A Case Study: Determining the Relationship between Socioeconomic Backgrounds of Matriculants and Their Environment of Medical Practice after Graduation

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Abstract

The objective of this study was to analyze the relationship between the College's students' socioeconomic status and their likelihood to practice medicine in an environmentally disadvantaged area. The environmentally disadvantaged students can be defined as applicants who have the abilities to succeed in health careers, but come from environments that may have prevented them from fully developing academic potential and applicants who are more likely to provide care to underserved areas than others (Johns Hopkins, 2013). Various factors that influence the physician shortage include: population growth, residential segregation, loan repayment, empathy level, and mission-based values.

The dataset for this study consisted of 264 medical students in matriculation years 2006 - 2009, matched with 209 medical students who graduated in years 2010 - 2013. The Geographic Information System (GIS) was used to select the 16 study variables (e.g., median household income, population density, and average household size) within census tracts. These variables were linked with the parents' or guardians' home addresses and practicing locations of medical graduates, respectively. K-means cluster analysis was used to group the medical students and graduates into the following categories: non-disadvantaged, moderately disadvantaged, and disadvantaged.

The predictive validity of the cluster analysis was validated by partial least squares (PLS) regression. More than 80% of graduates in the disadvantaged category, 60% of graduates in the moderately disadvantaged category, and 45% of graduates in the non-disadvantaged category practiced medicine in disadvantaged communities. The vast majority of medical graduates from disadvantaged populaces practiced in disadvantaged areas which significantly contributed to the College's mission of serving the underserved and reducing health disparities.

Introduction

During the post-Civil War era, after slaves were granted freedom, the city of Nashville had the highest mortality rate in the country (Epps & Hammock, 2009). The rate of death and disease among the ex-slaves were due to unavailability of healthcare. An institution with the purpose of serving the underserved minority population and educating African Americans, along with other minorities, was necessary to address the lack of healthcare (Epps & Hammock, 2009). Through the College, minorities as well as underserved populations were allowed to receive quality health care. The College, founded in 1876, is the nation's largest single private predominantly black institution for the education of health professionals (Johnson, 2000).

The College is the oldest fully-accredited private HBCU (Historically Black Colleges and Universities) in the nation that provides education and training in medicine, dentistry, and biomedical sciences (Epps & Hammock, 2009). The Robert Wood Johnson Foundation called the College a "national resource" (Johnson, 2000). This "national resource" grants the opportunity for low income and high-risk students to become physicians, dentists, and researchers (Johnson, 2000). Many students are from disadvantaged social and economic environments and they may or may not have received adequate secondary and undergraduate education (Johnson, 2000). Johnson (2000) stated that the College serves as an incubator for students and graduates to accept challenges for more responsibility throughout the United States. As of 2009, the College had graduated an estimated 21% of all African American physicians and dentists practicing in the United States (Epps & Hammock, 2009). Essential to minority health, the health professions, and the United States' health care delivery system is the need for underrepresented minority healthcare professionals.

The School of Medicine is known for its focus on health disparities within underserved and vulnerable populations. Many of the College's medical students can personally identify with health disparities, underserved populations, and disadvantaged communities because most medical students are from disadvantaged backgrounds or vulnerable populations. The goal of educating many disadvantaged medical students is to eliminate health disparities within their own community and the population at large. Moreover, medical students at the College are trained from a unique perspective of medical education and urban population research (Epps & Hammock, 2009).

Statement of the Problem

According to the trends of supply and demand, as the number of active physicians continues to grow, the population will grow even faster, which will result in a decrease of physicians per capita (Cooper, Getzen, McKee, & Laud, 2012). There will be 280 physicians per 100,000 of population by 2020 (Cooper, et al., 2012). There will be a deficit of 55,000 to 200,000 physicians by 2020 (COGME, 2005; Cooper, et al., 2012; Hawkins, Mcrritt, and Miller, 2004; Chen, 2009). Only 9% of physicians practice in rural, underserved areas (Chen, 2009). Only 7% to 10% of physicians are minorities while 20% to 25% of the U.S. population are minorities (Black, Latinos, Native Americans) (Katz, 2001; Smedley, Butler, & Bristow, 2004; Chen, 2009). Although the College, along with other institutions, are graduating a significant number of physicians to serve in disadvantaged and underserved communities, there is a shortage of primary care physicians practicing in disadvantaged and underserved communities.

