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There is a distinct disparity between adult males and females in lung function and cardiovascular fitness in the United States. This study utilizes a nationally representative sample in order to determine predictors of lung function between men and women. Simple means analysis, logistic and linear regressions were utilized in order to determine predictors of lung function between genders. Continuous analyses of lung function reveal that sex and BMI are the most important predictors of  $VO_2$  max. However, analyses of clinical cut-points of cardiovascular fitness indicate that gender was not a significant predictor.

CARDIOVASCULAR FITNESS AND LUNG FUNCTION OF ADULT MEN AND  
WOMEN IN THE UNITED STATES: NHANES 1999-2002

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CARDIOVASCULAR FITNESS AND LUNG FUNCTION OF ADULT MEN AND  
WOMEN IN THE UNITED STATES: NHANES 1999-2002

THESIS

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I would like to dedicate my thesis to my parents, Richard and Ida Jackson. The strength and perseverance they have shown me in their own lives inspired me to continue towards meeting my own academic and personal goals. I hope that in all of my success, they see their own.

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## CHAPTER ONE

### INTRODUCTION

Over 35 million Americans suffer from chronic lung diseases such as cancer, asthma, chronic obstructive pulmonary disease (COPD), and bronchitis <sup>1</sup>. Respiratory diseases are the fourth leading cause of death in the United States, preceded only by heart disease, cancers, and cerebrovascular disease <sup>2</sup>. Growing levels of lung disease coupled with declining levels of lung function are global health issues that are modifiable and preventable.

Respiratory diseases are a leading cause of death in women. In the past year, more women died of COPD and chronic bronchitis than men and lung cancer has become the leading cancer cause of death in women <sup>1</sup>. Furthermore, other chronic lung diseases have increased more rapidly for women than men. For example, in the past decade, asthma rates have risen by 97% in women in comparison to a 22% increase for men.

The reason for increasing differences in lung function between men and women has not been studied. The purpose of this study is to assess and explain differences in lung function between men and women using national data. It is expected that changes in social and behavioral predictors of lung function such as environmental exposure, socioeconomic status, access to care, and health behaviors have contributed to differences in lung function between men and women. The public health importance of these findings are the potential identification of modifiable mechanisms to reduce or eliminate sex differences in lung function and improve lung health for the US population.

## CHAPTER TWO

### LITERATURE REVIEW

#### *Life Span Epidemiology of Lung Function*

Throughout the human lifespan, female lungs are consistently smaller in size and in weight compared to male lungs. At birth, the female lungs have fewer respiratory bronchioles resulting in restricted airflow to the interior of the lungs<sup>3</sup>. During the first few weeks of life, significant changes and differences in lung function and development become apparent between men and women<sup>4</sup>. Significantly larger tidal flow volume differences are apparent in infant boys as early as the first few days of life<sup>5</sup>. Lower airway function in early infancy has serious implications for increased susceptibility to lung disease in childhood and serves as a risk factor for airflow obstruction in adulthood<sup>6</sup>. Despite lower levels of lung function at early stages of life, infant girls exhibit a more rapid maturation of lungs the first few weeks of life compared with boys<sup>7</sup>.

Throughout the lifespan, female lung growth occurs more rapidly than males but for a shorter duration. Maximum lung growth is complete in females early in adolescence while male lungs continue to develop into early adult life<sup>8</sup>, which is associated with increased lung capacity versus male counterparts at this stage of life<sup>9</sup>. Lung development in females peaks early in the adolescence years, whereas for males, thoracic growth continues into early adulthood<sup>10</sup>. Unlike with females, pulmonary function measurements in males indicate continued lung growth and development with age into early adulthood<sup>11</sup>.

