2017

RESPIRATORY FUNCTION AND ASSOCIATED RISK FACTORS IN THE KENTUCKY WOMEN'S HEALTH REGISTRY

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RESPIRATORY FUNCTION AND ASSOCIATED RISK FACTORS IN THE KENTUCKY WOMEN'S HEALTH REGISTRY.

CAPSTONE PROJECT PAPER

A paper submitted in partial fulfillment of the requirements for the degree of Master of Public Health in the University Of Kentucky College Of Public Health

By

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Lexington, Kentucky

April, 2017

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ABSTRACT:

From the University of Kentucky Women's Health Registry Database (KWHRD) a total of 1838 women were voluntarily asked to undergo Spirometric respiratory function tests. These women came to the clinic for various reasons. Various independent variables (risk factors) were also recorded for these women. Among these risk factors were: age, BMI, smoking status, asthmatic status, educational status and ethnicity.

The purpose of the study was to investigate whether any of the risk factors had significant impacts on women's respiratory health. Appropriate categorizations were tabulated for each risk factor so that comparisons would be possible and easier. The motivation of the research was to find out the negative outcomes of the statistical results of the comparisons of the independent and dependent variables, and develop preventive strategies to promote and improve women's respiratory health in this specific population. SPSS 22 software was used to analyze the results of the above mentioned risk factors on respiratory function variables. Descriptive statistics, simple regression analysis and multiple analyses were employed.

The results thus obtained demonstrate significant reduction as well as improvement in lung function. Aging is correlated with reduction in respiratory reduction. Increase in BMI, cigarette smoking and asthmatic status also reduce lung function. Educational status was found to have significant impact on women's respiratory health. The higher the educational status the better the Spirometric measurement results would be. Ethnicity was not significant in the analysis.

The public health implications of the study were to target the risk factors in Kentucky women in order to improve the respiratory function of women in this specific population. Educating,

empowering and awareness creation in women help to modify some of the behavioral risk patters to mitigate the negative health effects.

INTRODUCTION

Globally, women play key roles in social, economic, and political arenas. Thus, improving women's health should be a priority to each nation in the world. Understanding public health problems such as obesity and, smoking, in terms of affecting women's lung function is of paramount importance to society. There are many risk factors that can cause reduction of respiratory function in women. Most of these factors are preventable.

In attempting to reduce the risk factors to respiratory health, the first steps are to quantify the health risks and to assess their distribution [1]. Some of the most important risk factors in this data set are: age, body mass index (BMI), smoking, asthma, educational status and ethnicity. Regarding age for example, it is clear that populations are aging in most low and middle income countries, against a background of many unsolved infrastructural problems. Aging is a process associated with chronic and disabling diseases. Chronic respiratory diseases are among the most frequent and severe of all, also in the elderly.

Overweight and obesity represent a significant challenge to Americans' health. Their prevalence is a feature of American life with causes and consequences that extend beyond the scope of the health system, including socioeconomic, cultural, political, and lifestyle factors—in particular diet and physical activity, which together constitute leading causes of early death [2].

The U.S. health system is marked by significant challenges beyond the delivery of care in hospitals or provider offices. Such factors as socioeconomic status, behavior, environment, and health literacy have important implications for the health of individuals and communities. It is estimated that in the United States, 10 to 15 percent of preventable mortality is amenable to health care interventions, while approximately 40 percent of preventable deaths are attributable to behavior patterns that could potentially be modified [2]. Paradoxically, it is estimated that 95 percent of U.S. spending on health goes to direct provision of health services, with the remaining 5 percent being spent on public health [2]. While spending on health care is significantly higher in the United States than in other developed countries, the nation spends less, as a proportion of total spending, on public health and social programs that address those aspects of health outside of clinical care [3].

Cigarette smoking and asthma are important risk factors to respiratory disability in women resulting in chronic obstructive pulmonary disease. Improving the health of women must be one of the key goals of any society.

Educational Status is also very important in the health outcome of women. It is associated with high income, increased awareness of health, better and healthy diet, exercise, frequent checkups and insurance. These factors play significant roles in improved health conditions (18).

Ethnicity's role is not considered to be significant, but from the analysis, Caucasians do better than the minority (Hispanics, African-Americans and Asians) probably due to better education.