Purpose of the Study

The objective of this study was to analyze the relationship between medical students' socioeconomic status and their likelihood to practice medicine in an environmentally disadvantaged area. Environmentally disadvantaged refers to a location or community's living conditions that includes health disparities, food desserts, and inadequate health care. Johns Hopkins Medicine defines environmentally disadvantaged students as applicants who meet the following criteria: have the abilities needed to succeed in a health career, but come from backgrounds and educational environments that have made it difficult for them to reach and fully demonstrate their academic potential, and applicants who are more than likely to provide care to underserved areas and populations compared to others (Johns Hopkins, 2013). This study was also designed to assess whether or not the College accomplishes its mission to improve the health and health care of minority and underserved communities.

Factors Influencing Primary Care Physician Shortage

Physician Workforce Shortage

Physicians are an important component of the healthcare labor force (Cooper, Getzen, McKee, & Laud, 2012). More resources are needed for healthcare because of population growth and aging of the population. As population growth increases, the number of physicians decreases.

Population growth is a factor that cannot be counted out when determining the reasons for physician shortage. Cooper, Getzen, McKee, and Laud (2012) modified the Census Bureau estimates to forecast that the U.S. population will reach 345 million in 2020. The physician supply increased fivefold in 1929 to 2000, from 144,000 physicians to 772,000 physicians. Cooper et al., (2012) also predicted that the number of active physicians will continue to grow, reaching 964,700 in 2020. As the number of active physicians continues to grow, the population would grow even faster, which results in a decrease of physicians per capita.

Another contributor to the physician shortage in underserved communities is the cost of medical education. Eighty-six percent of medical school graduates had education debt averaging $161,290. Medical students who graduated from private schools incurred over $250,000 in medical school debt. In 1978, the medical school debt was 3.5 times less than in 2011 (Youngclaus, Koeheler, Kotlikoff, and Wiecha, 2013). Research suggests that debt has an influence on a physician's specialty choice, including demographics, personal interest in a specialty's content, patient care, and choice of lifestyle

If a primary care physician's debts are over $200,000, he or she can contemplate an extended repayment plan or federal loan repayment program such as Income -Based Repayment (IBR) or National Health Service Corps (NSHSC) to pay off the loans within an earlier time frame. Moreover, the more a medical student borrows in order to fulfill his or her educational goals, the more likely he or she should reconsider loan repayment options (Youngclaus et al., 2013). For decades, there has been a misconception concerning primary care specialties. Research has shown primary care physicians are more than capable of living comfortably and practicing medicine in underserved areas. A career as a primary care physician is economically viable in today's society.

Residential Segregation

Residential segregation refers to geographical locations or communities within the U.S. population where minorities or people of similar ethnic backgrounds reside; segregated communities may experience primary care physician (PCP) shortages A great percentage of minorities live in communities with limited healthcare services, sometimes referred to as "medical deserts" (Gaskin, Dinwiddie, Chan, and McCleary, 2012). Because the residents of a geographical location are segregated from affluent communities, racial disparities may exist. Some minorities may not face geographical barriers to health care because they live in proximity to teaching hospitals and federally qualified community health centers (Gaskin et al., 2012). Past studies indicate that members of minority communities are more likely to visit hospital outpatient departments, emergency rooms, and community health centers as a primary healthcare source in comparison to Whites.

There have been a few studies of the links between residential segregation and PCP shortage (Gaskin et al., 2012; Smith, 1999; Charles, 2003). The studies found that there is an association between residential segregation on minority accessibility to healthcare. This association is similar to negative relationships between minorities obtaining quality jobs, education, safety, and social networks.

The odds of being a PCP shortage area were 67% higher for majority African American zip codes compared to all other zip codes. The odds of being a PCP shortage area were 27% lower for majority Hispanic zip codes. Residential segregation is one of the variables that constitute PCP shortages in areas that are majority African American. According to the study, African Americans had less geographic access to primary care physicians when they lived in separate communities than Whites (Gaskin et al., 2012). Minorities who reside in "medical deserts" need transportation to travel to the next town or city to receive medical treatment. However, inner cities are dependent upon public transportation that may not travel to nearby towns or communities to drive minorities to healthcare facilities.

Black and Hispanic Physicians Serving the Underserved

A recent survey suggested that Black and Hispanic patients were more likely to report they had a Black or Hispanic physician (Moy & Bartman, 1995; Komaromy et al., 2014). Unfortunately, the lowest physician-to-population ratio occurred in areas of poverty, and underserved areas with higher proportions of Black and Hispanic populations. Also, rural areas have 40 percent fewer physicians compared to urban areas. Black physicians cared for 42.9 percent more of Black patients compared to other physicians. Hispanic physicians practiced in areas where the Hispanic population was three times higher than in areas where other physicians practiced. Hispanic physicians care for more uninsured patients than any other ethnic group. Komaromy et al. (2014) suggests that Black and Hispanic physicians fill a crucial need in underserved areas. High percentages of urban and rural communities are in need of health-care service providers, including more physicians.

