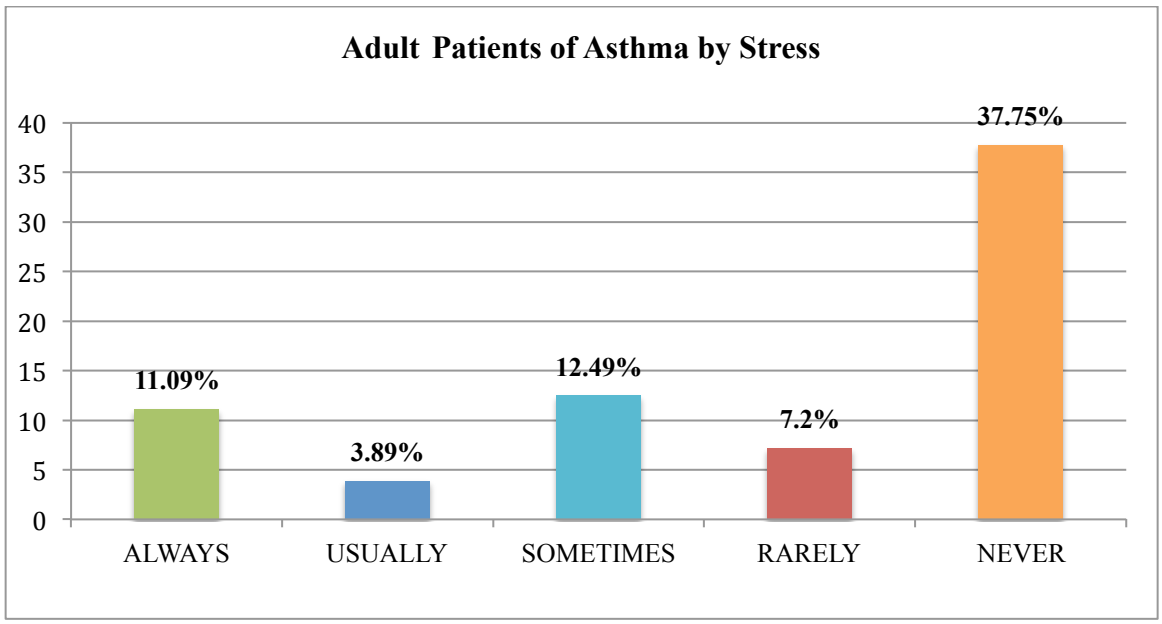


Figure 25. *Distribution of adult patients of asthma by having stress.*

INCOME2 is a socioeconomic predictor variable refers to income level. It is a categorical variable that consists of eight categories including: $1-$9,999, $10,000-$14,999, $15,000-$19,999, $20,000-$24,999, $25,000-$34,999, $35,000-$49,999, $50,000-$74,999, $75,000 and more. In adult patients of asthma with lowest income level, percentage of asthma prevalence (7.03%) is more than in adult patients with asthma in the same lowest income level (1.65%) (table 35) (figure 26).

Table 35.
Distribution of adult patients of asthma by income level.

Predictor variables of socioeconomic factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Income level	$1-$9,999	3096 (7.03)	725 (1.65)	3821 (8.68)
	$10,000-$14,999	3041 (6.91)	771 (1.75)	3812 (8.66)
	$15,000-$19,999	3342 (7.59)	919 (2.09)	4261 (9.68)
	$20,000-$24,999	3425 (7.78)	1152 (2.62)	4577 (10.40)
	$25,000-$34,999	3511 (7.98)	1305 (2.96)	4816 (10.94)
	$35,000-$49,999	4190 (9.52)	1778 (4.04)	5968 (13.56)
	$50,000-$74,999	4164 (9.46)	1868 (4.24)	6032 (13.70)
	+ $75,000	7288 (16.56)	3444 (7.82)	10732 (24.38)

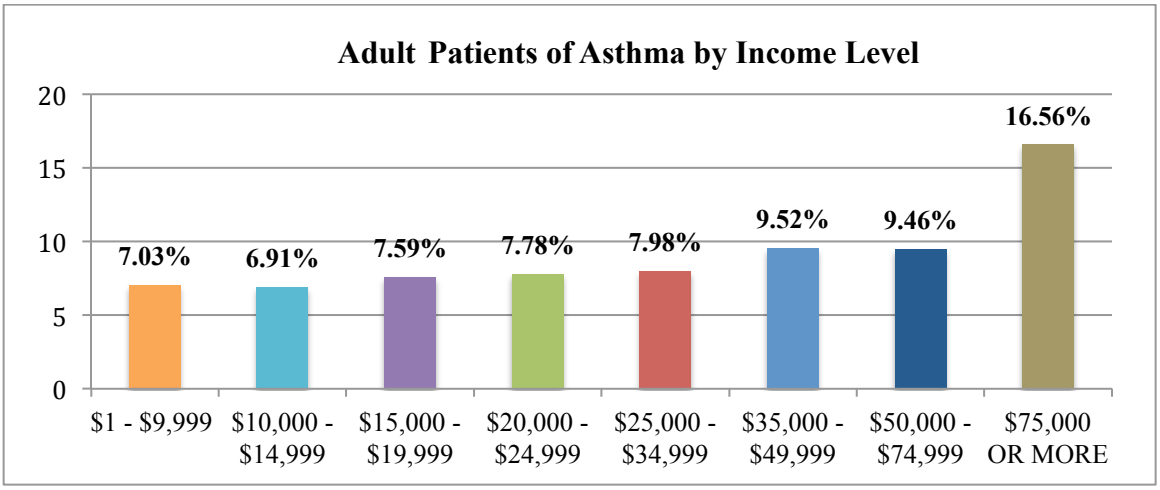


Figure 26. *Distribution of adult patients of asthma by income level.*

HLTHPLN1 is a socioeconomic predictor variable refers to having health care coverage. It is a binary variable: Yes and No. In adult patients of asthma, percentage of patients have health care coverage (67.68%) is more than percentage patients have health care coverage (24.86%) in patients with no asthma (table 36) (figure 27).

Table 36.
Distribution of adult patients of asthma by having health care coverage.

Predictor variables of socioeconomic factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Health coverage	Yes	29792 (67.68)	10945 (24.86)	40737 (92.54)
	No	2266 (5.15)	1017 (2.31)	11962 (27.17)

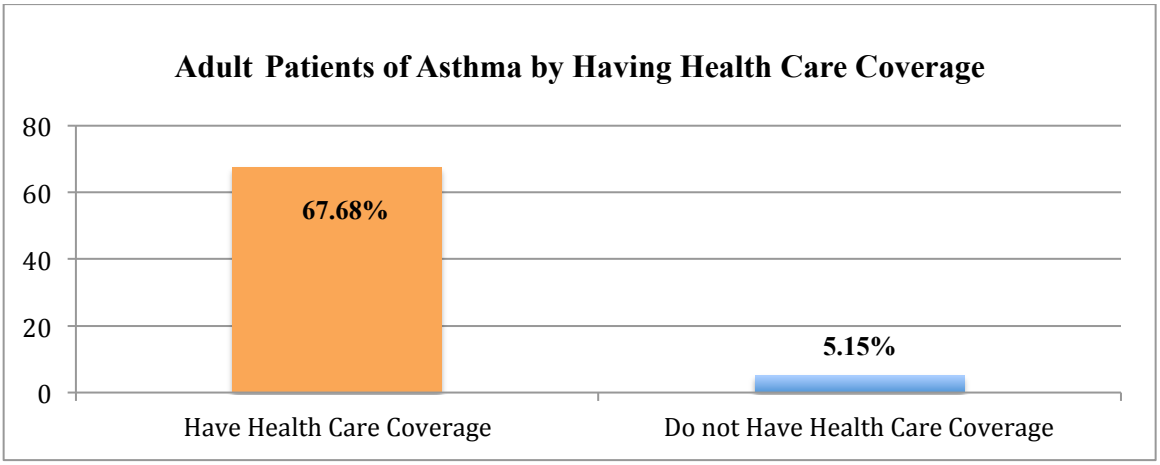


Figure 27. *Distribution of adult patients of asthma by having health care coverage.*

EDUCA is a socioeconomic predictor variable refers to education level. It is a categorical variable that consists of six categories including: never attended school, grades 1 through 8, grades 9 through 11, grade 12 or GED, college 1 year to 3 years, and college 4 years or more. In adult patients of asthma, percentage of patients never attended school (0.09%) is more than percentage of patients never attended school (0.02%) in patients with no asthma (table 37) (figure 28).

Table 37.
Distribution of adult patients of asthma by education level.

Predictor variables of socioeconomic factors		Do you still have asthma?		
Variable	Category	YES	NO	Total
		No. (Weighted %)	No. (Weighted %)	No. (Weighted %)
Education level	Never attend school	38 (0.09)	9 (0.02)	47 (0.11)
	Grades 1 - 8	936 (2.13)	201 (0.46)	1137 (2.58)
	Grades 9 - 11	2328 (5.29)	546 (1.24)	2874 (6.53)
	Grade 12 or GED	8905 (20.23)	2911 (6.61)	11816 (26.84)
	College 1 to 3 years	9485 (21.55)	3652 (8.30)	13137 (29.84)
	College + 4 years	10365 (23.55)	4643 (10.55)	15008 (34.09)

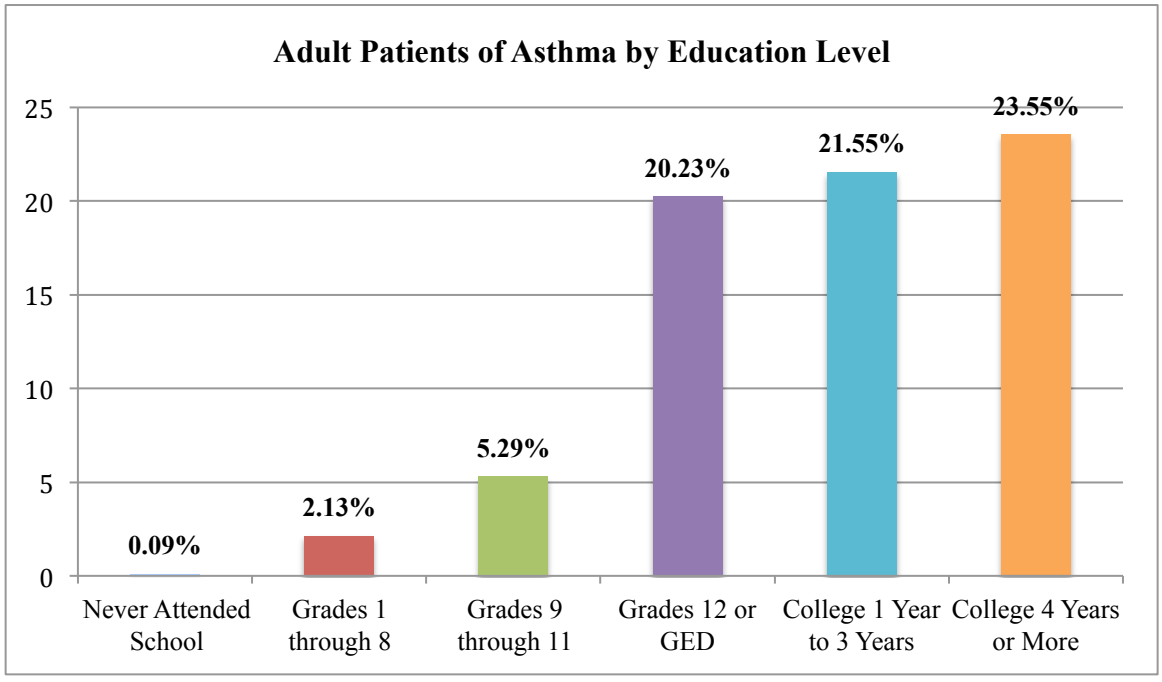


Figure 28. *Distribution of adult patients of asthma by education level.*

4.3 Inferential Analysis:

There are different inferential analysis methods that can be used to infer and detect the association among different variables. However, in this research, Chi-square test would be the best method to infer and detect the association among variables because all the variables in this research are categorical variables.

4.3.1 Inferential Analysis of The First Hypothesis:

The first hypothesis proposes that asthma as a chronic disease has statistically significant impact on HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.

To examine the association between asthma (ASTHNOW) and each one of activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), Chi-Square test was used (table 38).