ANATOMY AND PHYSIOLOGY OF THE RESPIRATORY SYSTEM

The respiratory system is situated in the thorax and is responsible for gaseous exchange between the circulatory system and the outside world. Air (oxygen) is taken in via the upper airways through the lower airways and into the small bronchioles and alveoli within the lung tissue. One of the key components of human health is measured whether or not one has a properly functioning breathing system. A myriad of social, environmental, and economical factors play significant roles on respiratory functions. The health consequence of impaired or compromised breathing system can be particularly important for women exposed to such high risk factors or low social status (e.g., education and income). Identifying breathing risk factors that often impact women is health and societal imperatives. This project is intended to examine and explore the relationship between respiratory function and some risk factors. As part of this study, several factors including age, BMI, smoking, asthma, educational status and Ethnicity were analyzed to examine the cause and effect on respiration using a set of secondary data obtained from the Kentucky Women Health Registry Database (KWHRD). Descriptive and regression analyses were performed to explore how these risk factors affect lung function and performance. Linear regression is a common Statistical Data Analysis technique. It is used to determine the extent to which there is a linear relationship between a dependent variable and one or more independent variables. There are two types of linear regression, simple linear regression and multiple linear regressions.

In **simple linear regression** a single independent variable is used to predict the value of a dependent variable. In **multiple linear regressions** two or more independent variables are used to predict the value of a dependent variable. The difference between the two is the number of independent variables. In both cases there is only a single dependent variable.

Spirometry measurements were used to quantify the changes of lung function.

OBSTRUCTIVE AND RESTRICTIVE LUNG DISEASE

Both chronic obstructive pulmonary disease (COPD) and restrictive lung diseases are important causes of morbidity and mortality in the US. The presence of obstructive or restrictive lung disease or respiratory symptoms in the absence of lung function impairment is associated with increased functional impairment [4].

To categorize the basic types of abnormality (obstruction vs. restriction) we use the FEV1/FVC ratio. Obstructive lung diseases include conditions that make it hard to exhale all the air in the lungs whereas people with restrictive lung diseases have difficulty fully expanding their lungs with air. A reduced FEV_1 /FVC ratio suggests obstruction. If the FEV_1 /FVC ratio is normal or high (with a low FVC), the abnormality is restriction. Spirometry measurements were used to quantify the changes of lung function. Spirometry is the simplest, most commonly performed, and most clinically useful pulmonary function test. If VC or FVC is normal, spirometry is generally normal (occasional patients have an isolated abnormality of FEV_1 of uncertain significance). In healthy young and middle-aged adults the FEV_1 /FVC ratio is usually >75% [5]. In the elderly the ratio is usually 70–75%. Reduction in the FEV_1 /FVC ratio indicates airway obstruction. The severity of obstruction is represented by the absolute FEV_1 expressed as a percentage of predicted. Airway obstruction that reverses with inhaled β_2 -agonist or oral steroid over 5 days or more (an absolute increase in FEV_1 >200 ml that is >15% of baseline) favors a diagnosis of asthma over COPD.

REVIEW OF LITERATURE

Currently available literature comparing, FVC, FEV_1, FEV_1/ FVC indicates reduction of respiratory function in those with high BMI, advanced age, smoking status, asthmatic status. As age increases, lung function declines because the elasticity and recoil capacity of the lung tissues deteriorate with age. Age and respiratory function are inversely correlated. Age has been observed to increase the risk of decline of lung function. The respiratory system undergoes various anatomical, physiological and immunological changes with age [6]. The structural changes include chest wall and thoracic spine deformities which impair the total respiratory system compliance leading to increase the work of breathing. The lung parenchyma loses its supporting structure causing dilation of airspaces. Respiratory muscle strength decreases with age and can impair effective cough which is important for airway clearance. After twenty five years, aging is associated with progressive decline in lung function. The air way's receptors undergo functional changes with age and are less likely to respond to drugs used in younger counter parts to treat the same disorders [6]. Older adults have decreased sensation of shortness of breath and diminished ventilator response to hypoxia and hypercapnia, making them more vulnerable to ventilator failure during high demand states and possible poor outcomes. The alveolar dead space increases with age. The older the patients the lower the FEV_1, and females have lower FEV_1).

Smoking has a direct effect on the respiratory system. The respiratory function test may indicate deterioration of respiratory function prior to clinical symptoms and its results can be used to prevent or reduce the incidence of respiratory diseases [7]. Spirometry measurements have shown considerable reduction in long time smokers due to reduced bronchial narrowing. Studies have further demonstrated the effect of smoking on pulmonary function of adults so that decreased pulmonary function including forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), and the ratio of FEV_1/FVC (FEV_1%). Spirometry is the simplest, most commonly used, and clinically useful pulmonary function test [8]. This respiratory dysfunction is primarily due to obstruction and small airway disease in adults.