Empathy

According to Chen, Lew, Hershman, and Orlander (2007), who conducted a cross-sectional study that is consistent with previous studies, empathy decreases after clinical training in medical school. Empathy is described as the physician's ability to cognitively recognize a patient's perspectives and experiences, and convey such an understanding back to the patient (Chen et al., 2007). Empathy promotes patient and physician satisfaction, contributes to patient enabling and participation, and may improve patient outcomes.

There is a link between gender and empathy level. According to previous studies, female physicians and medical students are more likely to have a greater level of empathy compared to male physicians and medical students (Hojat, Mangione, & Nasca, 2001; Chen et al., 2007). Also, level of empathy may increase with maturity. Financial indebtedness may potentially influence the selection of career choice and cause high debt students to prefer more lucrative or technical specialties.

According to Chen et al. (2007), students with high levels of empathy may choose people-oriented careers. First-year medical school classes normally have the highest empathy scores compared to fourth year medical school classes, who have the lowest empathy scores. This shows that there is a decrease in the level of empathy after the third year clinical training. There are several factors that can influence students'

empathy levels. Student doctors experience a wide range of emotions and stresses (long work hours, sleep deprivation, dependence on technology for diagnoses, shorter patient hospitalizations, and limited bedside interactions) and may struggle to maintain their empathy (Rosen, Gimotty, Shea, & Bellini, 2006; Chen et al., 2007). In order to be a better doctor, many student doctors will suppress their emotions and stresses to treat their patients effectively.

Importance of Having a Mission to Serve

In the United States, there are four medical schools with the mission of serving in disadvantaged and underserved areas: Charles R. Drew University of Medicine and Science, Howard University, Morehouse School of Medicine, and Meharry Medical College. Each of the schools serve the underserved from unique aspects of education, research and medical practice.

All medical schools are expected to have a level of social mission to train physicians to care for the population, including the primary care, underserved areas, and workforce diversity (Mullan, Chen, Petterson, Kolsy, & Spagnola, 2010). Morehouse College, Meharry Medical College, and Howard University ranked the highest out of all medical schools in relation to social mission scores. According to the social mission measures, western medical schools produce more primary care physicians compared to other regions (Mullan et al., 2010). Southern schools have the largest percentage of physicians practicing in underserved areas.

Study Sample and Data Source

The dataset for this study consisted of 264 medical students from the 2006 - 2009 matriculation years, matched with 209 medical students who graduated between the years of 2010 - 2013. There were 55 students whose census tract data was missing and whose graduation status was not recorded due to attrition and still enrolled statuses. The data set is derived from the College's Student Tracking System. The Census tract data was derived from the 2012 American Community Survey of the U.S. Census Bureau. This study was approved by the Institutional Review Board (IRB) of the College. Confidentiality was maintained throughout the study. The records for the study were kept in a password secure file on the College's computer server.

Study Methods

The geographical information system (GIS) was used to select the 16 study variables (Table 1) within census tracts linked with parents' or guardians' home addresses and practicing locations of medical graduates. K-means cluster analysis based on census tracts was used to group the medical students in the following categories: non-disadvantaged, moderately disadvantaged, or disadvantage. The XLSTAT 2013 software was used for PLS regression and IBM Statistical Package for Social Sciences (SPSS) version 21 was utilized for cluster analysis and Fisher's LSD procedure.

K-means Cluster Analysis

The centers of k (zip codes from matriculants' background environments or zipcodes from medical school graduates place of practice) are found by minimizing the mean squared distance from each data point to its nearest center (Kanungo et al, 2002). The Lloyd's k-means clustering algorithm, also known as the filtering algorithm, determines the optimal placements of the center of a cluster (Kanungo et al., 2002).