Significance level was chosen to be 0.05. So, if the results show that p-value = 0.05 or less meaning that the null hypothesis is rejected and there is a significant association between these two variables. If the results show that p-value is more than 0.05 meaning that the null hypothesis is accepted and there is no association between these variables. P-value is a value that is used to test a statistical hypothesis [123]. High P value means accepting null hypothesis, which is against the research hypothesis. Low P-values means rejecting null hypothesis, which means research hypothesis is true. Degree of Freedom (DF) is function of both sample size and predictor variable in a model [124]. DF = sample size (k) - 1. F-value (also called F-ratio) is measuring difference of means and relation of variability in the sample [125].

Table 38.
Association between asthma as a predictor variable and each one of HRQoL indicator variables in adult patients of asthma.

P-value of Chi-Square test to indicate the association between asthma and HRQoL variables	
Indicator variables of health related quality of life (HRQoL)	Predictor variable
	Do you still have asthma?
Activity limitations	< .0001
Physical health	< .0001
Mental health	< .0001

4.3.2 Inferential Analysis of The Second Hypothesis:

The second hypothesis proposes that there is a significant relation between several behavioral activities that adult patients practice including: smoking, alcohol use, exercise, and health routine checkup and HRQoL including: activity limitations, physical health, and mental health in these adult patients of asthma in the United States.

To examine the association between each one of current smoking status (_RFSMOK3), frequency of smoking (SMOKDAY2), last smoked (LASTSMK2), exercise (EXERANY2), health routine checkup (CHECKUP1), and alcohol use (AVEDRNK2) and each one of limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), Chi-Square test was used (table 39).

Significance level was chosen to be 0.05. So, if the results show that p-value = 0.05 or less meaning that the null hypothesis is rejected and there is a significant association between these two variables. However, if the results show that p-value is more than 0.05 meaning that the null hypothesis is accepted and there is no association between these two variables.

Table 39.
Association between behavioral predictor and each one of HRQoL indicator variables in adult patients of asthma.

P-value of Chi-Square test to indicate the association between behavioral factors and HRQoL variables						
Indicator variables of health related quality of life (HRQoL)	Predictor variable of behavioral factors					
	Current smoking status	Frequency of smoking	Last smoked	Exercise	Health routine checkup	Alcohol use
Activity limitations	< .0001	< .0001	< .0001	< .0001	< .0001	0.3469
Physical health	< .0001	< .0001	< .0001	< .0001	< .0001	0.4838
Mental health	< .0001	< .0001	< .0001	< .0001	< .0001	< .0001

4.3.3 Inferential Analysis of The Third Hypothesis:

The third hypothesis proposes that there is a significant relation between several clinical factors including: depressive disorder, obesity, diabetes, influenza vaccine and pneumonia vaccine and HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.

To examine the association between each one of depressive disorder (ADDEPEV2), body mass index (BMI) (_BMI5CAT), diabetes (DIABETE3), influenza vaccine (FLUSHOT6), and pneumonia vaccine (PNEUVAC3) and each one of activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), Chi-Square test was used (table 40).

Significance level was chosen to be 0.05. So, if the results show that p-value = 0.05 or less meaning that the null hypothesis is rejected and there is a significant association between these two variables. However, if the results show that p-value is more than 0.05 meaning that the null hypothesis is accepted and there is no association between these two variables.

Table 40.
Association between each one of clinical predictor variables and each one of HRQoL indicator variables in adult patients of asthma.

P-value of Chi-Square test to indicate the association between clinical factors and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable of clinical factors				
	Depressive disorder	Body mass index (BMI)	Diabetes	Influenza vaccine	Pneumonia vaccine
Activity limitations	< .0001	< .0001	< .0001	< .0001	< .0001
Physical health	< .0001	< .0001	< .0001	< .0001	< .0001
Mental health	< .0001	< .0001	< .0001	< .0001	< .0001

4.3.4 Inferential Analysis of The Fourth Hypothesis:

The fourth hypothesis proposes that differences of socioeconomic statuses (SES) factors including: stress, income level, health care coverage, and education level between adult patients of asthma can result significantly in different HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.

To examine the association between each one of stress (SCNTMEL1), income level (INCOME2), health care coverage (HLTHPLN1), and education level (EDUCA) and each one of activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), Chi-Square test was used (table 41).

Significance level was chosen to be 0.05. So, if the results show that p-value = 0.05 or less meaning that the null hypothesis is rejected and there is a significant association between these two variables. However, if the results show that p-value is more than 0.05 meaning that the null hypothesis is accepted and there is no association between these two variables.

Table 41.
Association between each one socioeconomic predictor variables and each one of HRQoL indicator variables in adult patients of asthma.

P-value of Chi-Square test to indicate the association between socioeconomic factors and HRQoL variables				
Indicator variables of health related quality of life (HRQoL)	Predictor variable of socioeconomic factors			
	Stress	Income level	Health care coverage	Education level
Activity limitations	< .0001	< .0001	0.2116	< .0001
Physical health	< .0001	< .0001	0.0377	< .0001
Mental health	< .0001	< .0001	< .0001	< .0001

4.4 Predictive Analysis:

In predictive analysis, this research used logistic regression in Statistical Analysis System Software (SAS) through PROC LOGISTIC to predict and determine the relation among variables.

4.4.1 Predictive Analysis of The First Hypothesis:

The first hypothesis proposes that asthma as a chronic disease has statistically significant impact on HRQoL including: activity limitations, physical health, and mental health in adult patients in the United States.

Before starting in predictive analysis, the results of inferential analysis has to be reviewed to forward the indicator variables of HRQoL that have statistically significant associations with predictor variable of asthma to the predictive analysis and to exclude predictor variables and indicator variables that do not have statistically significant associations (table 38).

To examine the predictive relation between asthma (ASTHNOW) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is

rejected and asthma is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 42).

Table 42.
Predictive analysis to predict relation between asthma as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between asthma and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Do you still have asthma?				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	814.1474	< .0001	0.510	0.487-0.534	0.0236
Physical health	543.2609	< .0001	0.993	0.993-0.994	0.0002
Mental health	76.7344	< .0001	0.997	0.997-0.998	0.0002

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

4.4.2 Predictive Analysis of The Second Hypothesis:

The second hypothesis proposes that there is a significant relation between several behavioral activities that adult patients practice including: smoking, alcohol use, exercise, and health routine checkup and HRQoL including: activity limitations, physical health, and mental health in these adult patients of asthma in the United States.

Before starting in predictive analysis, the results of inferential analysis has to be reviewed to forward the predictor variables of behavioral factors that have statistically significant associations with indicator variables of HRQoL to the predictive analysis and to exclude predictor variables and indicator variables that do not have statistically significant associations (table 39).

To examine the predictive relation between current smoking status (_RFSMOK3) as a predictor variable and each one of associated indicator variables of HRQoL variables including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen be

0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and current smoking status is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 43).

Table 43.
Predictive analysis to predict relation between current smoking status as a predictor variable and each one of associated HRQoL indicator variables.

P-value of Logistic regression to indicate the predictive relation between smoking status and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Current smoking status				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	642.1295	< .0001	1.924	1.829-2.024	0.0258
Physical health	64.5086	< .0001	1.203	1.150-1.259	0.0230
Mental health	295.5510	< .0001	1.502	1.434-1.573	0.0237

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between frequency of smoking (SMOKDAY2) as a predictor variable and associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and frequency of smoking is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 44).

Table 44.
Predictive analysis to predict relation between frequency of smoking as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between frequency of smoking and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Frequency of smoking	
	WCS	Pr > chi-Sq
Activity limitations	80.3522	< .0001
Physical health	26.6776	< .0001
Mental health	282.6578	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the levels of frequency of smoking, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 45).

Table 45.
Odds ratio of each level of frequency of smoking and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of frequency of smoking and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Frequency of smoking		Activity limitations	Physical health	Mental health
Every day	OR	1.330	1.149	1.619
	95% CI	1.246-1.419	1.084-1.217	1.526- 1.719
	Std.Err.	0.0241	0.0214	0.0218
Some days	OR	1.250	1.054	1.063
	95% CI	1.141-1.368	0.965- 1.151	0.972-1.163
	Std.Err.	0.0305	0.0270	0.0275
Not at all	OR	0.752	0.871	0.618
	95% CI	0.705- 0.802	0.822-0.922	0.582-0.656
	Std.Err.	0.0208	0.0185	0.0191

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between last smoked (LASTSMK2) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and last smoked is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 46).

Table 46.
Predictive analysis to predict relation between last smoked as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between last smoked and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Last smoked	
	WCS	Pr > chi-Sq
Activity limitations	7.3418	< .0001
Physical health	15.9357	< .0001
Mental health	164.6786	< .0001

To examine the significance of differences between the levels of last smoked, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 47).

Table 47.
Odds ratio of each level of last smoked and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of last smoked and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Last smoked		Activity limitations	Physical health	Mental health
Within the past month	OR	1.634	1.230	1.359
	95% CI	0.945-2.823	0.760-1.990	0.825-2.240
	Std.Err.	0.0679	0.0968	0.0989
Within the past 3 months	OR	1.525	1.075	1.162
	95% CI	0.876-2.657	0.659-1.754	0.861-1.568
	Std.Err.	0.1163	0.1044	0.1046
Within the past 6 months	OR	1.009	0.973	1.145
	95% CI	0.737-1.382	0.602-1.574	0.695-1.885
	Std.Err.	0.1064	0.0963	0.0985
Within the past year	OR	0.984	1.144	1.171
	95% CI	0.736-1.315	0.884-1.481	0.720-1.903
	Std.Err.	0.0917	0.0812	0.0845
Within the past 5 years	OR	1.080	0.946	1.097
	95% CI	0.846-1.380	0.760-1.177	0.690-1.745
	Std.Err.	0.0606	0.0540	0.0560
Within the past 10 years	OR	0.911	0.902	0.897
	95% CI	0.710-1.168	0.722-1.127	0.562-1.430
	Std.Err.	0.0639	0.0570	0.0599
Within the past 10 years or more	OR	0.892	0.981	0.685
	95% CI	0.709-1.122	0.632-1.521	0.434-1.083
	Std.Err.	0.0475	0.0423	0.0443
Never	OR	0.612	0.813	0.736
	95% CI	0.354-1.058	0.503-1.316	0.446-1.212
	Std.Err.	0.2245	0.1970	0.2051

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between exercise (EXERANY2) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is

rejected and exercise is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 48).

Table 48.
Predictive analysis to predict relation between exercise as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between exercise and HRQoL variables

Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Exercise				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	2590.6923	< .0001	3.151	3.014-3.293	0.0225
Physical health	173.1764	< .0001	1.296	1.247-1.347	0.0197
Mental health	53.8007	< .0001	1.163	1.117-1.211	0.0206

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between health routine checkup (CHECKUP1) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and health routine checkup is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 49).

Table 49.
Predictive analysis to predict relation between health routine checkup as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between health routine checkup and HRQoL variables

Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Health routine checkup	
	WCS	Pr > chi-Sq
Activity limitations	62.5110	< .0001
Physical health	0.0003	0.9871
Mental health	62.8212	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the levels of health routine checkup, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 50).

Table 50.
Odds ratio of each level of health routine checkup variable and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of health routine checkup and associated HRQoL variables			
Predictor variable		Indicator variables of health related quality of life (HRQoL)	
Health routine checkup		Activity limitations	Mental health
Within the past year	OR	0.761	1.014
	95% CI	0.713-0.811	0.791-1.300
	Std.Err.	0.0385	0.0293
Within the past 2 years	OR	0.792	1.223
	95% CI	0.727-0.863	1.154-1.296
	Std.Err.	0.0445	0.0352
Within the past 5 years	OR	0.825	1.327
	95% CI	0.626-1.086	1.230-1.432
	Std.Err.	0.0445	0.0402
Within the past 5 years or more	OR	0.791	1.279
	95% CI	0.600-1.044	0.987-1.657
	Std.Err.	0.0460	0.0415
Never	OR	0.961	0.986
	95% CI	0.738-1.250	0.769-1.263
	Std.Err.	0.1080	0.1016

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between alcohol use (AVEDRNK2) as a predictor variable and mental health (MENTHLTH) as associated indicator variable of HRQoL, logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and alcohol use is a statistically significant predictor of mental health (table 51).

Table 51.

Predictive analysis to predict relation between alcohol use as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between alcohol use and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Alcohol use				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Mental health	18.6215	< .0001	1.024	1.013-1.035	0.00552

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

4.4.3 Predictive Analysis of The Third Hypothesis:

The third hypothesis proposes that there is a significant relation between several clinical factors including: depressive disorder, obesity, diabetes, influenza vaccine and pneumonia vaccine and HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.

Before starting in predictive analysis, the results of inferential analysis has to be reviewed to forward the predictor variables of clinical factors that have statistically significant associations with indicator variables of health-related quality of life (HRQoL) to the predictive analysis and to exclude predictor variables and indicator variables that do not have statistically significant associations (table 40).