Adult female lungs are consistently smaller in capacity and weight, and consequently contain fewer respiratory bronchioles<sup>12</sup>. Another contributing factor for greater lung function in men is the increase in width of the thorax and trachea where women do not demonstrate any change<sup>13</sup>. Height-matched men have larger diameter airways and larger lung volumes and diffusion surfaces<sup>14</sup>. Age related loss of lung function occurs in both genders; however healthy males exhibit higher levels of lung function, yet women experience greater rates of decline in respiratory function<sup>15</sup>. In older adult females, lung function begins to rapidly decline at an earlier age and at a faster rate than age-matched male counterparts<sup>16</sup>. Although early life events have a strong influence on lung function between men and women, the growth process may only partially account for sex differences in lung function.

#### *Socioeconomic Determinants of Lung Function*

Socioeconomic factors have a significant impact on lung performance and vulnerability to lung disease. Between genders, social influences are important determinants in lung health outcomes. Social factors and roles such as occupational status, education and income level, as well as utilization of health care services that differ between men and women may partially explain disparities in lung function between the genders.

Environmental and occupational exposures have a strong influence on lung function and health. Coarse and fine airborne particles and various pollutants contribute to an increased risk of respiratory damage and disease. There is a high correlation

between fine particle concentration and asthma related response that include lower respiratory symptoms and decreased peak flow <sup>17</sup>. Exposure to ambient concentrations of ozone is related to lower levels of lung function and significant reductions in airway size<sup>18</sup>.

Women experience greater respiratory effects of ambient particles and air pollution exposure compared to men. There is a greater mortality rate observed in women than men due to ambient particles. Particles deposit in all regions of lung differently between genders <sup>19</sup>. In women, there is suggestive evidence that there is an increased susceptibility with exposure to particulate matter in inflammatory response of the respiratory system <sup>20</sup>.

Living in urban areas in proximity to traffic dense areas and industrial air pollution are also primary environmental risk factors for respiratory diseases. Rural communities are far removed from industrial air pollution, automobile traffic emissions, and other air quality and health that individuals in urban areas address. Residents of rural areas report overall better health and health behavior practices compared with their urban counterparts <sup>21</sup>.

Respiratory health and chronic respiratory conditions have a lower prevalence in rural communities than urban regions, and it has been suggested that the rural environment serves as a protective factor against developing chronic lung diseases<sup>22</sup>. Asthma prevalence rates are consistently lower among farm children compared to non-farm children. Differences in environmental exposures partially explain this phenomenon

in addition to agricultural and livestock exposures that serve as a protective component in the rural environment against developing various lung diseases<sup>23</sup>. Although rural children have better overall lung function than urban counterparts, rural girls exhibit a higher percentage of wheezing, asthma and airway hyper responsiveness than rural boys<sup>24</sup>.

Alternatively, urban area residents experience higher prevalence rates of respiratory diseases as a result of environmental hazards that are present in their environment. Urban area neighborhoods have a closer proximity to industrial and traffic pollution that are major risk factors for developing airway and lung disease<sup>25</sup>. Traffic exposure is a primary risk factor in urban areas for developing various lung diseases and lowering lung function. Area census tracts that face intersections and highways have a 60% increased risk of developing asthma compared to areas located away from major road sites<sup>26</sup>. Fine particulates are 29% more dense in the air in these areas compared with residential areas located further away<sup>27</sup>. There is no significant effect of traffic density on lung function in men; however women experience significant FEV<sub>1</sub> and FVC decline with higher traffic density exposure compared to subjects living further away from traffic dense areas<sup>28</sup>.

Occupational exposure to vapors, dust, or fumes is more common among males than among females. Trends indicate that men occupy a majority of the manual labor and construction fields. These occupational environments increase the amount of exposure and susceptibility to dust, mold, and various outdoor pollutants that may increase the risk

for adverse lung conditions <sup>29</sup>. However, among women, occupational status showed a significant difference in lung function outcomes. Women who hold administrative and higher socioeconomic positions showed decreased odds of developing chronic lung diseases compared to women in industrial and agricultural positions <sup>30</sup>. Because women are less likely to hold jobs that expose them to various ambient particulate matter, better lung function is observed in occupational field compared to men.