BMI has been shown to reduce lung function due to chest compression. There are significant linear relationships between BMI and vital capacity and total lung capacity. Obesity has long been recognized as having significant effects on respiratory function; lung volumes tend to be decreased, especially expiratory reserve volume [9]. Weight loss leads to a reversal of these changes. Obesity has also been shown to aggravate asthma and further reduce respiratory function. Epidemiological data indicates that obesity precedes the development of asthma and increases the prevalence of asthma. Among obese subjects significant correlation is found between BMI and reduction of pulmonary function values. BMI has significant effects on all of the lung volumes. Its impact has been shown to be greater when acting together rather than individual effects. Risk factor modification can either present or delay lung function decline.

Asthma causes spasmodic disorder and thus narrowing of the bronchioles resulting in deterioration of lung performance. Asthma causes a progressive decline in lung function although this is not fully explained. Asthmatics show a decline in FEV_1 compared to normal individuals. However, accelerated decline is not invariable. Many asthmatics retain normal or close to normal lung function throughout life showing reversibility from acute worsening and return to previous function [10].. The dependent variables we intend to use are FVC, FEV_1, FEV_1/FVC and others.

OBJECTIVES

The primary focus of this study was to explore and examine the relationship between some of the known risk factors that women are often exposed to and respiratory function. The study used secondary data obtained from Kentucky Women Health Registry (KWHR). The aim was to investigate the effects of the individual risk factors as well as their interaction and develp recommendations for intervention and mitigation of the problems. The results may be used by public health professionals to make informed decisions. We anticipated there would be important risk factors as causes of either obstructive or restrictive respiratory impairment based on spirometry measures. The objectives were to:

1) Examine the impact of risk factors (e.g., education, smoking, socio economic status) on women's respiratory functions
2) Suggest and inform preventive strategies that will improve women's health in general.

RESEARCH QUESTIONS

The ability to analyze and interpret environmental and social risk factors causing respiratory ailments and complications in women's health is the key to prevention. It is also important from the public health point of view and national policy perspective to fully understand these risk factors that disproportionality affect women of all ages and ethnic backgrounds. Meeting these societal imperatives requires long term data that permits researchers to analyze social and behavioral risks and to suggest interventions. Efforts to prevent and ameliorate the effects of behavior-related respiratory ailments, including smoking, obesity, and educational status are critical with profound consequences in women's well-being and vitality. For example, past studies have shown strong cause and effect relationship between women's respiration health and wide range of behaviors, educational status, and body fitness. While the need to examine and understand the complex nature of respiratory function and its root causes are critical, the data and information required to analyze this problem exist in various datasets and repositories. Such information is needed to effectively address the challenge of women's respiratory function. While a handful of previous studies have shown close ties between respiration and indicator variables such as vital capacity (FVC), forced expiratory volume in one second (FEV1), such studies are surprisingly limited in scope and geographical expanse. Hence the interest in exploring both health and socioeconomic considerations into women's health environmental monitoring efforts and evaluation has never been greater. The central aim of this proposed project is to understand women's respiratory functions as impacted by socioeconomic position, gender, race, and behavioral and environmental risk factors.

HYPOTHESIS

The central hypotheses on which this proposed project intended to test are:

1. Behavioral (e.g., smoking) and socio economic status play significant role in explaining women's respiratory function, which in turn inform overall wellbeing and health of society.

Independent variables:

The independent variables (risk factors) we consider in this study are:

- Demographic information including age, gender, and ethnicity(Caucasians versus minority (Hispanic, African- American and Asian))
- Educational status (high school diploma, some degree and graduate level). Some degree implies: associate degree, bachelor degree, Vocational or technical certificate or degree.
- Behavioral data such as smoking vs non-smoking (current smoker, former smoker, never smoked)

Dependent variable:

- Respiratory function including FVC, FEV_1, FEV_1/FVC, and FVC predicted, FEV_1 predicted, and FEV_1/FVC predicted. These are measured by spirometry in liters.

The data analysis was performed including descriptive statistics (means, standard deviation, frequency, minimum and maximum). In addition, simple regression analysis was used to examine the extent to which the dependent variable (as measured by r^2) explained by independent variables listed above. Data was analyzed using IBM ®SPSS 22 statistical software.

METHODS AND MATERIALS

To understand the relationship between risk factors and women's respiratory functions I used a multiyear dataset obtained from the University of Kentucky Women's Health Registry (KWHR). The women's ages are categorized into three classes: <30 years, between 31-50 and > 50 years. KWHR provides data on different, chronic health problems across the Commonwealth of Kentucky. The center collected data using surveys, questionnaires, and tests to investigate health issues, health disparities, health behaviors and health access.