According to the cluster analysis, Cluster 1 represents the highest mean of individual variables such as median household income and per capita income, and is therefore labeled as non-disadvantaged populaces. Non-disadvantaged populaces have the highest mean per capita income and household income and the lowest mean renter-occupied housing and population density. Cluster 2 represents the second-highest or middle mean of a variable and is labeled as moderately disadvantaged populaces. Moderately disadvantaged populaces have the next-to highest per capita income and household income as well as the second-highest renter-occupied housing and population density. Cluster 3 corresponds to the mean and is described as disadvantaged populaces. Disadvantaged populaces have the lowest mean in regards to per capita income and household income and the highest mean in regards to population density and renter-occupied housing. Census tracts aid in determining the overall socioeconomic status of an environment The census tract variables are characterized by demographic information and used to distinguish homogenous groups.

Fisher's LSD Procedure

The F test in one-way Analysis of Variance (ANOVA) was used to analyze the significant mean difference of the cluster and criteria variables among the cluster groups, respectively. If the p value for a variable being tested is greater than the .05 significance level, the variable means among the cluster groups are not significantly different. If the p value of a variable is less than the .05 significance level, the variable means among the cluster groups are significantly different.

The Fisher's Least Significant Difference (LSD) was used to further define the identity of the three cluster groups by comparing the mean difference of a variable between each of the cluster groups. The significant mean difference between the cluster groups aided in the definition of non-disadvantaged, moderately disadvantaged and disadvantaged groups. The comparison of the cluster groups was measured for each variable (population density, median household income, per capita income, and renter-occupied housing units).

Partial Least Squares Regression

The predictive validity of the cluster analysis would be validated by partial least squares (PLS) regression. PLS regression is a dimension's reduction tool that establishes a relationship between a set of observed variables and latent variables (Abdullah, Chen, Buford, & Bruce, 2013). PLS regression identifies significant variables associated with the disadvantaged, moderately disadvantaged, or non-disadvantaged groups. PLS regression utilizes Variable Importance in the Projection (VIP) to rank the variables that contribute the most to the classification of disadvantaged, moderately disadvantaged, or non-disadvantaged groups.

Table 1 shows the variable names and definitions that were utilized during the cluster analysis to identify whether a student is from a disadvantaged, moderately disadvantaged, or non-disadvantaged background.

Table 1.
Study Variables

Variable Description (SPSS Variable Name)	Variable Calculation	Source
Population Density (POP_DEN)	It is derived from the total population divided by the total land area in square mile.	United States Census Bureau
Median Household Income (MED_HH_INC)	The amount which divides the income distribution into two equal groups, half having income above that amount, and half having income below that amount.	United States Census Bureau
Per Capita Income (PER_CAP_INC)	It is calculated by taking a measure of all sources of income in the aggregate and dividing it by the total population.	U.S. Department of Commerce, Bureau of Economic Analysis
Average Household Income (AVG_H_INCOME)	It is calculated by taking the dollar amount of all household incomes combined and dividing it by total number of US households.	United States Census Bureau
Renter-Occupied Housing Units (RENT_OCCUPY)	The number of occupied housing units that are not owner occupied, as collected annually by American Community Survey.	American Community Survey of the United States Census Bureau
Owner-Occupied Housing Units (OWNER_OCU_HH_UNITS)	The number of occupied housing units that are owner occupied.	American Community Survey
Vacant Housing Units (VACAN_HH_UNITS)	A housing unit is vacant if no one is living in it at the time of Census accounting, unless its occupants are only temporarily absent.	American Community Survey
Average Household Size (AVG_HH_SZ)	It is calculated by dividing the number of people in household by the number of households.	United States Census Bureau
Unemployment Rate (UNEMP_RATE)	It is calculated as a percentage by dividing the number of unemployed individuals by all individuals currently in the labor force.	Bureau of Labor Statistics
Poverty Rate (POV_RATE)	It is calculated by using the sum of family income divided by the sum of poverty thresholds.	United States Census Bureau
Poverty Percent Under 18 Years of Age (PCT_POVERTY_UNDER_18)	The percentage is calculated by the number of children in poverty divided by the total US children's population.	American Community Survey
Educational Attainment (PCT_HIGH_DIPLOMA, PCT_LESS9THGRADE, PCT_LESS12THGRADE, PCT_BA_DEGREE, PCT_GRAD_PROF_DEGREE)	The percentage is calculated by highest level of education completed divided by total 25 years or older population.	American Community Survey

Statistical Hypothesis

The research questions in this study were: (1) Are the College's medical school graduates from disadvantaged backgrounds more likely to practice medicine in disadvantaged communities?; (2) what percent of the graduates practice medicine in disadvantaged communities? The null hypothesis of this study was: the College's medical school graduates from disadvantaged backgrounds are not likely to practice medicine in disadvantaged areas compared to graduates from non-disadvantaged backgrounds. The alternative hypothesis of the study was: the College's medical school graduates from disadvantaged backgrounds are likely to practice medicine in a disadvantaged community compared to graduates from non-disadvantaged background.