To examine the predictive relation between depressive disorder (ADDEPEV2) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and depressive disorder is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 52).

Table 52.

Predictive analysis to predict relation between depressive disorder as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between depressive disorder and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Depressive disorder				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	3591.7386	< .0001	3.708	3.552-3.870	0.0109
Physical health	923.5224	< .0001	1.776	1.712- 1.843	0.00945
Mental health	4122.0370	< .0001	3.638	3.497- 3.784	0.0101

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between body mass index (BMI) (_BMI5CAT) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and body mass index (BMI) is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 53).

Table 53.

Predictive analysis to predict relation between body mass index (BMI) as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between body mass index (BMI) and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Body mass index (BMI)	
	WCS	Pr > chi-Sq
Activity limitations	810.2482	< .0001
Physical health	196.8662	< .0001
Mental health	51.8548	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the levels of body mass index (BMI), logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 54).

Table 54.
Odds ratio of each level of body mass index (BMI) and variable and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of body mass index (BMI) and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Body mass index (BMI)		Activity limitations	Physical health	Mental health
	OR	0.833	0.916	1.009
Underweight	95% CI	0.707-0.981	0.791-1.061	0.867-1.175
	Std.Err.	0.0620	0.0557	0.0577
	OR	0.555	0.716	0.834
Normal weight	95% CI	0.470-0.655	0.684-0.750	0.715-0.974
	Std.Err.	0.0268	0.0236	0.0245
	OR	0.670	0.767	0.800
Overweight	95% CI	0.568-0.790	0.736-0.801	0.765-0.836
	Std.Err.	0.0257	0.0229	0.0238
	OR	1.201	1.091	0.991
Obese	95% CI	1.019-1.414	0.942-1.264	0.851-1.154
	Std.Err.	0.0247	0.0221	0.0230

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between diabetes (DIABETE3) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and diabetes is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 55).

Table 55.
Predictive analysis to predict relation between diabetes as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between diabetes and HRQoL variables					
Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Diabetes				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	1641.8337	< .0001	1.353	1.173- 1.559	0.0344
Physical health	212.1708	< .0001	1.205	1.061- 1.370	0.0301
Mental health	30.5159	< .0001	1.014	0.888- 1.159	0.0312

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between influenza vaccine (FLUSHOT6) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and influenza vaccine is a statistically significant predictor of HRQoL including: activity limitations and mental health (table 56).

Table 56.

Predictive analysis to predict relation between influenza vaccine as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between influenza vaccine and HRQoL variables

Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Influenza vaccine				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	108.7425	< .0001	0.519	0.496-0.544	0.0203
Physical health	368.2776	< .0001	0.673	0.646-0.701	0.0206
Mental health	46.0501	< .0001	0.859	0.824-0.896	0.0214

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between pneumonia vaccine (PNEUVAC3) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and pneumonia vaccine is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 57).

Table 57.

Predictive analysis to predict relation between pneumonia vaccine as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between pneumonia vaccine and HRQoL variables

Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Pneumonia vaccine				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Activity limitations	1502.0223	< .0001	0.446	0.428-0.464	0.0209
Physical health	95.8281	< .0001	0.837	0.807- 0.867	0.0182
Mental health	48.7530	< .0001	0.852	0.817- 0.889	0.0215

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

4.4.4 Predictive Analysis of The Fourth Hypothesis:

The fourth hypothesis proposes that differences of socioeconomic statuses (SES) factors including: stress, income level, health care coverage, and education level between adult patients of asthma can result significantly in different HRQoL including: activity limitations, physical health, and mental health in adult patients of asthma in the United States.

Before starting in predictive analysis, the results of inferential analysis has to be reviewed to forward the predictor variables of socioeconomic factors that have statistically significant associations with indicator variables of health-related quality of life (HRQoL) to the predictive analysis and to exclude predictor variables and indicator variables that do not have statistically significant associations (table 41).

To examine the predictive relation between stress (SCNTMEL1) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is

rejected and stress is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 58).

Table 58.
Predictive analysis to predict relation between stress as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between stress and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Stress	
	WCS	Pr > chi-Sq
Activity limitations	154.7811	< .0001
Physical health	19.8421	< .0001
Mental health	70.1001	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the levels of Stress, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 59).

Table 59.
Odds ratio of each level of stress and variable and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of Stress and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Stress		Activity limitations	Physical health	Mental health
	OR	5.826	1.625	2.888
Always	95% CI	4.090-8.300	1.236-2.136	2.175-3.835
	Std.Err.	0.1470	0.1137	0.1159
	OR	2.678	1.142	2.522
Usually	95% CI	1.664-4.310	0.720-1.812	1.650-3.854
	Std.Err.	0.1934	0.1664	0.1704
	OR	2.215	0.977	2.095
Sometimes	95% CI	1.672-2.934	0.706-1.352	1.616-2.717
	Std.Err.	0.1201	0.1041	0.1074
	OR	1.405	0.940	1.527
Rarely	95% CI	1.003-1.969	0.653-1.353	1.115-2.093
	Std.Err.	0.1411	0.1222	0.1292
	OR	0.172	0.615	0.346
Never	95% CI	0.120- 0.244	0.468-0.809	0.261-0.460
	Std.Err.	0.0898	0.0770	0.0821

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between income level (INCOME2) as a predictor variable and each one of associated indicator variables of HRQoL including:

activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and income level is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 60).

Table 60.
Predictive analysis to predict relation between income level as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between income level and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Income level	
	WCS	Pr > chi-Sq
Activity limitations	3295.0701	< .0001
Physical health	454.1671	< .0001
Mental health	473.7306	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the income levels, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 61).

Table 61.
Odds ratio of each level of income levels and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of income level and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Income level		Activity limitations	Physical health	Mental health
	OR	5.852	1.757	1.847
$1 - $9,999	95% CI	5.384-6.361	1.638-1.884	1.718-1.985
	Std.Err.	0.0326	0.0279	0.0287
	OR	1.003	1.727	1.693
$10,000 - $14,999	95% CI	0.909-1.106	1.611-1.852	1.574-1.820
	Std.Err.	0.0326	0.0279	0.0289
	OR	0.686	1.578	1.586
$15,000 - $19,999	95% CI	0.625-0.754	1.476-1.687	1.479-1.700
	Std.Err.	0.0298	0.0265	0.0274
	OR	0.537	1.506	1.441
$20,000 - $24,999	95% CI	0.490-0.589	1.411-1.607	1.346-1.543
	Std.Err.	0.0287	0.0257	0.0268
	OR	0.382	1.340	1.190
$25,000 - $34,999	95% CI	0.348-0.418	1.257-1.429	1.111-1.274

	Std.Err.	0.0285	0.0253	0.0267
	OR	0.319	1.245	0.670
$35,000 - $49,999	95% CI	0.292-0.348	1.173-1.322	0.619-0.725
	Std.Err.	0.0264	0.0232	0.0242
	OR	0.258	1.172	0.594
$50,000 - $74,999	95% CI	0.236-0.282	1.104-1.244	0.549-0.643
	Std.Err.	0.0270	0.0231	0.0244
	OR	0.171	0.569	0.541
$75,000 or more	95% CI	0.157-0.186	0.531-0.610	0.504-0.582
	Std.Err.	0.0230	0.0186	0.0196

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between health care coverage (HLTHPLN1) as a predictor variable and each one of associated indicator variables of HRQoL including: physical health (PHYSHLTH) and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is rejected and health care coverage is a statistically significant predictor of HRQoL including: physical health and mental health (table 62).

Table 62.

Predictive analysis to predict relation between health care coverage as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between health care coverage and HRQoL variables

Indicator variables of health related quality of life (HRQoL)	Predictor variable				
	Health care coverage				
	WCS	Pr > chi-Sq	OR	95% CI	Std. Err.
Physical health	2.3969	0.1216	1.054	0.986-1.134	0.0342
Mental health	61.3489	< .0001	0.914	0.727- 0.926	0.0448

Note: *WCS is Wald Chi-Square, OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. is Standard Error.*

To examine the predictive relation between education level (EDUCA) as a predictor variable and each one of associated indicator variables of HRQoL including: activity limitations (QLACTLM2), physical health (PHYSHLTH), and mental health (MENTHLTH), logistic regression was used. Significance level was chosen to be 0.05. So, if the results show that P-value = 0.05 or less meaning that the null hypothesis is

rejected and education level is a statistically significant predictor of HRQoL including: activity limitations, physical health, and mental health (table 63).

Table 63.
Predictive analysis to predict relation between education level as a predictor variable and associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the predictive relation between education level and HRQoL variables		
Indicator variables of health related quality of life (HRQoL)	Predictor variable	
	Education level	
	WCS	Pr > chi-Sq
Activity limitations	790.9080	< .0001
Physical health	59.1355	< .0001
Mental health	27.0514	< .0001

Note: *WCS is Wald Chi-Square, Pr > chi-Sq is P-value representing significance level.*

To examine the significance of differences between the education levels, logistic regression was used to get odds ratio (OR) and then examine the differences of exposure of each level (table 64).

Table 64.
Odds ratio of each level of education levels and associated HRQoL indicator variables in adult patients of asthma.

Odds ratio of levels of last smoked and associated HRQoL variables				
Predictor variable		Indicator variables of health related quality of life (HRQoL)		
Last smoked		Activity limitations	Physical health	Mental health
	OR	1.331	1.397	0.816
Never attended school	95% CI	0.695-2.549	0.794-2.458	0.434-1.537
	Std.Err.	0.2763	0.2403	0.2689
	OR	1.999	1.288	1.437
Grades 1 through 8	95% CI	1.032-3.872	1.148-1.446	0.756-2.731
	Std.Err.	0.0771	0.0678	0.0736
	OR	2.027	0.970	1.552
Grades 9 through 11	95% CI	1.054-3.897	0.550-1.713	0.822-2.930
	Std.Err.	0.0653	0.0572	0.0628
	OR	1.343	0.795	1.336
Grade 12 or GED	95% CI	0.701-2.572	0.452-1.400	0.709-2.514
	Std.Err.	0.0590	0.0515	0.0572
	OR	1.292	0.847	1.444
College 1 year to 3 years	95% CI	0.675-2.475	0.482-1.491	0.767-2.719
	Std.Err.	0.0588	0.0513	0.0569
	OR	0.751	0.716	1.225
College 4 years or more	95% CI	0.392-1.440	0.407-1.260	0.651-2.306
	Std.Err.	0.0588	0.0511	0.0568

Note: *OR is Odds Ratio, 95% CI is 95% Confidence Interval, Std. Err. Is Standard Error.*

CHAPTER VI

DISCUSSION AND CONCLUSION

5.1 Discussion:

Although there are several traditional measures of health that measure prevalence, incidence, hospitalization, and mortality of asthma among adults, these traditional measures of health do not explain the impact of asthma on health-related quality of life (HRQoL) of these adults. Also, there are several studies that studied generally the impact of asthma, as a chronic disease, on HRQoL without including different associated factors and the impact of these factors on HRQoL among adult patients of asthma. Moreover, there are several studies that studied the impact of some different associated factors with asthma on HRQoL in adult patients asthma without comparing the outcomes of these factors among these asthma patients in order to know the significance of these factors.

However, there is still no research or study gave a full-measure scale or comprehensive view of the impact of asthma on health-related quality of life (HRQoL) in adult patients in the United States as well as measuring the impact of different associated factors including: behavioral, clinical, and socioeconomic status factors on HRQoL in these patients.

This research studied whether or not there is a statistically significant relationship between asthma and health-related quality of life (HRQoL) in adult patients in the United States. Also, this research studied whether or not there is statistically significant relationship between several behavioral factors, several clinical factors, and different

socioeconomic factors with HRQoL in adult patients of asthma in the United States. HRQoL in this research include activity limitations, physical health, and mental health.

So, this research has four hypotheses as the following:

- First Hypothesis: Asthma as a chronic disease has statistically significant impact on the ability as well as health-related quality of life (HRQoL) (activity limitations, physical health, and mental health) in adult patients in the United States.
- Second Hypothesis: There is a significant relation between behavioral activities that the patients practice (smoking, alcohol use, exercise, and health routine checkup) and HRQoL (activity limitations, physical health, and mental health) in adult patients in the United States.
- Third Hypothesis: There is significant relation between clinical factors (depressive disorder, obesity, diabetes, influenza vaccine, and pneumonia vaccine) on HRQoL (activity limitations, physical health, and mental health) in adult patients of asthma in the United States.
- Fourth Hypothesis: Differences of socioeconomic statuses (SES) between adult patients of asthma (stress, income level, health care coverage, and education level) can result significantly in different HRQoL (activity limitations, physical health, and mental health) in adult patients of asthma in the United States.