The KWHR promotes research in women's health and secondly provides a database to investigate relationships and associations. Across Kentucky, this data is used by researchers to primarily develop strategies and programs to improve the health of Kentucky's women. In addition, the data is used to investigate health issues, disparities, behaviors, and health access. The outcome of this practice provides a platform for identifying problems, generating hypotheses, policy making, and conducting research. This enables us to understand health behaviors and risk factors and finally to devise mechanisms to mitigate them and improve the health of Kentucky women, and the health of Kentuckians in general. Periodically, during the data analysis phase, I consulted my mentor for his guidance, feedback, and specific instructions on how the data analysis and subsequent work should be undertaken. Descriptive statistics (means, standard deviation, frequency, minimum and maximum) was performed on independent variables such as age, BMI, smoking status, asthmatic status, educational level and ethnicity. Furthermore, linear and bi-variate regression analyses were used to examine how variables are linked and correlated. Bi-variate analysis is used to analyze relationship between two independent variables whereas regression analysis is used to analyze the relationship between dependent and independent variables. Multiple regressions can also be used to analyze more than two variables.

DATA

Kentucky Women's Health Registry (KWHR) Database (courtesy of Dr. David Mannino) was used. KWHR is intended to develop integrated hypothesis to explain variability in women's health and wellness across the Commonwealth of Kentucky. The data, however has its limitations as there are certain biases such as selection bias. This makes it difficult to infer or generalize for Kentucky women. Health is influenced by many social, behavioral, and environmental variables. KWHR seeks to understand how these variables are interrelated and affect women's health. Ultimately, the data is used by researchers to develop strategies to improve the health of Kentucky's women. The researchers use surveys, questionnaires, and tests in order to investigate health issues, disparities, behaviors and health access. The outcome of this practice provides a platform for identifying problems, generating hypothesis, policy making and conducting research. This enables us to understand health behaviors and risk factors and finally to devise mechanisms to mitigate them and improve the health of Kentucky women, and the health of Kentuckians in general. The health survey components include demographics, medical history, health behaviors, etc. The KWHR promotes research in women's health and secondly provides a database to investigate relationships and associations.

Extensive literature search related to the demographic independent variables and respiratory function variables was conducted to obtain guidance on data analysis and gauge the corroboration of our findings with similar studies. The data analysis preformed involved basic descriptive statistics (means, standard deviations, counts, percentages, minimums and maximums) and elaborate regression analysis.

The dependent variables used are FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in one second) together with their predicted values and their ratios, a total of six variables.

RESULT AND DISCUSSION

1. Descriptive Analysis

Missing Values

Table 1 lays out the missing data pattern. Out of the total (N=1838) participants in the study, two data points were missing on educational status and ethnicity variables, and one data point was missing on the smoking status variable. Considering the large sample size and the very small number of missing values, ignoring the missing values would be inconsequential.

Table 1: Total number of participants by risk factors

		Age	Asthma	BMI	Educational Status	Ethnicity	Smoker
Missing		1838	1838	1838	1836	1836	1837
		0	0	0	2	2	1

In what follows we present descriptive statistics results for each individual independent variable (risk factors) and each individual dependent variable (respiratory function metrics).

Age

Our data supports that age plays a significant role in the respiratory health status of women (Table 2). The data indicates that 19%, 37%, and 44% of the participants fall within in the age group of less than 30, between 31 and 50, and beyond, respectively. Past studies have demonstrated that the respiratory system undergoes various anatomical, physiological, and immunological changes with age, affecting human breathing mechanisms.

Table 2: Frequency distribution by age				
	Frequency	Percent	Valid Percent	Cumulative Percent
< 30	347	18.9	18.9	18.9
31 -- 50	680	37.0	37.0	55.9
> 50	811	44.1	44.1	100.0
Total	1838	100.0	100.0	

Age has been observed to increase the risk of decline of lung function. The respiratory system undergoes various anatomical, physiological and immunological changes with age [6]. The structural changes include chest wall and thoracic spine deformities which impair the total respiratory system compliance leading to increase the work of breathing. The lung parenchyma loses its supporting structure causing dilation of airspaces. Respiratory muscle strength decreases with age and can impair effective cough which is important for airway clearance. After twenty five years, aging is associated with progressive decline in lung function. The air way's receptors undergo functional changes with age and are less likely to respond to drugs used in younger counter parts to treat the same disorders. Older adults have decreased sensation of shortness of breath and diminished ventilator response to hypoxia and hypercapnia, making them more vulnerable to ventilator failure during high demand states and possible poor outcomes. The alveolar dead space increases with age.