Protected Fisher's LSD for Matriculants

The p value of ANOVA for the population density was greater than the .05 significance level, meaning that there was no significant mean difference of the population density among the cluster groups. The p values of ANOVA for the median household income, per capita income, and renter-occupied housing units were less than the .05 significance level, indicating that there was a significant mean difference among the cluster groups for median household income, per capita income, and renter-occupied housing units, respectively.

The group comparison consisted of three pairs: Cluster 1 vs Cluster 2; Cluster 1 vs Cluster 3; and Cluster 2 vs Cluster 3. The p value was greater than the .05 significance level in the Fisher's LSD procedure for C3 vs C1, which indicated that there was no significant mean difference of population density between C3 vs C1, disadvantaged populations and non-disadvantaged populations. The p value was greater than the .05 significance level in the Fisher's LSD procedure for C3 vs C2 and indicated that there was no significant mean difference of population density between disadvantaged populations and moderately disadvantaged populations. Median household income and per capita income had a p value less than the .05 significance level for Clusters 1, 2, and 3. This showed that there was a significant mean difference of median household income and per capita among disadvantaged, non-disadvantaged, and moderately disadvantaged groups. The variable (renter occupied housing units) had a p value less than the .05 significance level, which was a significant mean difference for C3 vs C1 and C3 vs C2. Therefore, the variable for renter-occupied housing units was greater in disadvantaged groups compared to non-disadvantaged groups and moderately disadvantaged groups.

Protected Fisher's LSD for Graduates

The p value of ANOVA for population density, median household income, per capita income, and renter-occupied housing units was less than the .05 significance level, indicating that there was a significant mean difference among the cluster groups for population density, median household income, per capita income, and renter-occupied housing units, respectively.

The population density for group comparison, C3 vs. C1 and C3 vs. C2, had a p value less than the .05 significance level in the Fisher's LSD procedure. These results indicated there was a significant mean difference between disadvantaged and non-disadvantaged practice environments (C3 vs C1); there was also a significant mean difference between disadvantaged and moderately disadvantaged practice environments (C3 vs C2). Group comparisons, C3 vs. C1 and C3 vs. C2 for median household income showed the p value

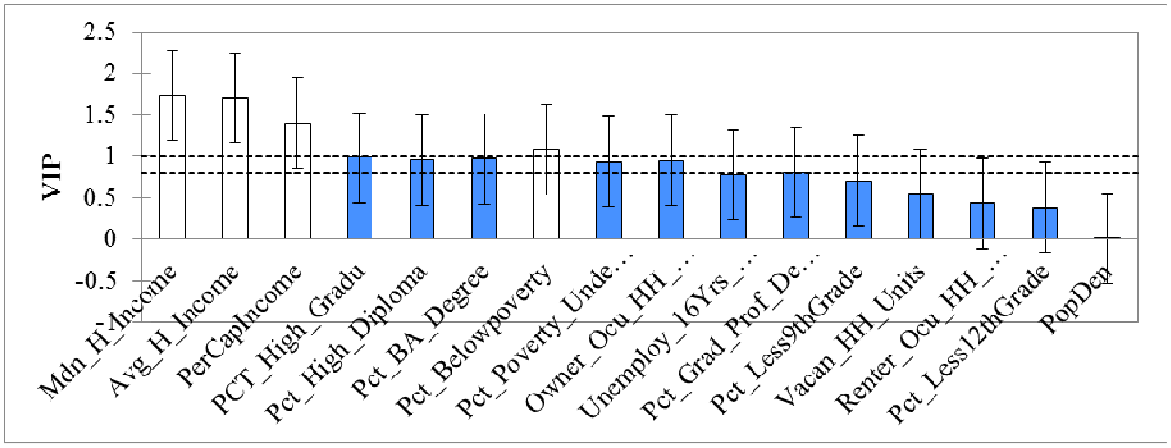
was less than the .05 significance level, indicating that there was a significant mean difference between disadvantaged and non-disadvantaged practice environments (C3 vs C1) and between disadvantaged and moderately disadvantaged practice environments ((C3 vs C2). Per capita income and renter-occupied housing units had a p value less than the .05 significance level in the Fisher's LSD for C1 vs C2 and C1 vs C3. As a result, there was a significant mean difference among non-disadvantaged and moderately disadvantaged practice environments (C1 vs C2) and non-disadvantaged and disadvantaged practice environments (C1 vs C3).