BRFSS 2014 data was used in order to examine the hypotheses of this research. BRFSS 2014 data consists of 461,436 patients. 59,749 of these patients had been told that they had asthma. However, 42,875 of patients that have been told they had asthma still have asthma. According to the distribution of adult patients of asthma by sex, asthma in females (50.84%) is more prevalent than asthma in males (20.90%). Also, according to

the distribution of adult patients of asthma by race, asthma is more prevalent in white non-Hispanic patients (54.76%) than other race groups. The distribution of adult patients of asthma by age showed that asthma is more prevalent in age 60 to 64 (8.78 %) than other age groups. Before confirming the relation between predictor variables and indicator variables of this research, this research used Statistical Analysis System Software (SAS) 9.4 and conducted three main analyses to accomplish the overall goal of this study including: 1) descriptive analysis to describe the distributions of the predictor and indicator variables, 2) inferential analysis to infer and detect the association among the predictor and indicator variables, and finally 3) predictive analysis to predict and determine the relation among the predictor and indicator variables.

In descriptive analysis of all research hypotheses, it is obvious that adult patients of asthma have poorer HRQoL including: activity limitations, physical health, and mental health than adult patients without asthma. Also, it is obvious that adult patients of asthma, who are smokers, exercisers, or alcohol users, have higher observations in having health problems than adult patients of asthma, who are not smokers, exercisers, or alcohol users. Also, it is obvious that adult patients of asthma, who have medical and some socioeconomic issues such as: depressive disorder, high BMI, diabetes, stress, and low income level, have higher observations in having health problems than adult patients of asthma, who do not have these medical and socioeconomic issues.

This led us to say there may be an association between these HRQoL indicator variables and each of asthma, behavioral, clinical, and socioeconomic predictor variables. Performing inferential analysis, Chi-Square test, with a significance level of 0.05 or less was the best choice to examine the association between these different variables. As a

result of inferential analysis, Chi-Square test, the majority of p-values are < .0001, meaning the null hypothesis is rejected and there is a significant association between each one of HRQoL indicator variables including: activity limitations, physical health, and mental health and each one of asthma, behavioral, clinical, and socioeconomic predictor variables including: asthma, current smoking status, frequency of smoking, last smoked, exercise, health routine checkup, alcohol use, depressive disorder, body mass index (BMI), diabetes, influenza vaccine, pneumonia vaccine, stress, income level, health care coverage, and education level (table 65).

Table 65.
Association between each one of asthma, behavioral, clinical, and socioeconomic predictor variables and each one of HRQoL indicator variables in adult patients of asthma.

P-value of Chi-Square test to indicate the association between each one of asthma, behavioral, clinical, and socioeconomic predictor variables and each one of HRQoL indicator variables			
Predictor variable	Indicator variables of health related quality of life (HRQoL)		
	Activity limitations	Physical health	Mental health
Have asthma	< .0001	< .0001	< .0001
Current smoking status	< .0001	< .0001	< .0001
Frequency of smoking	< .0001	< .0001	< .0001
Last smoked	< .0001	< .0001	< .0001
Exercise	< .0001	< .0001	< .0001
Health routine checkup	< .0001	< .0001	< .0001
Alcohol use	0.3469	0.4838	< .0001
Depressive disorder	< .0001	< .0001	< .0001
Body mass index (BMI)	< .0001	< .0001	< .0001
Diabetes	< .0001	< .0001	< .0001
Influenza vaccine	< .0001	< .0001	< .0001
Pneumonia vaccine	< .0001	< .0001	< .0001
Stress	< .0001	< .0001	< .0001
Income level	< .0001	< .0001	< .0001
Health care coverage	0.2116	0.0377	< .0001
Education level	< .0001	< .0001	< .0001

To confirm the predictive relation and get the odds ratio (OR) to measure the exposure of predictor variables as well as the predictive association between predictor variables and HRQoL indicator variables, the results of predictive analysis, logistic

regression, have to show a statistically significant relation between previous associated variables with a significance level of 0.05 or less.

As a result of predictive analysis, logistic regression, the majority of p-values are Pr > chi-Sq is < 0.0001, meaning the null hypothesis is rejected and there is a significant predictive relation between each one of HRQoL indicator variables including: activity limitations, physical health, and mental health and each one of asthma, behavioral, clinical, and socioeconomic predictor variables including: asthma, current smoking status, frequency of smoking, last smoked, exercise, health routine checkup, alcohol use, depressive disorder, body mass index (BMI), diabetes, influenza vaccine, pneumonia vaccine, stress, income level, health care coverage, and education level (table 66).

Table 66.
Predictive relation between each one of asthma, behavioral, clinical, and socioeconomic predictor variables and each one of associated HRQoL indicator variables in adult patients of asthma.

P-value of Logistic regression to indicate the association between each one of asthma, behavioral, clinical, and socioeconomic predictor variables and each one of HRQoL indicator variables

Predictor variable	Indicator variables of health related quality of life (HRQoL)		
	Activity limitations	Physical health	Mental health
Have asthma	< .0001	< .0001	< .0001
Current smoking status	< .0001	< .0001	< .0001
Frequency of smoking	< .0001	< .0001	< .0001
Last smoked	< .0001	< .0001	< .0001
Exercise	< .0001	< .0001	< .0001
Health routine checkup	< .0001	0.9871	< .0001
Alcohol use			< .0001
Depressive disorder	< .0001	< .0001	< .0001
Body mass index (BMI)	< .0001	< .0001	< .0001
Diabetes	< .0001	< .0001	< .0001
Influenza vaccine	< .0001	< .0001	< .0001
Pneumonia vaccine	< .0001	< .0001	< .0001
Stress	< .0001	< .0001	< .0001
Income level	< .0001	< .0001	< .0001
Health care coverage		0.1216	< .0001
Education level	< .0001	< .0001	< .0001

Note: *means there was not an association between these two variables.*

However, to measure the impact of each one of the predictive variables on each one of HRQoL indicator variables and to also measure the impact of different level of the predictor variable on each one of HRQoL indicator variables, odds ratio (OR) for each one of the predictive variables must be gotten and the percentage differences of impact must be calculated compering to the control, which is considered as OR of the impact of asthma on HRQoL in adult patients of asthma. Also, 95% confidence interval (95% CI) is important to know the true population that is used of overall population. Percentage of impact differences can be calculated by this formula [126]:

$$\text{Percentage differences} = (V1-V2) / ((V1+V2)/2)*100$$

While:
V1 = Number of exposed cases.
V2 = Number of exposed non-cases.

Asthma as a chronic disease has statistically significant association and predictive relation with HRQoL indicator variables including: activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for asthma as a chronic disease is 0.510, odds ratio of physical health problems for asthma as a chronic disease is 0.993, and odds ratio of mental health for asthma as a chronic disease is 0.997 (table 42). Therefore, these odds ratios would be use as controls to measure the impact of other predictor variables including: behavioral, clinical, and socioeconomic variables with their levels on HRQoL indicator variables in adult patients of asthma.

However, generally, adult patients of asthma have activity limitations by 64.90% more than adult healthy people with the true population effect between 48.7% to 53.4% and statistically significant association. Adult patients of asthma have physical health

problems by 163.40% more than adult healthy people with the true population effect between 99.3% to 99.4% and statistically significant association. Also, adult patients of asthma have mental health problems by 163.53% more than adult healthy people with the true population effect between 99.7% to 99.8% and statistically significant association (table 42).

Behavioral factors in this research include smoking, frequency of smoking, quitting smoking, exercise, health routine checkup, and alcohol use.

Smoking has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for smoking in adult patients of asthma is 1.924 while the odds ratio of activity limitations for asthma is 0.510. The odds ratio of physical health problems for smoking in adult patients of asthma is 1.203 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for smoking in adult patients of asthma is 1.502 while the odds ratio of mental health problems for asthma is 0.997 (table 42&43).

Smoking in adult patients of asthma increases activity limitations by 116.18% more than in adult patients of asthma, who do not smoke, with the true population effect of 100% and statistically significant association. Smoking in adult patients of asthma increases physical health problems by 19.12% more than in adult patients of asthma, who do not smoke, with the true population effect of 100% and statistically significant association. Smoking in adult patients of asthma increases mental health problems by 40.41% more than in adult patients of asthma, who do not smoke, with the true population effect of 100% and statistically significant association (table 42&43).

Frequency of smoking has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). However, there are three levels of frequency of smoking as a predictor variable including: every day smoking, some days smoking, and not at all smoking. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for every day smoking in adult patients of asthma is 1.330, the odds ratio of activity limitations for some days smoking in adult patients of asthma is 1.149, and the odds ratio of activity limitations for not at all smoking in adult patients of asthma is 1.619. The odds ratio of physical health problems for every day smoking in adult patients of asthma is 1.250, the odds ratio of physical health problems for some days smoking in adult patients of asthma is 1.054, and the odds ratio of physical health problems for not at all smoking in adult patients of asthma is 1.063. The odds ratio of mental health problems for every day smoking in adult patients of asthma is 0.752, the odds ratio of mental health problems for some days smoking in adult patients of asthma is 0.871, and the odds ratio of mental health problems for not at all smoking in adult patients of asthma is 0.618 (table 45).

Every day smoking in adult patients of asthma increases activity limitations by 6.20% more than in some days smoking in adult patients of asthma and by 55.52% more than in not at all smoking in adult patients of asthma with the true population effect between 70.5% to 100% and statistically significant association. Every day smoking in adult patients of asthma increases physical health problems by 8.62% more than in some

days smoking in adult patients of asthma and by 27.52% more than in not at all smoking in adult patients of asthma with the true population effect between 80.2% to 100% and statistically significant association. Every day smoking in adult patients of asthma increases mental health problems by 41.46% more than in some days smoking in adult patients of asthma and by 89.49% more than in not at all smoking in adult patients of asthma with the true population effect between 58.2% to 100% and statistically significant association (table 44&45).

Quitting smoking (last smoked) has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). However, there are eight levels of last smoked as a predictor variable including: within the past month, within the past 3 months, within the past 6 months, within the past year, within the past 5 years, within the past 10 years, within the past 10 years or more, and never smoked. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for last smoked within the past month in adult patients of asthma is 1.634, the odds ratio of activity limitations for last smoked within the past year in adult patients of asthma is 0.984, and the odds ratio of activity limitations for last smoked within the past 10 years in adult patients of asthma is 0.911. The odds ratio of physical health problems for last smoked within the past month in adult patients of asthma is 1.230, the odds ratio of physical health problems for last smoked within the past year in adult patients of asthma is 1.144, and the odds ratio of physical

health problems for last smoked within the past 10 years in adult patients of asthma is 0.902. The odds ratio of mental health problems for last smoked within the past month in adult patients of asthma is 1.359, the odds ratio of mental health problems for last smoked within the past year in adult patients of asthma is 1.171, and the odds ratio of mental health problems for last smoked within the past 10 years in adult patients of asthma is 0.897 (table 47).

Last smoked within the past month in adult patients of asthma increases activity limitations by 49.65% more than in last smoked within the past year in adult patients of asthma and by 56.81% more than in last smoked within the past 10 years in adult patients of asthma with the true population effect between 94.5% to 100% and statistically significant association. Last smoked within the past month in adult patients of asthma increases physical health problems by 7.24% more than in last smoked within the past year in adult patients of asthma and by 30.76% more than in last smoked within the past 10 years in adult patients of asthma with the true population effect between 76% to 100% and statistically significant association. Last smoked within the past month in adult patients of asthma increases mental health problems by 14.86% more than in last smoked within the past year in adult patients of asthma and by 40.95% more than in last smoked within the past 10 years in adult patients of asthma with the true population effect between 82.5% to 100% and statistically significant association (table 46&47).

Exercise has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for exercise in adult patients of asthma is 3.151 while the odds ratio of activity limitations for asthma is

0.510. The odds ratio of physical health problems for exercise in adult patients of asthma is 1.296 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for exercise in adult patients of asthma is 1.163 while the odds ratio of mental health problems for asthma is 0.997 (table 42&48).

Exercise in adult patients of asthma increases activity limitations by 144.27% more than in adult patients of asthma, who do not exercise, with the true population effect of 100% and statistically significant association. Exercise in adult patients of asthma increases physical health problems by 26.47% more than in adult patients of asthma, who do not exercise, with the true population effect of 100% and statistically significant association. Exercise in adult patients of asthma increases mental health problems by 15.37% more than in adult patients of asthma, who do not exercise, with the true population effect of 100% and statistically significant association (table 48).