Asthma

Table 3 indicates that 79% of the participants were found to be non-asthmatic, reflecting that only a minority of women were susceptible to allergic airway diseases. Asthma causes spasmodic disorder and thus narrowing of the bronchioles resulting in deterioration of lung performance.

Asthma is among the many risk factors affecting lung function in women. Previous studies have also shown asthma is strongly linked to other risk factors including BMI, smoking, and age [11]. For example, women who smoked for an extended period were found to be asthmatic with a compromised general health status. Asthma causes a progressive decline in lung function although not fully explained. Asthmatics show a decline in FEV1 compared to normal individuals. However, accelerated decline is not invariable. Many asthmatics retain normal or close to normal lung function throughout life showing reversibility from acute worsening and return to previous function [10]. Asthma causes spasmodic disorder and thus narrowing of the bronchioles resulting in deterioration of lung performance.

Table 3: Frequency distribution by asthmatic status

	Frequency	Percent	Valid Percent	Cumulative Percent
Asthmatic	389	21.2	21.2	21.2
Non-Asthmatic	1449	78.8	78.8	100.0
Total	1838	100.0	100.0	

BMI

BMI has been shown to reduce lung function due to chest compression. Obesity has long been recognized as having significant health effects on respiratory function by reducing lung volumes, especially expiratory reserve volume. On the other hand, weight loss tends to reverse these changes [9]. Obesity has also been shown to aggravate asthma and further reduce respiratory function. There are significant linear relationships between BMI and vital capacity and total lung capacity. Epidemiological data indicates that obesity precedes the development of asthma and increases the prevalence of asthma. Among obese subjects significant correlation is found between BMI and reduction of pulmonary function values.

Table 4: Frequency distribution by BMI

	Frequency	Percent	Valid Percent	Cumulative Percent
< 25	528	28.7	28.7	28.7
25 -- 30	561	30.5	30.5	59.2
> 30	749	40.8	40.8	100.0
Total	1838	100.0	100.0	

BMI has significant effects on all of the lung volumes. Its impact has been shown to be greater when acting together rather than individual effects. Risk factor modification can either present or delay lung function decline.

Smoking

Smoking has a direct effect on the respiratory system. The respiratory function test may indicate deterioration of respiratory function prior to clinical symptoms and its results can be used to prevent or reduce the incidence of respiratory diseases [7].

Table 5: Frequency distribution by smoking

	Frequency	Percent	Valid Percent	Cumulative Percent
Current	307	16.7	16.7	16.7
Former	448	24.4	24.4	41.1
Never	1082	58.9	58.9	100.0
Total	1837	99.9	100.0	

The majority of the participants (59%) in the study are non-smokers, although 24% were former smokers and 17% are current smokers (Table 5). Spirometry measurements have shown considerable reduction in long time smokers due to reduced bronchial narrowing. Studies have further demonstrated the effect of smoking on pulmonary function of adults so that decreased pulmonary function including forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and FEV1/FVC. This respiratory dysfunction is primarily due to obstruction and small airway disease in adults.

Educational Status

Table 6 shows that out of 1836 respondents 5% had less than high school, 91 % had some degree and 4% had post Graduate degree. Most of the participants had some degree such as associate degree, bachelor degree etc.

Table 6: Frequency distribution by Educational Status				
	Frequency	Percent	Valid Percent	Cumulative Percent
Less than High School	92	5.0	5.0	5.0
Some Degree	1673	91.0	91.1	96.1
Post Graduate	71	3.9	3.9	100.0
Total	1836	99.9	100.0	

Ethnicity

In the data, the participants were first categorized into two groups as Caucasians and Minority (Hispanics, African-Americans and Asians). Table 7 depicts the majority (88%) of respondents were Caucasians where as 12% were Minority ethnic groups.

Table 7: Frequency distribution by Ethnicity				
	Frequency	Percent	Valid Percent	Cumulative Percent
Caucasian	1609	87.5	87.6	87.6
Minority	227	12.4	12.4	100.0
Total	1836	99.9	100.0	

Respiratory Function Variables (spirometry values):

FVC: forced vital capacity; total volume of air a patient is able to exhale for the total duration of the test during maximal effort

FEV_1: forced expiratory volume in one second; total volume of air a patient is able to exhale in the first second during maximal effort.

