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Prescribing Change for Minority Students: Diagnosing Inequalities in Science Education in the Clark County School District

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Abstract

Promoting entry of underrepresented minority groups into the allied health professions is paramount to developing a balanced workforce that reflects the needs of an evolving populace. Currently, significant underrepresentation of racial minority groups in health and science related fields correlates with data showing an overrepresentation of black and Latino students in Title 1 (at-risk and low-income) schools. Data suggest that students who are exposed to "higher quality" science education, such as "hands on" experiences, have increased interest in pursuing a health or science related career. These findings prompt the hypothesis that Title 1 schools face inequalities in their science education when compared to Non-Title 1 schools. The study presented herein utilizes surveys targeted to Clark County School District high school science teachers to analyze variation in science education between Title 1 and Non-Title 1 high schools. These surveys reveal that Title 1 schools perform significantly fewer biology experiments than Non-Title 1 schools. In addition, this study indicates a correlation between lower socioeconomic status and the absence of a school science club. Science clubs are important outlets for mentorship and further exposure to science education, especially for minority students of low socioeconomic backgrounds. These results may provide the basis for legislative action to improve minority students' access to health/science programs. Future retrospective and/or prospective studies may determine how secondary science education influences such factors as college acceptance rate, percentage of college matriculates declaring majors in science related fields, and ultimately, rates of entry into healthcare fields.

Introduction

Last October, a passenger on a Delta Airlines flight was having a medical episode[1]. Tamika Cross, another passenger on the flight, heard the passenger's wife scream for help and a flight attendant yell, "Call overhead for a physician on board!" Tamika, a black doctor, immediately raised her hand to alert the flight attendant that she was a doctor and could help. The flight attendant dismissed her and stated, "Oh no sweetie, put your hand down. We are

[1] See the Delta Airlines 'News' Section for further inquiry into this event.

looking for actual physicians or nurses or some type of medical personnel, we don't have time to talk to you." Dr. Cross tried to explain to the flight attendant that she was a doctor, but she was continually interrupted. The announcement repeated again: "Any physician on board please press your button!" This time, Dr. Cross stared at the flight attendant as she pressed her button. The flight attendant said, "Oh wow, you're an actual physician?" Dr. Cross stated that she was. The flight attendant then asked, "Let me see your credentials. What type of doctor are you? Where do you work?"

During this same time, a white male passenger approached the row of the medically distressed passenger and stated that he was a physician. The flight attendant then looked at Dr. Cross and said, "Thanks for your help, but he can help us and he has his credentials." Dr. Cross claims that he never showed his credentials, but that as a white male he automatically "fit the description of a doctor" (Hauser). This incident ultimately led to policy changes for Delta Airlines and an apology to Dr. Cross. Yet, this incident raises questions about what it historically means to "look" like a doctor; and, how the traditional "look" oftentimes causes individuals who are not "white and male" to face discrimination. To begin to change society's perception of what a doctor looks like, we must encourage more students of color to pursue medicine. This discrimination event makes one wonder if the flight attendant's reluctance to acknowledge Dr. Cross' professional status is connected to the larger problem of underrepresentation of minority groups in the medical profession.

In 2011, the Association of American Medical Colleges reported that whites and Asians accounted for approximately 58% and 20%, respectively, of matriculates into U.S. medical schools, while Latinos and blacks comprised the remaining 9% and 6%, respectively. The sociological impact of such underrepresentation is underscored by several studies showing that

patient satisfaction rates are higher amongst patients seen by doctors of the same race as themselves (Hopkins). Because patient satisfaction is positively correlated with medication compliance and appropriate follow up, the underrepresentation of minorities in health related fields may have a negative impact on health at a population level. In addition, the U.S. Census projects that non-whites will account for a majority of the U.S. population by 2050, thus further emphasizing the need to increase representation of minority populations in health and science related fields.

Compounding the underrepresentation problem is that high quality science education is not distributed evenly geographically or demographically throughout the United States. This has significant impacts on students in various socioeconomic levels, especially Hispanic minorities (Rogers-Chapman). Current research has also found that homogenous (90% to 100% of students come from minority racial backgrounds) schools with high percentages of underrepresented minority and poor students are linked to disparities in learning opportunities and resource accessibility (Kuscera et al.). Minority students in poor schools are more likely to face conditions of overcrowding, and have diminished access to college preparation courses and/or qualified teachers compared to affluent white counterparts (Kuscera et al). To address these conditions, the United States has launched the "Educate to Innovate" initiative to increase American students' engagement in STEM (Science, Technology, Engineering, and Mathematics) courses. In 2015, the Obama Administration announced $240 million in new STEM commitments to inspire and prepare more students, especially those from underrepresented groups, to pursue STEM fields (White House).