Health routine checkup has statistically significant association and predictive relation with activity limitations and mental health problems in adult patients of asthma (table 65&66). However, there are five levels of health routine checkup as a predictor variable including: within the past year, within the past 2 years, within the past 5 years, within the past 5 years or more, and never did health routine checkup. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations and mental health problems.

The odds ratio of activity limitations for health routine checkup within the past year in adult patients of asthma is 0.761, the odds ratio of activity limitations for health routine checkup within the past 5 years in adult patients of asthma is 0.825, and the odds

ratio of activity limitations for never did health routine checkup in adult patients of asthma is 0.961. The odds ratio of mental health problems for health routine checkup within the past year in adult patients of asthma is 1.014, the odds ratio of mental health problems for health routine checkup within the past 5 years in adult patients of asthma is 1.327, and the odds ratio of mental health problems for never did health routine checkup in adult patients of asthma is 0.986 (table 50).

Health routine checkup within the past year in adult patients of asthma decreases activity limitations by 8.07% less than in health routine checkup within the past 5 years in adult patients of asthma and by 23.22% less than in never did health routine checkup in adult patients of asthma with the true population effect between 71.3% to 81.1% and statistically significant association. Health routine checkup within the past year in adult patients of asthma decreases mental health problems by 26.74% less than in health routine checkup within the past 5 years in adult patients of asthma and by 2.8% less than in never did health routine checkup in adult patients of asthma with the true population effect between 79.1% to 100% and statistically significant association (table 49&50).

Alcohol use has statistically significant association and predictive relation with only mental health problems in adult patients of asthma (table 65&66). The odds ratio of mental health problems for alcohol use in adult patients of asthma is 1.024 while the odds ratio of mental health problems for asthma is 0.997 (table 42&51). Alcohol use in adult patients of asthma increases mental health problems by 2.67% more than in adult patients of asthma, who do not use alcohol, with the true population effect of 100% and statistically significant association (table 51).

Clinical factors in this research include depressive disorder, body mass index (BMI), diabetes, influenza vaccine, and pneumonia vaccine.

Depressive disorder has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for depressive disorder in adult patients of asthma is 3.708 while the odds ratio of activity limitations for asthma is 0.510. The odds ratio of physical health problems for depressive disorder in adult patients of asthma is 1.776 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for depressive disorder in adult patients of asthma is 3.638 while the odds ratio of mental health problems for asthma is 0.997 (table 42&52).

Depressive disorder in adult patients of asthma increases activity limitations by 151.63% more than in adult patients of asthma, who do not have depressive disorder, with the true population effect of 100% and statistically significant association. Depressive disorder in adult patients of asthma increases physical health problems by 56.55% more than in adult patients of asthma, who do not have depressive disorder, with the true population effect of 100% and statistically significant association. Depressive disorder in adult patients of asthma increases mental health problems by 113.95% more than in adult patients of asthma, who do not have depressive disorder, with the true population effect of 100% and statistically significant association (table 52).

Body mass index (BMI) has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). However, there are four levels of body mass

index (BMI) as a predictor variable including: underweight, normal weight, overweight, and obese. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for obese in adult patients of asthma is 1.201, the odds ratio of activity limitations for overweigh in adult patients of asthma is 0.670, the odds ratio of activity limitations for normal weight in adult patients of asthma is 0.555, and the odds ratio of activity limitations for underweight in adult patients of asthma is 0.833. The odds ratio of physical health problems for obese in adult patients of asthma is 1.091, the odds ratio of physical health problems for overweigh in adult patients of asthma is 0.767, the odds ratio of physical health problems for normal weight in adult patients of asthma is 0.716, and the odds ratio of physical health problems for underweight in adult patients of asthma is 0.916. The odds ratio of mental health problems for obese in adult patients of asthma is 0.991, the odds ratio of mental health problems for overweigh in adult patients of asthma is 0.800, the odds ratio of mental health problems for normal weight in adult patients of asthma is 0.834, and the odds ratio of mental health problems for underweight in adult patients of asthma is 1.009 (table 54).

Obese in adult patients of asthma increases activity limitations by 56.76% more than in overweigh in adult patients of asthma, by 73.57% more than in normal weight in adult patients of asthma, and by 36.18% more than in underweight in adult patients of asthma with the true population effect between 47% to 100% and statistically significant association. Obese in adult patients of asthma increases physical health problems by 34.87% more than in overweigh in adult patients of asthma, by 41.50% more than in

normal weight in adult patients of asthma, and by 17.43% more than in underweight in adult patients of asthma with the true population effect between 94.2 to 100% and statistically significant association. Obese in adult patients of asthma increases mental health problems by 21.32% more than in overweigh in adult patients of asthma, by 17.20% more than in normal weight in adult patients of asthma, and by 1.8% more than in underweight in adult patients of asthma with the true population effect between 85.1% to 100% and statistically significant association (table 53&54).

Diabetes has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for diabetes in adult patients of asthma is 1.353 while the odds ratio of activity limitations for asthma is 0.510. The odds ratio of physical health problems for diabetes in adult patients of asthma is 1.205 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for diabetes in adult patients of asthma is 1.014 while the odds ratio of mental health problems for asthma is 0.997 (table 42&55).

Diabetes in adult patients of asthma increases activity limitations by 90.49% more than in adult patients of asthma, who do not have diabetes, with the true population effect of 100% and statistically significant association. Diabetes in adult patients of asthma increases physical health problems by 19.29% more than in adult patients of asthma, who do not have diabetes, with the true population effect of 100% and statistically significant association. Diabetes in adult patients of asthma increases mental health problems by 1.69% more than in adult patients of asthma, who do not have diabetes, with the true

population effect between 88.8% to 100% and statistically significant association (table 55).

Influenza vaccine has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). The odds ratio of activity limitations for influenza vaccine in adult patients of asthma is 0.519 while the odds ratio of activity limitations for asthma is 0.510. The odds ratio of physical health problems for influenza vaccine in adult patients of asthma is 0.673 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for influenza vaccine in adult patients of asthma is 0.859 while the odds ratio of mental health problems for asthma is 0.997 (table 42&56).

Influenza vaccine in adult patients of asthma decreases activity limitations by 1.74% less than in adult patients of asthma, who do not have influenza vaccine, with the true population effect between 49.6% to 54.4% and statistically significant association. Influenza vaccine in adult patients of asthma decreases physical health problems by 38.41% less than in adult patients of asthma, who do not have influenza vaccine, with the true population effect of between 64.6% to 70.1% and statistically significant association. Influenza vaccine in adult patients of asthma decreases mental health problems by 14.87% less than in adult patients of asthma, who do not have influenza vaccine, with the true population effect of between 82.4% to 89.6% and statistically significant association (table 56).

Pneumonia vaccine has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult

patients of asthma (table 65&66). The odds ratio of activity limitations for pneumonia vaccine in adult patients of asthma is 0.446 while the odds ratio of activity limitations for asthma is 0.510. The odds ratio of physical health problems for pneumonia vaccine in adult patients of asthma is 0.837 while the odds ratio of physical health problems for asthma is 0.993. The odds ratio of mental health problems for pneumonia vaccine in adult patients of asthma is 0.852 while the odds ratio of mental health problems for asthma is 0.997 (table 42&57).

Pneumonia vaccine in adult patients of asthma decreases activity limitations by 13.38% less than in adult patients of asthma, who do not have pneumonia vaccine, with the true population effect between 42.8% to 46.4% and statistically significant association. Pneumonia vaccine in adult patients of asthma decreases physical health problems by 17.04% less than in adult patients of asthma, who do not have pneumonia vaccine, with the true population effect between 80.7% to 86.7% and statistically significant association. Pneumonia vaccine in adult patients of asthma decreases mental health problems by 15.68% less than in adult patients of asthma, who do not have pneumonia vaccine, with the true population effect between 81.7% to 88.9% and statistically significant association (table 57).

Socioeconomic factors in this research include stress, income level, health care coverage, and education level.

Stress has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). However, there are five levels of stress as a predictor variable including: always stressed, usually stressed, sometimes stressed, rarely stressed, and

never stressed. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for always stressed in adult patients of asthma is 5.826, the odds ratio of activity limitations for sometimes stressed in adult patients of asthma is 2.215, and the odds ratio of activity limitations for never stressed in adult patients of asthma is 0.172. The odds ratio of physical health problems for always stressed in adult patients of asthma is 1.625, the odds ratio of physical health problems for sometimes stressed in adult patients of asthma is 0.977, and the odds ratio of physical health problems for never stressed in adult patients of asthma is 0.615. The odds ratio of mental health problems for always stressed in adult patients of asthma is 2.888, the odds ratio of mental health problems for sometimes stressed in adult patients of asthma is 2.095, and the odds ratio of mental health problems for never stressed in adult patients of asthma is 0.346 (table 59).

Always stressed in adult patients of asthma increases activity limitations by 98.81% more than in sometimes stressed in adult patients of asthma and by 188.52% more than in never stressed in adult patients of asthma with the true population effect between 12% to 100% and statistically significant association. Always stressed in adult patients of asthma increases physical health problems by 49.80% more than in sometimes stressed in adult patients of asthma and by 90.17% more than in never stressed in adult patients of asthma with the true population effect between 46.8% to 100% and statistically significant association. Always stressed in adult patients of asthma increases mental health problems by 31.82% more than in sometimes stressed in adult patients of

asthma and by 157.20% more than in never stressed in adult patients of asthma with the true population effect between 26.1% to 100% and statistically significant association (table 58&59).

Income level has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult patients of asthma (table 65&66). However, there are eight levels of income level as a predictor variable including: $1-$9999, $10000-$14999, $15000-$19999, $20000-$24999, $25000-$34999, $35000-$49999, $50000-$74999, and $75000 or more. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for income level of $1-$9999 in adult patients of asthma is 5.852, the odds ratio of activity limitations for income level of $25000-$34999 in adult patients of asthma is 0.382, and the odds ratio of activity limitations for income level of $75000 or more in adult patients of asthma is 0.171. The odds ratio of physical health problems for income level of $1-$9999 in adult patients of asthma is 1.757, the odds ratio of physical health problems for income level of $25000-$34999 in adult patients of asthma is 1.340, and the odds ratio of physical health problems for income level of $75000 or more in adult patients of asthma is 0.569. The odds ratio of mental health problems for income level of $1-$9999 in adult patients of asthma is 1.847, the odds ratio of mental health problems for income level of $25000-$34999 in adult patients of asthma is 1.190, and the odds ratio of mental health problems for income level of $75000 or more in adult patients of asthma is 0.541 (table 61).

Income level of $1-$9999 in adult patients of asthma increases activity limitations by 175.48% more than in income level of $25000-$34999 in adult patients of asthma and by 188.64% more than in income level of $75000 or more in adult patients of asthma with the true population effect between 15.7% to 100% and statistically significant association. Income level of $1-$9999 in adult patients of asthma increases physical health problems by 26.92% more than in income level of $25000-$34999 in adult patients of asthma and by 102.14% more than in income level of $75000 or more in adult patients of asthma with the true population effect between 53.1% to 100% and statistically significant association. Income level of $1-$9999 in adult patients of asthma increases mental health problems by 43.26% more than in income level of $25000-$34999 in adult patients of asthma and by 109.38% more than in income level of $75000 or more in adult patients of asthma with the true population effect between 50.4% to 100% and statistically significant association (table 60&61).

Health care coverage has statistically significant association and predictive relation with only mental health problems in adult patients of asthma (table 65&66). The odds ratio of mental health problems for health care coverage in adult patients of asthma is 0.914 while the odds ratio of mental health problems for asthma is 0.997 (table 42&62). Health care coverage in adult patients of asthma decreases mental health problems by 8.68% less than in adult patients of asthma, who do not have health care coverage, with the true population effect between 72.7% to 92.6% and statistically significant association (table 62).

Education level has statistically significant association and predictive relation with activity limitations, physical health problems, and mental health problems in adult

patients of asthma (table 65&66). However, there are six levels of education level as a predictor variable including: never attended school, grades 1 through 8, grades 9 through 11, grade 12 or GED, college 1 year to 3 years, and college 4 years or more. Each one of these levels has different odds ratio leading to indicate the difference of impact between these levels on HRQoL in adult patients of asthma including: activity limitations, physical health problems, and mental health problems.