FEV_1/FVC ratio: the percentage of the FVC expired in one second.

2. Frequency Analysis

Table 8 demonstrates different categories of the independent variable (BMI) along with the dependent variables as measured by FVCL, FEV1L, FEV1/FVC and their predicted values. Table 8 describes the mean, minimum, maximum, number of population and standard deviation of the dependent variables (FVC, FEV_1, FEV_1/FVC, FVC Predicted, FEV_1 predicted and FEV_1/FVC.

Table 8: Relationship between BMI and lung function as measured by FVCL, FEV1, FEV1/FVC and their predicted values

BMI	FVCL	FEV1L	FEV1FVC	Predicted	FEV1L predicted	FEV1FVC predicted
< 25						
Mean	3.30	2.66	.80	91.7	90.4	98.1
Minimum	.89	.64	.49	51.0	33.0	62.0
Maximum	6.07	4.77	.99	138.0	131.0	125.0
N	528	528	528	528	528	528
StdDev	.72	.68	.08	13.7	15.6	8.5
25 -- 30						
Mean	3.12	2.50	.80	89.9	89.2	98.5
Minimum	1.02	.44	.42	35.0	25.0	53.0
Maximum	5.18	4.29	.95	125.0	125.0	126.0
N	561	561	561	561	561	561
StdDev	.76	.68	.07	14.7	16.3	8.1
30						
Mean	2.97	2.40	.81	86.7	87.4	100.2
Minimum	1.23	.90	.47	43.0	32.0	60.0
Maximum	5.22	4.52	.92	132.0	136.0	116.0
N	749	749	749	749	749	749
StdDev	.67	.59	.06	14.2	15.1	6.8
Grand Total						
Mean	3.11	2.51	.80	89.1	88.8	99.1
Minimum	.89	.44	.42	35.0	25.0	53.0
Maximum	6.07	4.77	.99	138.0	136.0	126.0
N	1838	1838	1838	1838	1838	1838
StdDev	.73	.65	.07	14.4	15.7	7.8

When we analyze the lung function in each category of BMI, we can observe that as the quantity of BMI increases from 25 and above the various dependent functions such as FVC, FEV1 decrease steadily confirming the impact that BMI has a negative influence on lung function. The ratio FEV1/FVC declines with increase in BMI and also the various predicted values also decline.

Table 9: Descriptive statistics among age and lung function as measured by FVC, FEV1, FEV1/FVC and their predicted values.

Age	FVCL	FEV1L	FEV1FVC	Predicted	FEV1L predicted	FEV1FVC predicted
< 30						
Mean	3.71	3.11	.84	96.7	94.5	98.3
Minimum	2.05	1.06	.52	55.0	36.0	60.0
Maximum	6.07	4.77	.98	132.0	130.0	113.0
N	347	347	347	347	347	347
StdDev	.58	.49	.06	11.9	12.4	6.7
31 -- 50						
Mean	3.34	2.71	.81	91.1	90.6	98.7
Minimum	1.62	1.10	.57	44.0	36.0	69.0
Maximum	5.68	4.52	.99	138.0	136.0	121.0
N	680	680	680	680	680	680
StdDev	.60	.51	.05	13.3	14.1	6.6
50						
Mean	2.66	2.08	.78	84.1	84.8	99.6
Minimum	.89	.44	.42	35.0	25.0	53.0
Maximum	4.27	3.37	.95	123.0	129.0	126.0
N	811	811	811	811	811	811
StdDev	.60	.52	.07	14.4	17.1	8.9
Grand Total						
Mean	3.11	2.51	.80	89.1	88.8	99.1
Minimum	.89	.44	.42	35.0	25.0	53.0
Maximum	6.07	4.77	.99	138.0	136.0	126.0
N	1838	1838	1838	1838	1838	1838
StdDev	.73	.65	.07	14.4	15.7	7.8

Increase in age results in decline in lung function as demonstrated above. The elasticity of the lung declines with age. Age may not be modified as it is a natural process but we can minimize its effect by controlling modifiable variables that can aggravate the situation.

Table 10: Descriptive statistics among asthma and lung function as measured by FVC, FEV1, FEV1/FVC and their predicted values.