Lung function is positively associated with educational achievement and income status. This relationship is consistent with other socioeconomic factors where higher levels of education and income demonstrate better overall lung function than individuals with lower education and income status <sup>31</sup>. Maternal education is a strong predictor of lung function in children. Children born to mothers with lower levels of have lower FEV1 values compared to children whose maternal education consisted of at least a college degree <sup>32</sup>.

Income level and educational status are closely correlated with one another. Household income levels exhibit a positive correlation with lung function and general health; where higher household income levels yield higher FEV<sub>1</sub> and FVC values in both women and men compared to lower income families <sup>33</sup>. Both education and income levels are important determinants of lung function in men and women. These factors are strong predictors of optimal lung and overall health.

Health care access and utilization differences in gender and symptomatic individuals have a significant impact on health policy and management in the United States. Perceptions and attitudes towards illness and disease can act as an important



determinant in diagnosis and detection of lung disease<sup>34</sup>. Patients with severe lung disease such as COPD use hospital care 2.3 times more than age and gender matched asymptomatic individuals. Accurate and early diagnoses of lung disease are important determinants of lung health<sup>35</sup>. Standards for treatment and detection of lung diseases have improved with the use of spirometric techniques for diagnosing chronic lung diseases. Spirometric data are also used to determine individual lung capacity and volume. Surveys of chest physicians indicated supplementary use of chest x-rays and spirometry in addition to standard clinical data and reported symptoms in order to accurately diagnosis lung disease in their patients<sup>36</sup>. However, a distinct bias exists between genders in the diagnosis of chronic lung diseases in women. When compared to men, women are consistently under-diagnosed with COPD and other chronic lung conditions despite similar presented symptoms<sup>37</sup>. In initial diagnosis and treatment of lung diseases, there are significant gender differences in the attitudes of physicians in diagnosing women with lung disease. Despite lower pack-years of smoking and increased reported symptoms of respiratory difficulties, physicians failed to order supplemental testing for females that resulted in an overall under-diagnosis of COPD<sup>38</sup>. This disparity in diagnoses can partially account for poor lung health among women.

### *Health Behaviors*

Health disparities between men and women are fundamentally associated with behavioral practices and lifestyle decisions. In general women lead healthier lifestyles and engage in healthy behaviors more often than men, yet demonstrate lower levels of

lung function and overall health. Occupational roles and status of men compared to women in part explains this gender health paradox <sup>39</sup>.

Tobacco exposure is one of the major risk factors in the development of lung disease and is responsible for the rapid decline in lung function. Tobacco smoking plays a major role in the mortality of U.S. women, where 90% of all lung cancer deaths among women are attributable to smoking<sup>40</sup>. One third of the male population in the world smokes, while the number of women who are exposed to tobacco is greater than previous generations and continues to <sup>41</sup>. Smoking during pregnancy is responsible for reduced lung function in infants as early as the first 4-5 weeks of life. Parental smoking is associated with an increased number of lower respiratory tract infections, and the presence of persistent cough and phlegm in children of smoking parents <sup>41</sup>. A clear interaction between chronic bronchitis and airflow obstruction is observed in addition to decline in forced expiratory volume in one second (FEV<sub>1</sub>) amongst ever-smokers <sup>42</sup>.

While it is known that smoking is associated with reduced lung function in general, women experience a greater overall loss of lung function than men <sup>43</sup>. Although smoking habits in women are less prevalent than in men, females experience a higher proportion of respiratory symptoms compared to males despite a lower prevalence of smoking status <sup>44</sup>. In the effects of cigarette smoking, women with COPD demonstrate greater levels of breathlessness relative to men at similar degrees of airflow obstruction and emphysema severity <sup>45</sup>. Likewise, women report smoking fewer pack-years than men but demonstrate similar levels of COPD severity as men <sup>46</sup>. In women with no history of smoking, passive tobacco exposure is shown to moderately reduce lung

function, whereas in women with asthma reduction in lung function is significantly greater than that of the general population <sup>47</sup>.