The odds ratio of activity limitations for education level of college 4 years or more in adult patients of asthma is 0.751, the odds ratio of activity limitations for education level of grade 12 or GED in adult patients of asthma is 1.343, and the odds ratio of activity limitations for never attended school in adult patients of asthma is 1.331. The odds ratio of physical health problems for education level of college 4 years or more in adult patients of asthma is 0.716, the odds ratio of physical health problems for education level of grade 12 or GED in adult patients of asthma is 0.795, and the odds ratio of physical health problems for never attended school in adult patients of asthma is 1.397. The odds ratio of mental health problems for education level of college 4 years or more in adult patients of asthma is 1.225, the odds ratio of mental health problems for education level of grade 12 or GED in adult patients of asthma is 1.336, and the odds ratio of mental health problems for never attended school in adult patients of asthma is 0.816 (table 64).

Education level of college 4 years or more in adult patients of asthma decreases activity limitations by 65.54% less than in education level of grade 12 or GED in adult patients of asthma and by 55.71% less than in never attended school in adult patients of asthma with the true population effect between 39.2% to 100% and statistically

significant association. Education level of college 4 years or more in adult patients of asthma decreases physical health problems by 10.45% less than in education level of grade 12 or GED in adult patients of asthma and by 64.45% less than in never attended school in adult patients of asthma with the true population effect between 40.7% to 100% and statistically significant association. Education level of college 4 years or more in adult patients of asthma decreases mental health problems by 8.66% less than in education level of grade 12 or GED in adult patients of asthma and by 40.07% more than in never attended school in adult patients of asthma with the true population effect between 65.1% to 100% and statistically significant association (table 63&64).

5.2 Conclusion:

Although there are many researches have studied the concept of health related quality of life (HRQoL) in the relation to many different demographic characteristics or different diseases by using different database, this research used the most recent BRFSS (2014) database to study and investigate the impact of asthma as well as different associated factors including: behavioral, clinical, and socioeconomic factors on more indicators of HRQoL that have not done before. Behavioral factors in this research include smoking, frequency of smoking, quitting smoking, exercise, health routine checkup, and alcohol use. Clinical factors in this research include depressive disorder, body mass index (BMI), diabetes, influenza vaccine, and pneumonia vaccine. Socioeconomic factors in this research include stress, income level, health care coverage, and education level. Health related quality of life (HRQoL) in this research include activity limitations, physical health, and mental health.

BRFSS 2014 data consists of 461,436 patients, 42,875 of these patients are current adult patients of asthma. Statistical Analysis System Software (SAS) 9.4 was used to perform different analysis methods including: descriptive analysis methods, inferential analysis methods, and predictive analysis models. Significance level was chosen to be 0.05 or less.

As a result of descriptive analysis of all research hypotheses, it is obvious that adult patients of asthma have higher observations in having health problems including: activity limitations, physical health, and mental health than adult patients without asthma. Also, it is obvious that adult patients of asthma, who have behavioral, clinical, and socioeconomic issues, have higher observations in having these health problems than adult patients of asthma, who do not have behavioral, clinical, and socioeconomic issues.

As a result of inferential analysis of all research hypotheses, it is obvious that the majority of p-values are < .0001, meaning the null hypothesis is rejected and there is a significant association between each one of HRQoL indicator variables and each one of behavioral, clinical, and socioeconomic predictor variables.

As a result of predictive analysis, of all research hypotheses, it is obvious that the majority of p-values are Pr > chi-Sq is < 0.0001, meaning the null hypothesis is rejected and there is a significant predictive relation between each one of HRQoL indicator variables and each one of behavioral, clinical, and socioeconomic predictor variables.

In general, adult patients of asthma have activity limitations by 64.90%, physical health problems by 163.40%, and mental health problems by 163.53% more than adult healthy people.

Each one of smoking, frequency of smoking, exercise, alcohol use, depressive disorder, body mass index (BMI), diabetes, and stress as a predictor variables has statistically significant association and predictive relation with HRQoL in adult patients of asthma. However, these predictor variables are bad variables to have increase activity limitations, physical health problems, and mental health HRQoL in adult patients of asthma.

Smoking in adult patients of asthma increases activity limitations by 116.18%, physical health problems by 19.12%, and mental health problems by 40.41% more than in adult patients of asthma, who do not smoke. Every day smoking in adult patients of asthma increases activity limitations by 55.52%, physical health problems by 27.52%, and mental health problems by 89.49% more than in not at all smoking in adult patients of asthma. Exercise in adult patients of asthma increases activity limitations by 144.27%, physical health problems by 26.47%, and mental health problems by 15.37% more than in adult patients of asthma, who do not exercise. Alcohol use in adult patients of asthma increases mental health problems by 2.67% more than in adult patients of asthma, who do not use alcohol. Depressive disorder in adult patients of asthma increases activity limitations by 151.63%, physical health problems by 56.55%, and mental health problems by 113.95% more than in adult patients of asthma, who do not have depressive disorder. Obese in adult patients of asthma increases activity limitations by 73.57%, physical health problems by 41.50%, and mental health problems by 17.20% more than in normal weight in adult patients of asthma. Diabetes in adult patients of asthma increases activity limitations by 90.49%, physical health problems by 19.29%, and mental health problems by 1.69% more than in adult patients of asthma, who do not

smoke. Always stressed in adult patients of asthma increases activity limitations by 188.52%, physical health problems by 90.17%, and mental health problems by 157.20% more than in never stressed in adult patients of asthma.

Each one of quitting smoking, health routine checkup, influenza vaccine, pneumonia vaccine, and health care coverage has statistically significant association and predictive relation HRQoL in adult patients of asthma. However, these predictor variables are good variables to have because they decrease activity limitations, physical health problems, and mental health HRQoL in adult patients of asthma.

Quitting smoking within the past month in adult patients of asthma increases activity limitations by 56.81%, physical health problems by 30.76%, and mental health problems by 40.95% more than in quitting smoking within the past 10 years in adult patients of asthma. Health routine checkup within the past year in adult patients of asthma decreases activity limitations by 23.22% and mental health problems by 2.8% more than in never did health routine checkup in adult patients of asthma. Influenza vaccine in adult patients of asthma decreases activity limitations by 1.74%, physical health problems by 38.41%, and mental health problems by 14.87% less than in adult patients of asthma, who do not have influenza vaccine. Pneumonia vaccine in adult patients of asthma decreases activity limitations by 13.38%, physical health problems by 17.04%, and mental health problems by 15.68% less than in adult patients of asthma, who do not pneumonia vaccine. Health care coverage in adult patients of asthma decreases mental health problems by 8.68% more than in adult patients of asthma, who do not have health care coverage.

Each one of income level and education level has statistically significant association and predictive relation with HRQoL in adult patients of asthma. However, these predictor variables depend on the level, as the levels are higher as the HRQoL indicator variables are better.

Income level of $1-$9999 in adult patients of asthma increases activity limitations by 188.64%, physical health problems by 102.14%, and mental health problems by 109.38% more than in income level of $75000 or more in adult patients of asthma. Education level of college 4 years or more in adult patients of asthma decreases activity limitations by 65.54%, physical health problems by 10.45%, and mental health problems by 8.66% less than in education level of grade 12 or GED in adult patients of asthma.

Finally, even if there are few good behavioral, clinical, and socioeconomic factors that make health related quality of life is better in adult patients of asthma, there some behavioral, clinical, and socioeconomic factors can make HRQoL worst if they occur along with asthma disease. Also, we can confirm that adult patients of asthma in the United States are in high risk to have poorer HRQoL than adult people with no asthma.

5.3 Future Research Recommendations:

This research is proposed to measure health-related quality of life (HRQoL) of adult patients of asthma in the United States by measuring the impact of asthma disease as well as different associated factors. Since that measuring HRQoL is valid, reliable, sensitive, responsive, and interpretable to monitor HRQoL of adult patients of asthma, this measuring would allow to get a complete knowledge and understanding of the impact of this disease as well as the impact of different associated factors on adult patients of asthma.

This research is limited to Behavioral Risk Factor Surveillance System (BRFSS) 2014 database, which is based on telephone survey, not clinical diagnosis operated by specialists. So, the results might be underestimated. Also, this research is based on a U.S. population. Therefore, generalizing the results to other countries must be interpreted carefully. This type of data can give us a general great vision about the impact of a specific disease as well as several important associated factors. However, there is a need for clinical diagnosis data operated by specialists to analyze the impact of any specific disease with associated factors to avoid underestimation of the results. Also, it is a great idea to have worldwide data for measuring the impact of specific and associated factors on HRQoL of different patients from different countries.

Moreover, a full-measure scale or comprehensive view of the impact of other diseases as well as other different associated factors disease would help the researchers of this specific disease to increase their ability to describe and predict health outcomes regarding to the measure of the impact of this disease and these different associated factors. Also, this full-measure scale would create successful understanding in purpose to manage different associated factors in a specific disease. In addition, this comprehensive view would help to get better knowledge and understanding of the interaction between certain associated factors and that specific disease. All that would help the patients of a specific disease to have knowledge and understanding of different associated factors that might affect their HRQoL in purpose to control that specific disease to have a better life.

REFERENCES:

[1] Centers for Disease Control and Prevention (CDC). 2014. Asthma. Available at http://www.cdc.gov/asthma/ retrieved from internet on October 13, 2015.

[2] Australian Centre for Asthma Monitoring 2004. Measuring the impact of asthma on quality of life in the Australian population.AIHW Cat No. ACM 3 Canberra: AIHW.ISBN 1740244338.

[3] National Institutes of Health (NIH) 2014. What Is Asthma?. Available at http://www.nhlbi.nih.gov/health/health-topics/topics/asthma retrieved from internet on October 13, 2015.

[4] Ferreira LN, Brito U, and Ferreira PL. Quality of life in asthma patients. Sociedade Portuguesa de Pneumologia 2012: Volume 16, Issue 1, 2010. DOI: 10.1016/S0873-2159 (15) 30005-2.

[5] Chen H, Gould MK, Blanc PD, Miller DP, Kamath TV, Lee JH, and Sullivan SD. Asthma control, severity, and quality of life: quantifying the effect of uncontrolled disease. American Academy of Allergy, Asthma & Immunology 2007: 120 (2): 396-402. DOI: 101016/jjaci200704040.

[6] Testa MA, Simonson DC. Assesment of quality-of-life outcomes. N Engl J Med. 1996: 334 (13): 835-40. PMID: 8596551.

[7] Strine TW, Ford ES, Balluz L, Chapman DP, Mokdad AH. Risk behaviors and health-related quality of life among adults with asthma: the role of mental health status. Chest. 2004:126 (6):1849-54. PMID: 15596683.

[8] Di marco F, Verga M, Santus P, Giovannelli F, Busatto P, Neri M, Girbino G, Bonini S, and Centanni S. Close correlation between anxiety, depression, and asthma control. Respir Med. 2010: 104 (1): 22-8. DOI: 10.1016/j.rmed.2009.08.005.

[9] Juniper EF. Using humanistic health outcomes data in asthma. Pharmaco economics. 2001: 19 Suppl 2:13-9. PMID: 11700784.

[10] Behavioral Risk Factor Surveillance System (BRFSS). Centers for Disease Control and Prevention (CDC) 2015. Behavioral Risk Factor Surveillance System (BRFSS). Available at http://www.cdc.gov/brfss/index.html Retrieved from internet on October 25, 2015.

[11] Global Initiative for Asthma (GINA). 1993-2015. General Information About Asthma. Available at http://www.ginasthma.org Retrieved from internet on November 6, 2015.

[12] Thomson NC, Chaudhuri R, Livingston E. Asthma and cigarette smoking. Dept of Respiratory Medicine, Division of Immunology, Infection and Inflammation, University of Glasgow, Glasgow, UK. Eur Respir J. 2004: 24(5): 822-33. PMID: 15516679.

[13] Sisson JH. Alcohol and airways function in health and disease. Alcohol. 2007: 41(5): 293-307. PMID: 17764883.

[14] Carlsen KH, Carlsen KC. Exercise-induced asthma. Paediatr Respir Rev. 2002; 3(2): 154-60. DOI: 10.1016/S1526-0550(02)00009-4. PMID: 12297065.

[15] Zahran HS, Person CJ, Bailey C, Moorman JE. Predictors of asthma self-management education among children and adults--2006-2007 behavioral risk factor surveillance system asthma call-back survey. J Asthma. 2012; 49(1):98-106. DOI: 10.3109/02770903.2011.644012.

[16] Palo Alto Medical Foundation. 2015. Preparing for Your Asthma Check-up. Available at http://www.pamf.org/asthma/education/prepare.html retrieved from internet on November 7, 2015.

[17] Delgado J, Barranco P, Quirce S. Obesity and asthma. J Investig Allergol Clin Immunol. 2008;18(6):420-5. PMID: 19123432.

[18] Ehrlich SF, Quesenberry CP, Van den eeden SK, Shan J, Ferrara A. Patients diagnosed with diabetes are at increased risk for asthma, chronic obstructive pulmonary disease, pulmonary fibrosis, and pneumonia but not lung cancer. Diabetes Care. 2010; 33(1): 55-60. PMID: 19808918.