Asthma	FVCL	FEV1L	FEV1FVC	Predicted	FEV1L predicted	FEV1FVC predicted
Mean	3.02	2.39	.79	86.5	84.6	97.2
Minimum	1.05	.44	.42	43.0	25.0	53.0
Maximum	5.68	4.69	.99	138.0	131.0	121.0
N	389	389	389	389	389	389
StdDev	.78	.69	.08	15.3	16.8	9.2
2						
Mean	3.14	2.54	.81	89.8	89.9	99.5
Minimum	.89	.64	.49	35.0	31.0	60.0
Maximum	6.07	4.77	.98	135.0	136.0	126.0
N	1449	1449	1449	1449	1449	1449
StdDev	.71	.64	.06	14.0	15.1	7.3
Grand Total						
Mean	3.11	2.51	.80	89.1	88.8	99.1
Minimum	.89	.44	.42	35.0	25.0	53.0
Maximum	6.07	4.77	.99	138.0	136.0	126.0
N	1838	1838	1838	1838	1838	1838
StdDev	.73	.65	.07	14.4	15.7	7.8

Table 10 depicts descriptive statistics of Asthma and the dependent variables in the same manner as described above. In the subjects with asthma, the lung function progressively decline. This fact is also supported by previous studies conducted by other researchers.

Table 11: Descriptive statistics among smoking and lung function as measured by FVC, FEV1, FEV1/FVC and their predicted values. 1 denotes a current smoker, 2 denotes a former smoker, and 3 denotes an individual who never smoked.

Smoker	FVCL	FEV1L	FEV1FVC	Predicted	FEV1L predicted	FEV1FVC predicted
Mean	3.54	2.84	.80	95.0	95.0	99.0
Minimum	3.54	2.84	.80	95.0	95.0	99.0
Maximum	3.54	2.84	.80	95.0	95.0	99.0
N	1	1	1	1	1	1
StdDev	.	.	.	.	.	.
1						
Mean	3.08	2.41	.78	86.8	83.4	95.3
Minimum	1.25	.80	.47	45.0	31.0	60.0
Maximum	5.07	3.89	.97	132.0	124.0	120.0
N	307	307	307	307	307	307
StdDev	.72	.66	.08	15.0	16.9	9.3
2						
Mean	2.98	2.36	.79	87.4	87.1	98.7
Minimum	1.05	.44	.42	43.0	25.0	53.0
Maximum	5.22	4.52	.95	122.0	124.0	126.0
N	448	448	448	448	448	448
StdDev	.74	.68	.08	14.6	17.0	8.9
3						
Mean	3.17	2.59	.82	90.5	91.0	100.3
Minimum	.89	.64	.50	35.0	33.0	64.0
Maximum	6.07	4.77	.99	138.0	136.0	121.0
N	1082	1082	1082	1082	1082	1082
StdDev	.72	.63	.06	13.9	14.2	6.3
Grand Total						
Mean	3.11	2.51	.80	89.1	88.8	99.1
Minimum	.89	.44	.42	35.0	25.0	53.0
Maximum	6.07	4.77	.99	138.0	136.0	126.0
N	1838	1838	1838	1838	1838	1838
StdDev	.73	.65	.07	14.4	15.7	7.8

Table 11 depicts descriptive statistics of Smokers and the dependent variables in the same manner as described above. Smoking causes inflammation and obstruction of the airways leading to a bronchial obstruction. It is the leading cause of COPD. It causes obstructive lung disease.

Table 12: Parameter Estimates

Dependent Variable	Parameter	B	95% Confidence Interval	
			Lower Bound	Upper Bound
FVC Predicted	[Asthma=1]	-3.038	-4.537	-1.538
	[Asthma=2]	0[a]	.	.
	[Ethnicity=1]	.286	-1.586	2.158
	[Ethnicity=2]	0[a]	.	.
	[Smoker=1](current)	-3.348	-5.059	-1.637
	[Smoker=2](former)	-.774	-2.278	.730
	[Smoker=3](Never)	0[a]	.	.
	[BMI=1]	2.939	1.404	4.474
	[BMI=2]	2.566	1.097	4.034
	[BMI=3]	0[a]	.	.