Participation in exercise is positively associated with higher levels of lung function both in healthy, non-smoking males and females. However, non-smoking men demonstrated higher FEV<sub>1</sub>, FVC levels after exercise than non-smoking women <sup>48</sup>. Bronchial hyper responsiveness, a characteristic of asthma and inflammation of the airways, is negatively associated with increased frequency and duration of physical activity. In asymptomatic women, after adjusting for confounding factors, FEV<sub>1</sub> levels are still consistently lower in women after exercise than age-matched men <sup>49</sup>. While exercise poses as a protective factor in expanding the lung and increasing respiratory function, its overall effect on individual health is minimal.

Nutrition and dietary intake are both associated with the cause and prevention of various diseases. Through cell development, regulation of the airway smooth muscle, and enzymatic reaction of neuromuscular transmission, an adequate diet containing a balance of omega 3 fatty acids, antioxidants and electrolytes; may inhibit various reactions and promote cellular activities in the lungs that reduce an individual's susceptibility to adverse lung health <sup>50</sup>. In children, an adequate diet consisting of recommended daily allowances of nutrients reflects a greater effect on airflow in girls than boys <sup>51</sup>. This phenomenon could reflect the early anatomical developmental differences between genders. Limited research in the Nurses' Health Study has shown that higher levels of antioxidants and vitamins in dietary consumption act as a protective factor against COPD development in female nurses <sup>52</sup>.

### *Statement of Problem*

At present, what is not known are variables that effect cardiovascular fitness and lung function between men and women. Previous research has focused on adolescent cardiovascular fitness and disparities between race/ethnicities. This study will use nationally representative data to identify sex differences in lung function. It is expected that women will have lower lung function than men. Further, social and behavioral factors are expected to explain the majority of the difference in lung function between men and women. Therefore, the findings from this study could be used to build effective intervention efforts to improve lung function for the United States population and reduce disparities in lung function between men and women.

## CHAPTER THREE

### METHODOLOGY

#### *Data*

This study uses data from the 1999-2000, and 2001-2002 National Health and Nutrition Examination Surveys. These data are publicly available for download from the National Center for Health Statistics, which is part of the Center for Disease Control and Prevention. NHANES is a stratified, multi-staged monitoring survey that uses probability sampling to evaluate the health and nutritional status of the civilian, non-institutionalized population of the United States. Further details about NHANES can be found elsewhere<sup>53-54</sup>. Individuals will be eligible if they are female or male, aged 20- 49 years, and provided a reproducible VO<sub>2</sub> max score.

#### *Dependent Variable*

Cardiovascular fitness is measured by conducting exercise stress tests on a treadmill or cycle ergometer through VO<sub>2</sub> max values. VO<sub>2</sub> max is the maximum amount of oxygen uptake, measured in liters of oxygen per minute (l/min) or milliliters of oxygen per kilogram of weight per minute (ml/kg/min), and is considered the best indicator of cardiovascular health and lung function<sup>55</sup>. Measurement of VO<sub>2</sub> max involves a physical effort in duration and intensity to fully tax the aerobic system. In clinical testing, involves a graded exercise test (either on a treadmill or on a cycle ergometer) in which exercise intensity is incrementally increased while measuring ventilation of oxygen and carbon dioxide concentration of the inhaled and exhaled air<sup>56</sup>. VO<sub>2</sub> max is reached when oxygen

consumption remains at steady state despite an increase in workload. During the process, the amounts of oxygen utilized and carbon dioxide expired are measured at a predetermined sub maximal exercise capacity to determine the  $VO_2 \text{ max}$ <sup>57-59</sup>.