[19] Centers for Disease Control and Prevention (CDC) 2014. Flu and People with Asthma. Available at http://www.cdc.gov/flu/asthma/ retrieved from internet on November 5, 2015.

[20] Public Health Agency of Canada. An Advisory Committee Statement (ACS). National Advisory Committee on Immunization (NACI). February 2014. Available at http://www.phac-aspc.gc.ca/naci-ccni/acs-dcc/2014/pvaa-vaaa_0414-eng.php retrieved from internet on November 5, 2015.

[21] Chen E, Miller GE. Stress and inflammation in exacerbations of asthma. Brain Behav Immun. 2007;21(8):993-9. doi:10.1016/j.bbi.2007.03.009. PMID: 17493786.

[22] Kozyrskyj AL, Kendall GE, Jacoby P, Sly PD, Zubrick SR. Association between socioeconomic status and the development of asthma: analyses of income trajectories. Am J Public Health. 2010; 100(3): 540-6. PMID: 19696386.

[23] Szilagyi PG, Dick AW, Klein JD, et al. Improved asthma care after enrollment in the State Children's Health Insurance Program in New York. Pediatrics. 2006; 117(2): 486-96. PMID: 16452369.

[24] Eagan TM, Gulsvik A, Eide GE, Bakke PS. The effect of educational level on the incidence of asthma and respiratory symptoms. Respir Med. 2004; 98(8): 730-6. PMID: 15303637.

[25] Partners Asthma Center. 2010. The Harvard Medical School Guide To Taking Control Of Asthma: Chapter 1: What is Asthma? Available at http://www.asthma.partners.org/NewFiles/HMSTakingControlOfAsthmaChapter1.html#top%20shaperect retrieved from internet on November 7, 2015

[26] Mansi R, Joshi S.V, Pandloskar S.R, and Dhar H.L. 2007. Correlation between blood sugar, cholesterol and asthma status. Indian J Allergy Asthma Immunol. 2007; 21: 31–4.

[27] Gorman BK, Chu M. Racial and ethnic differences in adult asthma prevalence, problems, and medical care. Ethn Health. 2009; 14(5): 527-52. PMID: 19533477.

[28] National Asthma Education and Prevention Program (NAEPP), Third Expert Panel on the Diagnosis and Management of Asthma. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Bethesda (MD): National Heart, Lung, and Blood Institute (US); 2007 Aug. Section 4, Stepwise Approach for Managing Asthma in Youths ≥12 Years of Age and Adults.

[29] Mason R.J, Broaddus V.C, King T, King T, Schraufnagel D, Murray F, and Nadel J.A. 2010. Murray and Nadel's Textbook of Respiratory Medicine, 5th Edition. ISBN: 978-1-4160-4710-0.

[30] Lemanske RF, Busse WW. Asthma: clinical expression and molecular mechanisms. J Allergy Clin Immunol. 2010;125(2 Suppl 2):S95-102. DOI: 10.1016/j.jaci.2009.10.047. PMID 20176271.

[31] Ripoll I, and Leutholtz B.C. 2011. Exercise and Disease Management, Second Edition. ISBN 978-1-4398-2759-8.

[32] Partners Asthma Center. 2010. Breath Of Fresh Air: Feature Articles. Chapter 30: Cigarette Smoking and Asthma. Available at http://www.asthma.partners.org/NewFiles/BoFAChapter30.html#top%20shaperect Retrieved from internet on November 9, 2015.

[33] Boulet LP, Fitzgerald JM, Mcivor RA, Zimmerman S, Chapman KR. Influence of current or former smoking on asthma management and control. Can Respir J. 2008; 15(5): 275-9. PMCID: PMC2679551.

[34] Journal of Allergy and Clinical Immunology (JACI). 2015. Cigarette smoking and severe asthma - a harmful mix. Available at http://www.aaaai.org/global/latest-research-

summaries/Current-JACI-Research/cigarette-smoking-severe-asthma.aspx Retrieved from internet on November 9, 2015

[35] Althuis MD, Sexton M, and Prybylski D. Cigarette smoking and asthma symptom severity among adult asthmatics. J Asthma. 1999;36(3):257-64. PMID: 10350222.

[36] Ulrik CS, and Lange P. Cigarette smoking and asthma. Monaldi Arch Chest Dis. 2001; 56 (4): 349-53.PMID: 11770219.

[37] Siroux V, Pin I, Oryszczyn MP, Le moual N, and Kauffmann F. Relationships of active smoking to asthma and asthma severity in the EGEA study. Epidemiological study on the Genetics and Environment of Asthma. Eur Respir J. 2000; 15(3): 470-7. PMID: 10759439.

[38] Lange P, Parner J, Vestbo J, Schnohr P, Jensen G. A 15-year follow-up study of ventilatory function in adults with asthma. N Engl J Med. 1998; 339(17): 1194-200. PMID: 9780339.

[39] Boulet LP, Lemière C, Archambault F, Carrier G, Descary MC, Deschesnes F. Smoking and asthma: clinical and radiologic features, lung function, and airway inflammation. Chest. 2006; 129(3): 661-8. PMID: 16537865.

[40] Chalmers GW, Macleod KJ, Little SA, Thomson LJ, Mcsharry CP, Thomson NC. Influence of cigarette smoking on inhaled corticosteroid treatment in mild asthma. Thorax. 2002; 57(3): 226-30. PMID: 11867826.

[41] Livingston E, Thomson NC, Chalmers GW. Impact of smoking on asthma therapy: a critical review of clinical evidence. Drugs. 2005; 65(11): 1521-36. PMID: 16033290.

[42] Romero palacios PJ. [Asthma and tobacco smoke]. Arch Bronconeumol. 2004; 40(9): 414-8. PMID: 15458618.

[43] Asthma UK. 2015. Asthma triggers: Alcohol. Available at http://www.asthma.org.uk/advice-trigger-alcohol Retrieved from internet on November 10, 2015.

[44] Partners Asthma Center. 2010. Breath Of Fresh Air: Feature Articles. Chapter 4: Exercise and Asthma. Retrieved from internet on November 10, 2015. Available at http://www.asthma.partners.org/NewFiles/BoFAChapter4.html#top%20shaperect

[45] American Academy of Allergy, Asthma & Immunology. 2015. Exercise-Induced Bronchoconstriction (EIB). Available at http://www.aaaai.org/conditions-and-treatments/conditions-dictionary/exercise-induced-bronchoconstriction.aspx Retrieved from internet on November 10, 2015.

[46] Khan DA, and Carlsen KC. Exercise-induced bronchoconstriction: burden and prevalence. Allergy Asthma Proc. 2012; 33(1): 1-6. PMID: 22370526.

[47] Parsons JP, Cosmar D, Phillips G, Kaeding C, Best TM, and Mastronarde JG. Screening for exercise-induced bronchoconstriction in college athletes. J Asthma. 2012; 49(2): 153-7. PMID: 22276571.

[48] Asthma Australia. 2013. Asthma, anxiety & depression. Available at http://www.asthmaaustralia.org.au/WorkArea/DownloadAsset.aspx?id=19327353887 Retrieved from internet on November 11, 2015.

[49] Krommydas GC, Gourgoulianis KI, Angelopoulos NV, Kotrotsiou E, Raftopoulos V, Molyvdas PA. Depression and pulmonary function in outpatients with asthma. Respir Med. 2004; 98(3):220-4. PMID: 15002757. DOI: 10.1016/j.rmed.2003.09.018.

[50] Goral A, Lipsitz JD, Muhsen K, Gross R. Depressive symptoms, risk factors and sleep in asthma: results from a national Israeli health survey. Gen Hosp Psychiatry. 2012;34(1):17-23. DOI: 10.1016/j.genhosppsych.2011.09.007.

[51] Rumbak MJ, Kelso TM, Arheart KL, and Self TH. Perception of anxiety as a contributing factor of asthma: indigent versus nonindigent. J Asthma. 1993; 30(3): 165-9. PMID: 8325825.

[52] Yellowlees PM, and Kalucy RS. Psychobiological aspects of asthma and the consequent research implications. Chest. 1990;97(3):628-34. PMID: 2407451.

[53] Katon WJ, Richardson L, Lozano P, Mccauley E. The relationship of asthma and anxiety disorders. Psychosom Med. 2004; 66(3): 349-55. PMID: 15184694.

[54] Goodwin RD, Jacobi F, and Thefeld W. Mental disorders and asthma in the community. Arch Gen Psychiatry. 2003;60(11):1125-30. PMID: 14609888.

[55] Goodwin RD, Olfson M, Shea S, Lantigua RA, Carrasquilo O, Gameroff MJ, and Weissman MM. Asthma and mental disorders in primary care. Gen Hosp Psychiatry. 2003; 25(6): 479-83. PMID: 14706414.

[56] Goodwin RD, Fergusson DM, and Horwood LJ. Asthma and depressive and anxiety disorders among young persons in the community. Psychol Med. 2004; 34(8): 1465-74. PMID: 15724877.

[57] Prosser R, Carleton B, and Smith A. The comorbidity burden of the treated asthma patient population in British Columbia. Chronic Dis Can. 2010; 30(2): 46-55. PMID: 20302685.

[58] Dimatteo MR, Lepper HS, Croghan TW. Depression is a risk factor for noncompliance with medical treatment: meta-analysis of the effects of anxiety and

depression on patient adherence. Arch Intern Med. 2000; 160(14): 2101-7. PMID: 10904452.

[59] Eisner MD, Katz PP, Lactao G, Iribarren C. Impact of depressive symptoms on adult asthma outcomes. Ann Allergy Asthma Immunol. 2005; 94(5): 566-74. PMID: 15948301.

[60] Strine TW, Mokdad AH, Balluz LS, Berry JT, Gonzalez O. Impact of depression and anxiety on quality of life, health behaviors, and asthma control among adults in the United States with asthma, 2006. J Asthma. 2008; 45(2): 123-33. PMID: 18350404.

[61] Scott KM, Von Korff M, Ormel J, Zhang MY, Bruffaerts R, Alonso J, Kessler RC, Tachimori H, Karam E, Levinson D, Bromet EJ, Posada-Villa J, Gasquet I, Angermeyer MC, Borges G, de Girolamo G, Herman A, and Haro JM. Mental disorders among adults with asthma: results from the World Mental Health Survey. Gen Hosp Psychiatry. 2007; 29(2): 123-33. PMID: 17336661. DOI: 10.1016/j.genhosppsych. 2006.12.006.

[62] Strunk RC, Mrazek DA, Fuhrmann GS, and Labrecque JF. Physiologic and psychological characteristics associated with deaths due to asthma in childhood. A case-controlled study. JAMA. 1985; 254(9): 1193-8. PMID: 4021061.

[63] de Voogd JN, Wempe JB, Koëter GH, Postema K, van Sonderen E, Ranchor AV, Coyne JC, and Sanderman R. Depressive symptoms as predictors of mortality in patients with COPD. Chest. 2009; 135(3): 619-25. PMID: 19029432.

[64] Centers for Disease Control and Prevention (CDC) 2013. Asthma and Obesity. Available at http://www.cdc.gov/asthma/asthma_stats/asthma_obesity.htm Retrieved from internet on November 11, 2015.

[65] Ten hacken NH. Physical inactivity and obesity: relation to asthma and chronic obstructive pulmonary disease?. Proc Am Thorac Soc. 2009;6(8):663-7. PMID: 20008872.

[66] Zammit C, Liddicoat H, Moonsie I, and Makker H. Obesity and respiratory diseases. Int J Gen Med. 2010;3:335-43. doi: 10.2147/IJGM.S11926.

[67] Ehrlich SF, Quesenberry CP, Van den eeden SK, Shan J, and Ferrara A. Patients diagnosed with diabetes are at increased risk for asthma, chronic obstructive pulmonary disease, pulmonary fibrosis, and pneumonia but not lung cancer. Diabetes Care. 2010;33(1):55-60. PMID: 19808918.

[68] Hsia CC, and Raskin P. Lung function changes related to diabetes mellitus. Diabetes Technol Ther. 2007; 9 Suppl 1: S73-82. PMID: 17563307.

[69] Litonjua AA, Lazarus R, Sparrow D, Demolles D, and Weiss ST. Lung function in type 2 diabetes: the Normative Aging Study. Respir Med. 2005; 99(12): 1583-90. PMID: 16291079.

[70] Mckeever TM, Weston PJ, Hubbard R, and Fogarty A. Lung function and glucose metabolism: an analysis of data from the Third National Health and Nutrition Examination Survey. Am J Epidemiol. 2005; 161(6): 546-56. PMID: 15746471.