Partial Least Squares Regression

Partial least squares (PLS) regression allows the researcher to identify a subset of significant explanatory variables contributing to the outcome variable. The outcome variables are the categorical: non-disadvantaged (Cluster 1), moderately disadvantaged (Cluster 2), and disadvantaged (Cluster 3). As a dimension reductions tool, PLS regression permits more variables being used to assess the model fitting and determine the relationship among variables. PLS regression handles collinearity problems, which allows the researcher to use more socioeconomic variables in the cluster analysis. In this study, the variables included: median household income, average household income, and per capita income. The criteria variables were percent of population graduated from high school, percent of population with a high school diploma, percent of population with a bachelor's degree or higher, percent of population living below poverty line, and so forth, Criteria variables are additional variables used to validate the significant difference of the three clusters. The Variable Importance in the Projection (VIP) ranked the variables that contributed the most to the classification of disadvantaged (C3), moderately disadvantaged (C2), or non-disadvantaged (C1) groups.

As shown in Figure 1, four independent variables greatly contributed to the three cluster groups: median household income (VIP = 1.73), average household income (VIP = 1.703), per capita income (VIP = 1.398), and percent below poverty (VIP=1.101) due to their 95% confidence intervals containing a VIP of 1.5. These variables were the most important for defining the categorical outcome variable (disadvantaged, moderately disadvantaged, or non-disadvantaged groups).

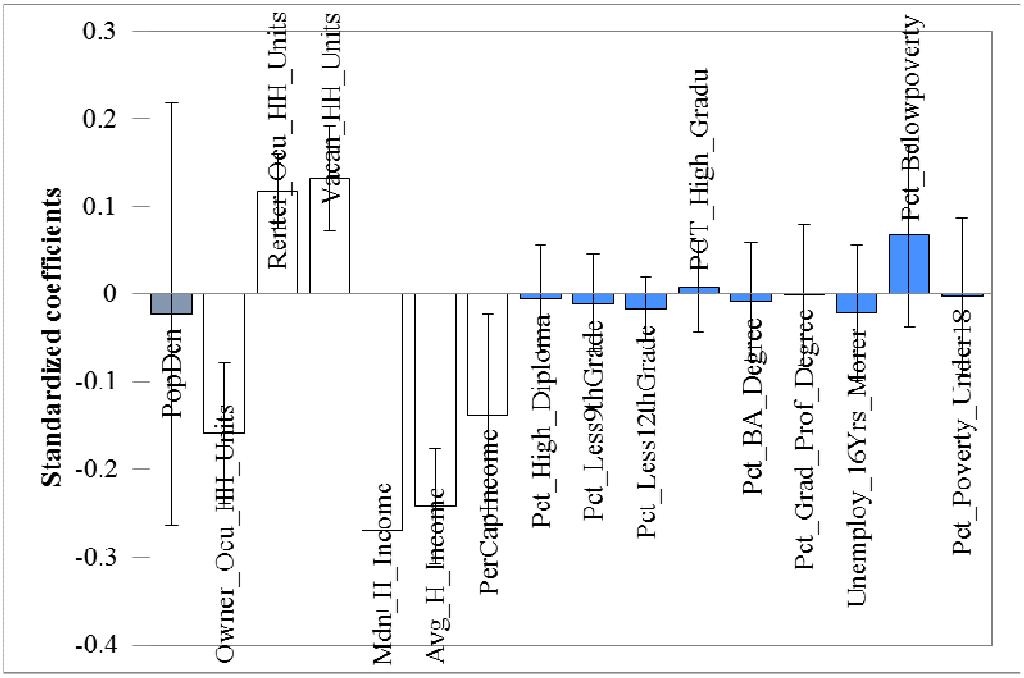
Figure 1.
Variable Importance in the Projection Model (95% Conf. Interval)



Standardized Regression Coefficient

The standardized regression coefficient determined which independent variables had a significant impact on the categorical variable (non-disadvantaged, moderately disadvantaged, and disadvantaged groups.) by using the 95% confidence interval. If a variable's 95% confidence interval for the standardized coefficient contained zero, it did not significantly contribute to non-disadvantaged, moderately disadvantaged, and disadvantaged groups. If a variable's 95% confidence interval for the standardized coefficient did not contain zero, it significantly contributed to non-disadvantaged, moderately disadvantaged, and disadvantaged groups. According to Figure 2, there were six independent variables that were either negatively or positively associated with non-disadvantaged (C1), moderately disadvantaged (C2), and disadvantaged (C3) groups.