Using sex and age-specific criteria from NHANES data, the estimated  $VO_2 \text{ max}$  will be categorized as a low, moderate or high level of cardiovascular fitness and lung function outcome based on data from the Aerobic Center Longitudinal Study a  $VO_2 \text{ max}$  below the 20<sup>th</sup> percentile of the Aerobic Center Longitudinal Study; a moderate fitness level will be a value between the 20<sup>th</sup> and 59<sup>th</sup> percentile, and high cardiovascular fitness will be defined as above the 60<sup>th</sup> percentile.<sup>60</sup>

#### *Covariates*

Socioeconomic indicators include age, race/ethnicity, and education. Health behaviors include smoking status, exercise, and diet. Anatomical control variables will be assessed by body mass index (height in meters /weight in kilograms-squared).

#### *Statistical Analysis*

A simple means analysis will be used to observe the differences in lung function between groups. Results will be stratified by age and sex. Multivariate linear and logistic regression models will be used to adjust for factors predictive of lung function if these factors explain the differences in lung function for men and women. All analyses will be adjusted for sample weights, strata, and population sampling unites using STATA 10.0 (StatCorp, College Station, TX ). P-values less than 0.05 will be considered statistically significant.

## CHAPTER FOUR

### RESULTS

#### *Description of the Sample*

Table 1 describes the variables used in the study stratified by sex. Given that the National Health and Nutrition Examination Survey is a nationally representative sample of the United States population, the demographic characteristics of the sample closely match figures from the US Census. Overall, 51% of the sample was female and 48.6 were male. The race/ethnic distribution was 38% Non Hispanic White and 62% non-White which includes non Hispanic Black, Mexican-Americans, Hispanics and Asians. Over half of the sample has a high school degree (58%). With regard to health behaviors, compared to males, females had higher body mass index, higher serum triglyceride, lower participation moderate activity, and lower serum cotinine. The outcome is cardiovascular fitness level based upon sex-age cut points of estimated VO<sub>2</sub> max. In this sample, women had a lower level of VO<sub>2</sub> max (37.92) compared to men at 45.85. The average VO<sub>2</sub> max values for this cross sectional sample were 42.0. Males had a higher proportion of high cardiovascular fitness (35%) compared to women (32%) and women had a higher proportion of low cardiovascular fitness (29%) than men (26%).

#### *Association of Sex and Cardiovascular Fitness by Age*

Table 2 presents the weighted percentage of cardiovascular fitness levels for males and females by age. Among persons 20-29 years of age, there were no significant

difference between men and women for low cardiovascular fitness (13%). However more men 20-29 (23%) achieved high levels of cardiovascular fitness than women (20%). Women 30-39 years of age had a higher percentage (12%) of low cardiovascular fitness than men (11%). Women 40-49 years of age had a higher percentage among low cardiovascular fitness levels (5%) compared with male counterparts (4%). Overall average indicates that women had higher percentages (10%) of low cardiovascular fitness levels than men (9%). Men also had a higher total percentage (23%) of high cardiovascular fitness level compared to 20% of overall women.

Table 3 shows the weighted average VO<sub>2</sub> max values for males and females stratified by age group. Averages in the overall categories indicate that men across all age groups had, on average, higher VO<sub>2</sub> max values (45.02) than females (36.82). Consistently across all age groups men had significantly higher mean VO<sub>2</sub> max values than women. Men between the ages of 20-29 had an average VO<sub>2</sub> max value of 46.07 compared to women counterparts at 37.96. Men in the 30-39 age range in this sample had a VO<sub>2</sub> max average of 45.33 compared to 37.32 for women. In the highest age bracket, 40-49 years, men continued to show high VO<sub>2</sub> max values (43.92) and women significantly lower (35.20).

#### *Multivariate Association of Sex and Cardiovascular Fitness*

Table 4 provides standardized and unstandardized coefficients from the linear regression of VO<sub>2</sub> max with adjustment for the complex sampling design of NHANES. Overall, the regression model explained 18% of the variance for VO<sub>2</sub>max. All



independent variables are statistically significant except for serum cotinine and physical activity. White race was positively associated with VO<sub>2</sub> max. All other variables were negatively associated with VO<sub>2</sub> max. Standardized coefficients are provided to compare which predictor variables are most strongly associated with VO<sub>2</sub> max. Sex is substantially larger than all other standardized coefficients suggesting that it may be the most important predictor of VO<sub>2</sub> max in this analysis. Body mass index was the next strongest predictor followed by education, serum triglycerides, age, serum cotinine, physical activity, and race.