[71] Lawlor DA, Ebrahim S, and Smith GD. Associations of measures of lung function with insulin resistance and Type 2 diabetes: findings from the British Women's Heart and Health Study. Diabetologia. 2004; 47(2): 195-203. PMID: 14704837.

[72] Davis WA, Knuiman M, Kendall P, Grange V, Davis TM. Glycemic exposure is associated with reduced pulmonary function in type 2 diabetes: the Fremantle Diabetes Study. Diabetes Care. 2004; 27(3): 752-7. PMID: 14988297.

[73] Lange P, Parner J, Schnohr P, and Jensen G. Copenhagen City Heart Study: longitudinal analysis of ventilatory capacity in diabetic and nondiabetic adults. Eur Respir J. 2002; 20(6): 1406-12. PMID: 12503696.

[74] Lange P, Groth S, Mortensen J, Appleyard M, Nyboe J, Schnohr P, and Jensen G. Diabetes mellitus and ventilatory capacity: a five year follow-up study. Eur Respir J. 1990; 3(3): 288-92. PMID: 2340886.

[75] Innocenti F1, Fabbri A, Anichini R, Tuci S, Pettinà G, Vannucci F, De Giorgio LA, and Seghieri G. Indications of reduced pulmonary function in type 1 (insulin-dependent) diabetes mellitus. Diabetes Res Clin Pract. 1994; 25(3): 161-8. PMID: 7851270.

[76] Lange P, Groth S, Kastrup J, Mortensen J, Appleyard M, Nyboe J, Jensen G, and Schnohr P. Diabetes mellitus, plasma glucose and lung function in a cross-sectional population study. Eur Respir J. 1989; 2(1): 14-9. PMID: 2651148.

[77] Weir DC, Jennings PE, Hendy MS, Barnett AH, Burge PS. Transfer factor for carbon monoxide in patients with diabetes with and without microangiopathy. Thorax. 1988; 43(9): 725-6. PMCID: PMC461463.

[78] Centers for Disease Control and Prevention (CDC). 2015. Vaccines and Immunizations. Available at http://www.cdc.gov/vaccines/vpd-vac/pneumo/vacc-in-short.htm Retrieved from internet on November 18, 2015.
[79] Asthma Australia. 2015. Colds and flu. Retrieved from internet on November 18, 2015. Available at http://www.asthmaaustralia.org.au/Colds_and_flus.aspx

[80] The American Institute of Stress. 1979-2015. What is Stress? Available at http://www.stress.org/what-is-stress/ Retrieved from internet on November 18, 2015.

[81] Cohen, S., Kessler, R. C., & Underwood Gordon, L. (Eds.) (1995). Measuring stress: A guide for health and social scientists. New York: Oxford. Chapter 1: Strategies for measuring stress in studies of psychiatric and physical disorders

[82] Chen E, Hanson MD, Paterson LQ, Griffin MJ, Walker HA, Miller GE. Socioeconomic status and inflammatory processes in childhood asthma: the role of psychological stress. J Allergy Clin Immunol. 2006; 117(5): 1014-20. DOI: 10.1016/j.jaci.2006.01.036.

[83] Partners Asthma Center. 2010. Breath Of Fresh Air: Feature Articles. Chapter 15: Poverty and Asthma. Available at http://www.asthma.partners.org/NewFiles/BoFAChapter15.html Retrieved from internet on November 12, 2015

[84] Bandiera FC, Pereira DB, Arif AA, Dodge B, and Asal N. Race/ethnicity, income, chronic asthma, and mental health: a cross-sectional study using the behavioral risk factor surveillance system. Psychosom Med. 2008; 70(1): 77-84. PMID: 18158369.

[85] Winston C. Liao, Robert L. Woldman. North Carolina Division of Public Health and Conceptual MindWorks, Inc. Relation between health care coverage and childhood asthma-Related Outcomes.

[86] Clark NM, Mitchell HE, and Rand CS. Effectiveness of educational and behavioral asthma interventions. Pediatrics. 2009; 123 Suppl 3: S185-92. DOI: 10.1542/peds.2008-2233I.

[87] Basagaña X, Sunyer J, Kogevinas M, Zock J, Tauleria E, Jarvis D, Burney P, and Anto J. Socioeconomic status and asthma prevalence in young adults: the European Community Respiratory Health Survey. Am J Epidemiol. 2004; 160(2): 178-88. DOI: 10.1093/aje/kwh186.

[88] Fayers P, and Machin D. Quality of Life, Assessment, Analysis, and Interpretation. John Wiley & Sons Incorporated; 2000. ISBN: 9780471968610. DOI: 10.1002/0470846283.

[89] Spilker B 1990. Introduction. In: Spilker B (eds). Quality of life assessments in clinical trials. New York: New York Taven Press, Pages 3–9.

[90] Juniper EF, Wisniewski ME, Cox FM, Emmett AH, Nielsen KE, and O'byrne PM. Relationship between quality of life and clinical status in asthma: a factor analysis. Eur Respir J. 2004; 23(2): 287-91. PMID: 14979505.

[91] Marks GB, Dunn SM, and Woolcock AJ. An evaluation of an asthma quality of life questionnaire as a measure of change in adults with asthma. J Clin Epidemiol. 1993; 46(10): 1103-11. PMID: 8410095.

[92] Williams S, Sehgal M, Falter K, Dennis R, Jones D, Boudreaux J, Homa D, Raskin-Hood C, Brown C, Griffith M, and Redd S. Effect of asthma on the quality of life among children and their caregivers in the Atlanta Empowerment Zone. J Urban Health. 2000; 77(2): 268-79. PMID: 10856008.

[93] Feeny D, Furlong W, Mulhern RK, Barr RD, and Hudson M. A framework for assessing health-related quality of life among children with cancer. Int J Cancer Suppl. 1999; 12:2-9. PMID: 10679863.

[94] Kirshner B, and Guyatt G. A methodological framework for assessing health indices. J Chronic Dis. 1985; 38(1): 27-36. PMID: 3972947.

[95] Mishra G, and Schofield MJ. Norms for the physical and mental health component summary scores of the SF-36 for young, middle-aged and older Australian women. Qual Life Res. 1998; 7(3): 215-20. PMID: 9584551.

[96] Ware JE, and Gandek B. Overview of the SF-36 Health Survey and the International Quality of Life Assessment (IQOLA) Project. J Clin Epidemiol. 1998; 51(11): 903-12. PMID: 9817107.

[97] Patrick DL, and Deyo RA. Generic and disease-specific measures in assessing health status and quality of life. Med Care. 1989; 27(3 Suppl): S217-32. PMID: 2646490.

[98] Rabin R, and De charro F. EQ-5D: a measure of health status from the EuroQol Group. Ann Med. 2001; 33(5): 337-43. PMID: 11491192.

[99] Cook KF, Ashton CM, Byrne MM, Brody B, Geraci J, Giesler RB, Hanita M, Souchek J, and Wray NP. A psychometric analysis of the measurement level of the rating scale, time trade-off, and standard gamble. Soc Sci Med. 2001;53(10):1275-85. PMID: 11676400.

[100] Western Oregon University. Chapter 3. Central Tendency. PDF Available at https://www.wou.edu/las/physci/taylor/g302/dataanal.pdf Retrieved from internet on December 1, 2015.

[101] Australian Bureau of Statistics. 2013. Measures of Central Tendency. Available at http://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical+language+-+measures+of+central+tendency Retrieved from internet on December 1, 2015.

[102] Manikandan S. Measures of central tendency: Median and mode. J Pharmacol Pharmacother. 2011;2(3):214-5. PMCID: PMC3157145. DOI: 10.4103/0976-500X.83300.

[103] Chernick MR, Friis RH. Introductory Biostatistics for the Health Sciences, Modern Applications Including Bootstrap. John Wiley & Sons; 2003. ISBN 0-471-41137-X.

[104] Manikandan S. Measures of central tendency: The mean. J Pharmacol Pharmacother. 2011;2(2):140-2. PMCID: PMC3127352. DOI: 10.4103/0976-500X.81920.

[105] Manikandan S. Measures of dispersion. J Pharmacol Pharmacother. 2011; 2(4): 315-6. PMC3198538. DOI: 10.4103/0976-500X.85931.

[106] Griffiths AJF, Gelbart WM, Miller JH, and Lewontin RC. Modern Genetic Analysis. New York: W. H. Freeman; 1999. Measures of Dispersion: The Variance. ISBN-10: 0-7167-3118-5. Bookshelf ID: NBK21375.

[107] Manikandan S. Frequency distribution. J Pharmacol Pharmacother. 2011; 2(1): 54-6. PMC3117575. DOI: 10.4103/0976-500X.77120.

[108] Pennsylvania State University.Chapter 2: Frequency Distributions and Graphs. PDF Available at http://bk.psu.edu/clt/Stat200/Chapter2_Printable.pdf retrieved from internet on December 1, 2015.

[109] Lora D. Delwiche and Susan J. Slaughter. The Little SAS® Book: A Primer, Fifth Edition. Chapter 8 and chapter9. October 2012. SAS Institute. ISBN# 978-1-61290-343-9.

[110] Bewick V, Cheek L, Ball J. Statistics review 9: one-way analysis of variance. Crit Care. 2004;8(2):130-6. PMCID: PMC420045. DOI: 10.1186/cc2836.

[111] The University of California, Los Angeles. Institute for Digital Research and Education. What statistical analysis should I use? Statistical analyses using SAS. 2015. Available at http://www.ats.ucla.edu/stat/sas/whatstat/whatstat.htm Retrieved from internet on December 5, 2015.

[112] John Maindonald. August 2010. Parametric vs Nonparametric Models for Discrimination & Classi cation.

[113] Mukaka MM. Statistics corner: A guide to appropriate use of correlation coefficient in medical research. Malawi Med J. 2012;24(3):69-71. PMCID: PMC3576830.

[114] Mchugh ML. The chi-square test of independence. Biochem Med (Zagreb). 2013;23(2):143-9. PMCID: PMC3900058. DOI: 10.11613/BM.2013.018.

[115] Zhang B, Zhang Y. Mann-Whitney U test and Kruskal-Wallis test should be used for comparisons of differences in medians, not means: comment on the article by van der Helm-van Mil et al. Arthritis Rheum. 2009; 60(5): 1565. PMID: 19404977. DOI: 10.1002/art.24497.

[116] Boston University School of Public Health. 2013. Tests with More than Two Independent Samples. The Kruskal-Wallis Test. Available at

http://sphweb.bumc.bu.edu/otlt/MPH-Modules/BS/BS704_Nonparametric/BS704_Nonparametric7.html Retrieved from internet on December 6, 2015.

[117] Marill KA. Advanced statistics: linear regression, part I: simple linear regression. Acad Emerg Med. 2004;11(1):87-93. PMID: 14709436. DOI: 10.1197/j.aem.2003.09.005.

[118] Marill KA. Advanced statistics: linear regression, part II: multiple linear regression. Acad Emerg Med. 2004;11(1):94-102. PMID: 14709437. DOI: 10.1197/j.aem.2003.09.006.

[119] Szumilas M. Explaining odds ratios. J Can Acad Child Adolesc Psychiatry. 2010;19(3) :227-9. PMCID: PMC2938757.

[120] Sperandei S. Understanding logistic regression analysis. Biochem Med (Zagreb). 2014;24 (1):12-8. PMCID: PMC3936971. doi: 10.11613/BM.2014.003.

[121] Bewick V, Cheek L, Ball J. Statistics review 14: Logistic regression. Crit Care. 2005;9(1):112-8. PMCID: PMC1065119. doi: 10.1186/cc3045.

[122] Kirk Paul Lafler. Basic SAS PROCedures for Generating Quick Results. Paper 256-29.SAS, SAS Alliance Partner, and SAS Certified Professional are registered trademarks of SAS Institute Inc. in the USA and other countries.

[123] Geoff Cumming. 2010. UNDERSTANDING, TEACHING AND USING p VALUES. School of Psychological Science, La Trobe University, Australia. ICOTS8 (2010) Invited Paper Refereed.

[124] Shanta Pandey and Charlotte Lyn Bright. 2008. What Are Degrees of Freedom? CCCCode: 107O-S3O9/O8. National Association of Sotial Workers.

[125] David W. Stockburger. Missouri State University. Introductory Statistics: Concepts, Models, and Applications. ANOVA. @Copyright 1996 by David W. Stockburger.

[126] Clemson University.2006.Physics Tutorial: % Error & % Difference. Available at http://www.clemson.edu/ces/phoenix/tutorials/error/ Retrieved from internet on Marc 6, 2015.