Figure 2.
Confidence Interval of Standardized Regression Coefficient



Owner occupied housing units (-0.158), median household income (-0.270), average household income (-0.242), and per capita income (-0.138) were negatively associated with the three clusters. As owner occupied housing units, median household income, average household income, and per capita income increased, the cluster group changed accordingly from disadvantaged to non-disadvantaged. Two variables were positively associated with the three clusters: renter-occupied housing units (0.117) and vacant housing units (0.132). Cluster groups with the most renter-occupied housing units and vacant housing units were labeled as moderately disadvantaged and disadvantaged rather than non-disadvantaged. These results are consistent with the cluster definitions in measuring the predictive validity of the study. Also, the R squared value of 0.63 demonstrated the model goodness of fit. Sixty-three percent of the variation in the outcome variable--non-disadvantaged, moderately disadvantaged, and disadvantaged groups was explained by the independent variables such as population density, median household income, per capita income, and renter-occupied housing units.

Socioeconomic Status of Medical Matriculants

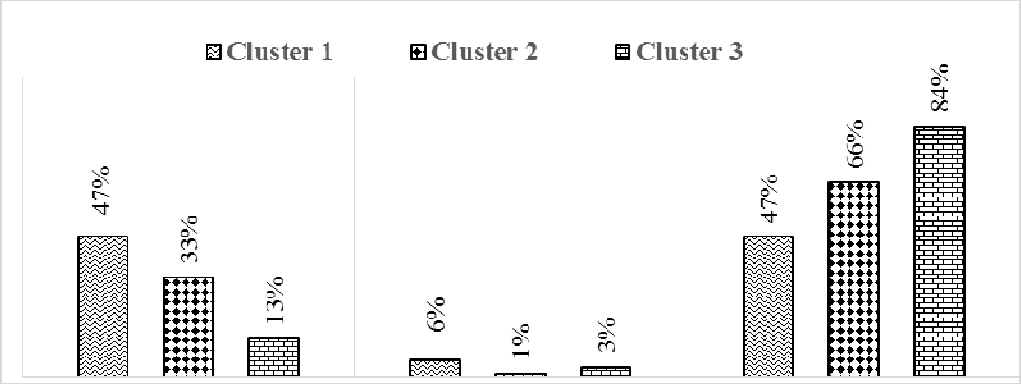
There are three clusters for student socioeconomic status: non-disadvantaged students (cluster 1), moderately disadvantaged students (cluster 2), and disadvantaged students (cluster 3), which show the families' socioeconomic backgrounds for the medical school matriculants of 2006 - 2009 who graduated in years 2010 - 2013.

Eight percent (17/209) of matriculants were from non-disadvantaged backgrounds, Cluster 1. Cluster 2 revealed that 33% (69/209) of matriculants were from moderately disadvantaged backgrounds. Fifty-nine percent (13/209) of matriculants, cluster 3, were from disadvantaged backgrounds.

Practice Environments for Medical Graduates

Figure 3 identifies the community of medical practice for the graduates in 2010-2013. The three clusters are non-disadvantaged populaces (Cluster 1), moderately disadvantaged populaces (Cluster 2), and disadvantaged populaces (Cluster 3). In Cluster 1, 23% (47/209) of medical graduates practiced medicine in non-disadvantaged communities. Only 3% (6/209) practiced medicine in a moderately disadvantaged community. Of the graduates, 75% (156/209) practiced medicine in disadvantaged communities.

Figure 3.
Medical Graduates Practicing in Communities



Cluster 1 – Non-disadvantaged Backgrounds

Nearly half of Cluster 1 (47% or 8/17) from non-disadvantaged populaces practiced in non-disadvantaged communities while the other half (47% or 8/17) from non-disadvantaged populaces practiced in disadvantaged communities. Cluster 1 medical graduates were from non-disadvantaged populaces, which demonstrated that the College's mission is being fulfilled. Graduates from non-disadvantaged populaces are honoring their commitment to serve the underserved population.

Cluster 2 – Moderately –Disadvantaged Backgrounds

Cluster 2 represents moderately disadvantaged populaces. Approximately, one-third or 33% (23/69) of graduates from moderately disadvantaged populaces practiced medicine in non-disadvantaged

communities. Nearly two thirds or 65% (45/69) of graduates from moderately disadvantaged populaces practiced medicine in disadvantaged communities.