	[Educational Status=1]	-7.700	-11.883	-3.516
	[Educational Status=2]	-1.964	-5.136	1.208
	[Educational Status=3]	0[a]	.	.
	[Age=1]	11.767	10.020	13.514
	[Age=2]	6.870	5.492	8.249
	[Age=3]	0[a]	.	.
FEV_1 Predicted	[Asthma=1]	-5.117	-6.780	-3.454
	[Asthma=2]	0[a]	.	.
	[Ethnicity=1]	.282	-1.794	2.359
	[Ethnicity=2]	0[a]	.	.
	[Smoker=1]	-7.219	-9.117	-5.321
	[Smoker=2]	-2.137	-3.805	-.468
	[Smoker=3]	0[a]	.	.
	[BMI=1]	1.085	-.617	2.787
	[BMI=2]	1.205	-.424	2.833

	[BMI=3]	0[a]	.	.
	[Educational Status=1]	-6.940	-11.581	-2.299
	[Educational Status=2]	-.903	-4.421	2.615
	[Educational Status=3]	0[a]	.	.
	[Age=1]	9.283	7.345	11.221
	[Age=2]	5.807	4.278	7.336
	[Age=3]	0[a]	.	.
FEV_1FVCPredicted	[Asthma=1]	-2.459	-3.299	-1.620
	[Asthma=2]	0[a]	.	.
	[Ethnicity=1]	.407	-.640	1.455
	[Ethnicity=2]	0[a]	.	.
	[Smoker=1]	-4.867	-5.824	-3.909
	[Smoker=2]	-1.882	-2.723	-1.040
	[Smoker=3]	0[a]	.	.
	[BMI=1]	-2.265	-3.123	-1.406

	[BMI=2]	-1.710	-2.532	-.888
	[BMI=3]	0[a]	.	.
	[Educational Status=1]	.714	-1.627	3.056
	[Educational Status=2]	.947	-.829	2.722
	[Educational Status=3]	0[a]	.	.
	[Age=1]	-.918	-1.896	.060
	[Age=2]	-.908	-1.680	-.136
	[Age=3]	0[a]	.	.

Table 12 demonstrates more specific association, magnitude and estimate of correlation (F Value and P Value).

CONCLUSIONS

The main goal of the study was to assess/ examine whether socio-economic, behavioral and environmental risk factors affect women's respiratory function. The study found out that BMI and smoking were the two risk factors impacting women's lung function.

Currently available literature comparing FVC, FEV1, FEV1/FVC, FVC predicted, FEV1 predicted and FEV1 predicted indicate reduction of respiratory function in those with high BMI, advanced age, smoking status, and asthmatic status. As age increases, lung function declines because the elasticity and recoil capacity of the lung tissues deteriorate with age. Our study demonstrated that the risk factors analyzed are in agreement with previous studies conducted by other researchers. One of the key components of human health is measured whether or not one has a properly functioning breathing system. A myriad of socioeconomic, environmental, and behavioral factors play significant roles on respiratory functions. The health consequence of impaired or compromised breathing system can be particularly important for women exposed to such high risk factors or low social status (e.g. socioeconomic status). Identifying respiratory risk factors that often impact women is health and societal imperatives. This project is intended to examine and explore the relationship between respiratory function and some risk factors. As part of this study, several factors including Age, BMI, Smoking, Asthma, Educational status and Ethnicity were analyzed to examine the cause and effect on respiration using a set of secondary data obtained from the Kentucky Women Health Registry (KWHR). Descriptive and regression analyses were performed to explore how these risk factors affect lung function and performance.

This study has demonstrated that the risk factors have profound effect in the respiratory function. These variables can be divided as behavioral, biological and socioeconomic factors. The modifiable factors are BMI, Smoking and Educational status. The effects of aging on lung function on women, ethnicity and asthma can be aggravated if the modifiable risk factors are not controlled. To improve public health in general and Kentucky women in particular, it is imperative to use all tools available to mitigate the negative outcomes of the effects of these repiratory risk factors. Obesity is a cause of many health disorders, including restricting breathing mechanisms. Asthma is an inflammation and hypersecretion of the bronchial tree which can be aggravated when coupled with obesity and cigarette smoking. Smoking is a huge health risk that causes poor lung performance due to inflammation and bronchial secretion. It causes cancer in most organs and more importantly heart problems. Education is also associated with better respiratory health outcome primarily because people with higher income avoid obesity, do more exercise, opt for better housing and awareness to improve their health. Ethnicity is not considered a significant factor on lung function. From the public health perspective our findings suggest modifying some of the risk factors can have better health outcomes.

POTENTIAL IMPACT OF THE STUDY

Based on the data analysis, the following conclusions may be drawn:

I. Monitor the respiratory health status of women on regular basis to identify modifiable risk factors ahead of time and plan accordingly.

II. Inform, educate, and empower women on the effect of social and environmental risk factors that impacts lung functions and preventive options.

III. Provide public health policy makers with first hand data and information to plan, strategize, and implement regulatory and preventive measures.

IV. This preliminary analysis may provide the foundation for large scale studies on a long-term basis that impact not only women in Kentucky but also in US and beyond.

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