Table 5 presents results from logistic regression analysis of high cardiovascular fitness with adjustment for the complex sampling design of NHANES. In this analysis, only age, race, and body mass index were statistically significant predictors of high cardiovascular fitness. All other variables were not statistically significant. Other factors equal, high cardiovascular fitness level was positively associated with age and white race and negatively associated with body mass index. These results suggest that, other factors equal, white race, more years of age are associated with a higher likelihood of being fit, while higher levels of body mass index are associated with a lower likelihood of being fit. Unlike in the linear regression results where sex was found to be the most important predictor of VO<sub>2</sub> max, in the logistic regression analysis sex was not found to be statistically significant.

## CHAPTER 5

### DISCUSSION AND CONCLUSIONS

This study sought to identify behavioral and socioeconomic determinants of lung function between men and women in the United States using a nationally representative sample. Cardiovascular fitness level cut-points and VO<sub>2</sub> max assessments were used to measure lung function. Overall, there are important gender differences in lung function in this nationally representative sample of adults. Gender was the strongest predictor of lung function, where females had lower levels of VO<sub>2</sub> max and cardiovascular fitness consistently across all age groups. In addition to gender, key predictors of lung function were body mass index, race/ethnicity, education and age.

Analysis of the continuous measure of lung function revealed that sex and body mass index were the two most important predictors of VO<sub>2</sub> max. However, analysis of the clinical cut-point measure suggested that race/ethnic minority status and age were associated with better lung function, and gender was not a significant predictor. Taken together, these results suggest a potential problem with the clinical cardiovascular fitness cut-points. Age and minority status should be negatively associated with lung function as has been found in other studies using alternative measurement devices such as spirometry 61-67.

Furthermore, given that gender was the strongest predictor of the continuous measure of lung function, one would expect that gender should at least be among the significant predictors in the binary categorization of lung function. Therefore, this study

provides support for a previous study that argued continuous estimates of VO<sub>2</sub> max levels more accurately represent lung function as opposed to age-sex categorization of cardiovascular fitness<sup>68</sup>.

In the context of current lung function literature regarding lung function and cardiovascular fitness, this study highlights the disparities in predictor variables of cardiovascular fitness levels. Clinical cardiovascular fitness cut-points established by the Aerobics Center Longitudinal Study (ACLS) classify cardiovascular fitness into low, medium and high categories based upon estimated VO<sub>2</sub> max values. However, results from this study suggest that more investigation is needed into the classification of cardiovascular fitness in these clinical categorizations due to the differences in predictors of VO<sub>2</sub> max.

### *Strengths and Limitations*

The principal strength of this study is the use of a large, nationally representative sample with clinical assessment for the outcome measure and several control variables. However, this study was limited by the cross-sectional nature of the study design which precluded causal inferences. Another limitation is that some measures such as physical activity were self-reported. Results should also be reviewed cautiously because of the procedures used to assess cardiovascular fitness. Exclusion criterion for participation in VO<sub>2</sub> max and cardiovascular fitness testing of the NHANES included age, physical and other medical and physical limitations<sup>69-70</sup>. Therefore there is the potential for selection bias of a healthier sample compared to the broader population. Finally, this study was

unable to include other important determinants of lung functions such as exposure to toxins.

### *Conclusion*

Given that the resources for public health initiatives are increasingly scarce, and that lung health is an under-promoted area of public health research, future research is needed in this area to further investigate differences in gender and lung function. Future direction in this area should focus on examining trends in lung function using cardiovascular fitness over an extended time period to accurately assess patterns and predictors of respiratory health in the United States. Furthermore, this study indicates a disparity between clinical cardiovascular fitness categorizations and a VO<sub>2</sub> max values, which indicate a need for more research into lung function disparities.