Even though the graduates of Cluster 2 were from moderately disadvantaged populaces, the majority of the cluster practiced medicine among disadvantaged populations. Two times as many graduates from moderately disadvantaged areas practiced in disadvantaged areas compared to non-disadvantaged areas. The mission to serve the underserved contributes to lessening the physician shortage in underserved areas.

Cluster 3 – Disadvantaged Backgrounds

The results for graduates from disadvantaged populaces are shown in Cluster 3. Thirteen percent (16/123) of graduates from disadvantaged populaces practiced medicine in non-disadvantaged environments. Four graduates, 3% (4/123), practiced in moderately disadvantaged communities. Most graduates from disadvantaged populaces practiced in disadvantaged communities, 84% (103/123). Six times as many graduates from disadvantaged communities practiced medicine in disadvantaged areas compared to non-disadvantaged areas.

Communities of Medical Practice

More than 80 percent (103/156) of graduates from disadvantaged backgrounds (Cluster 3), 60 percent (45/156) of graduates from moderately disadvantaged backgrounds (Cluster 2), and about 45 percent (18/156) of graduates from non-disadvantaged backgrounds (Cluster 1) practiced medicine in disadvantaged communities. However, over 3% from cluster 3, 1% from cluster 2, and 5% from cluster 1 practiced medicine in a moderately disadvantaged community. The majority of the graduates of each cluster practiced medicine in a disadvantaged community, whether moderately disadvantaged or disadvantaged. In summary, over 80 percent of graduates from disadvantaged populaces practiced in disadvantaged areas, which significantly contributed to the mission of the College and the reduction of health disparities.

Discussion

The primary care physician shortage is rapidly increasing as the economic cost for the health care markets increases. The federal and state governments are devoted to funding the latest medical technologies; however, funding cannot produce physicians with compassion for the underserved communities.

Physicians working in non-disadvantaged communities are considered to be at a greater advantage than physicians working in moderately disadvantaged and disadvantaged communities. Most of these physicians are able to work with the state of the art medical technologies, have patients who are willing to pay out-of-pocket fees and insurance co-payments. They have a great amount of leisure time, family time, and tend to make more money. Physicians who work in moderately disadvantaged communities could also have the best of both worlds. Their patients may be able to pay for medical treatments and the physicians may work with up-to date medical equipment. Most physicians working in disadvantaged communities are said to have the most debt, worst patient-payment history, and overused medical instruments.

The College trains medical students to be mission-driven and have compassion towards patients, doctors, and people. More than 80 percent of graduates from disadvantaged backgrounds (Cluster 3), 60 percent of graduates from moderately disadvantaged backgrounds (Cluster 2), and 45 percent of graduates

from non-disadvantaged backgrounds (Cluster 1) practice medicine in disadvantaged communities. The College's graduates are devoted to giving back to disadvantaged communities. As discussed in the literature, the factors that influence the primary care physician shortage are: residential segregation, lifestyle and leisure time, loan repayment time, prestige, empathy level, physician-patient communication, social compassion, and mission-based values. There are not enough physicians with mission-based values to serve the underserved. This can contribute to the physician shortage in underserved areas across America. When physicians choose to practice in disadvantaged areas, the mission of the College is honored.

Strength of the Study

This study identified whether or not the 264 matriculants were from disadvantaged backgrounds, moderately disadvantaged backgrounds, or non-disadvantaged backgrounds. Moreover, the study assessed whether or not the 209 medical school graduates practiced in disadvantaged, moderately disadvantaged, or non-disadvantaged communities. The study accomplished its objectives in determining the relationship between the medical students' socioeconomic status and their likelihood to practice medicine in an environmentally disadvantaged area. The results of the study demonstrated that the College's mission is appropriate and fruitful. Various statistical models (K-means cluster analysis, PLS Regression) and statistical tests (ANOVA F test, Fisher's LSD test) were used to accurately define the cluster groups, identify the significant variables, and measure the predictive validity of the cluster analysis model.

Limitations of the Study

The results of the k-means cluster analysis for the medical graduates' practice environments did not distinguish primary care physicians from other specialties. The practice environments of the graduates include the environments of primary care physicians as well as other specialists. As a result, this could be identified as a limitation of the study. Twenty percent or 55 of the medical matriculants were excluded from the study due to missing data in census tracts and attrition status, or not graduating within their expected years. Also, the study was selected from a sample of students in recent years. The medical graduates from the classes of 2010 - 2013 could be in the process of completing their residency years. During residency years, medical doctors may or may not train in areas where they would like to establish their practice. These limitations affect the study in terms of generalizability.

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