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Table 1. Sample Characteristics Stratified by Sex: NHANES 1999-2002

TOTAL	MEN	WOMEN	TOTAL	MEN	WOMEN	TOTAL
	N	Mean (SE) or %	N	Mean (SE) or %	N	Mean (SE) or %
Female, %	21,004	100	10,214	48.63	10,790	51.37
Age, years	21,004	29.5 (24.9)	10,214	29.0 (0.25)	10,790	30.0 (0.24)
White, %	21,004	62	10,214	62	10,790	61.5
High School or Less, %	17,498	42	8,415	40	9,083	43
Body Mass Index,	17,472	25.0 (7.03)	8,478	24.35	8,994	25.21 (0.08)
Serum Triglycerides, mg/dl	3,503	124(95.4)	1,725	123.41 (2.38)	1,778	124.35 (2.18)
Serum Cotinine, ng/ml	15,583	33.4 (93.0)	7,596	42.31 (1.20)	7,987	25.04 (0.88)
Physical Activity, %	14,965	44	7,142	45	7,823	44
Cardiovascular Fitness, %	5,515	27	2,822	26	2,693	29
Low		38		39		39
Medium		34		35		32
High VO <sub>2</sub> max, ml/min/kg	5,515	42 (10.3)	2,822	45.85 (0.19)	2,693	37.92 (0.17)

To convert ng/mL cotinine to nmol/L, multiply by 5.68.

To convert mg/dL triglycerides to mmol/L, multiply by 0.0112.

Table 2: Weighted Percentages of Cardiovascular Fitness Level by Age for Men and Women

	MEN				WOMEN			
	Total	20-29	30-39	40-49	Total	20-29	30-39	40-49
Low	9%	13%	11%	4%	10%	13%	12%	5%
Medium	19%	21%	20%	15%	18%	19%	18%	16%
High	23%	19%	21%	21%	20%	14%	18%	28%
N	5515	4111	4875	640	5515	4111	4875	640

Table 3: Weighted Means (Standard Errors) of VO<sub>2</sub> max by Age for Men and Women

	MEN				WOMEN			
	Total	20-29	30-39	40-49	Total	20-29	30-39	40-49
Mean (SE)	45.02 (0.28)	46.07 (0.36)	45.33 (0.31)	43.92 (0.78)	36.82 (0.29)	37.96 (0.29)	37.32 (0.30)	35.20 (0.49)
N	5515	2114	2496	326	5515	1997	2379	314

Table 4: Linear Regression of VO<sub>2</sub> max on Selected Independent Variables

	Standardized Coefficient	Unstandardized Coefficient	Standard Error	P-Value
Female	-0.32	-7.03	0.94	0.00
Age	-0.04	-0.04	0.03	0.30
White	0.00	1.2	0.87	0.20
Education	-0.09	-1.95	0.98	0.10
Body Mass Index	-0.14	-0.15	0.07	0.05
Serum Triglycerides	-0.07	-0.01	0.00	0.02
Serum Cotinine	0.02	-0.00	0.00	0.91
Physical Activity	-0.02	-0.24	0.71	0.74
Constant		51.29		
R <sup>2</sup>		0.18		

Table 5: Logistic Regression of High Cardiovascular Fitness on Selected Independent Variables

	Odds Ratio	95% Confidence Interval	P value
Female	0.96	0.56-1.66	0.89
Age	1.05	1.02- 1.07	0.00
White	1.40	1.09- 1.77	0.01
Education	1.27	0.83-1.90	0.25
Body Mass Index	0.96	0.94-0.99	0.02
Serum Triglycerides	0.99	0.99-1.00	0.28
Serum Cotinine	1.00	0.99-1.00	0.69
Physical Activity	0.90	0.61-1.33	0.57
X <sup>2</sup> (df)		18.08 (8)	

Figure 1. Conceptual Model for Determinants of Lung Function