Research at the curriculum level typically analyzes how a student's participation in a science-focused school or program influences his or her likelihood to pursue a science or health

related career. A number of studies (Scott, Berk et al., Fleming et al., Oscos-Sanchez et. al, Salto et al.) confirm that students who are exposed to "higher quality" science education[2], or who are in science-focused schools or programs, display an increased interest in pursuing a health or science related career. Therefore, the United States' educational system has primarily addressed the low percentage of minority students entering health or science related fields by focusing efforts on enriching science education through science-focused high schools or programs. In contrast, a paucity of work analyzing the curriculum of general comprehensive public high schools exists, which leaves a gap in the research.

I argue that it is more important to study the delivery of science education in comprehensive public high schools than in science-focused high schools because they enroll the majority of disadvantaged and minority students. For example, the 2010 U.S. Census reported the race count for the total population as approximately 63% White, 5% Asian, 16% Hispanic, and 13% black (Census). Data from the Department of Education demonstrate that 67% of Latino and 66% of black students attend a Title 1[3] (at-risk and low-income) school. In comparison, approximately 30% of white and 39% of Asian students attend a Title 1 school; therefore, black and Latino minority groups are overrepresented at Title 1 schools.

Because Latino and black students are both overrepresented at Title 1 schools and underrepresented in science related fields, I studied the quality of science education as a function

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[2] Experts define higher quality science education as access to hands-on experiments, laboratory materials and equipment, specimens, laboratory space, and a qualified teacher.

[3] "Title I is the federal education law that provides funding to elementary and secondary schools for programs and services to help economically disadvantaged students to succeed. The purpose of Title I is to ensure that all students have an equal opportunity to reach State learning standards. Title I is intended to help close the gap in academic achievement between students in different ethnic and income groups" (CCSD). Note that in order for a school to qualify for Title 1 status, more than 40% of the school's student body must qualify for free-or-reduced lunch.

of socioeconomic status at high schools in the Clark County School District (CCSD). My study was designed to test the hypothesis that the quality of high school science education diminishes with decreasing socioeconomic status. This research will aid in helping my readers understand the bigger and more important question of how institutionalized educational disparities may affect low-income/minority students' aspirations to pursue a health or science career. Determining if there are institutionalized science educational disparities that affect low-income/minority students may be the first step to increase their rates of entry into health or science fields. Increasing minority rates of entry into health or science fields may help society change its perception of "what doctors look like," so that other doctors of color will never have to face the discrimination that Dr. Cross did on her Delta Airlines flight.

In order to understand the relationship between potential disparities in science education between Non-Title 1 and Title 1 schools, I utilize several research questions to guide my work, which include:

1. Do differences in science education exist as a function of socioeconomic status in the Clark County School District?
2. Does the primary race/ethnicity of the students in the Clark County School District correlate with quality of science education?

I hypothesize that there are differences in science education between Non-Title 1 (predominantly white) and Title 1 (predominantly black and Latino) schools because the rates of entry into post-secondary health/science fields is significantly different between each racial group. The expected results may provide the basis for legislative action to improve minority students' access to health/science programs. Future retrospective and/or prospective studies may determine how secondary science education influences such factors as college acceptance rates, percentage of college matriculates declaring majors in science related fields, and ultimately, rates of entry into healthcare fields.

Background

Structural discrimination theory suggests that discrimination against minority racial/ethnic groups is the result of the normal functioning of societal institutions (Ray). Systemic discrimination is an "institutionalized pattern of discrimination that cuts across major political, economic, and social organizations in a society" (Feagin). This theory states that certain racial groups find themselves "perpetually disadvantaged by society's opportunity and reward structures because of the result of past discrimination, including slavery, Jim Crow Laws, unequal hiring practices, and residential segregation", amongst others (Ray). For example, through the process of residential segregation:

> Blacks (Latinos) have been relegated to poor urban ghettos with deteriorating infrastructure, minimal tax base, non-existent grocery stores, high rates of poverty, crime, drug use, and disease. Low quality schools in these racially segregated neighborhoods provide black (Latino) children with a lower quality education than white children. This then reduces their ability to attend college and obtain high paying jobs. Discrimination, in this case, does not depend on the actions of specific individuals or organizations. Instead, it is a function of the standard operating procedures of social institutions. Indeed, individuals themselves no longer need to engage in discriminatory practices because the years of racial/ethnic inequality have sedimented into the very fabric of society, much in the same way that rock builds upon rock in the formation of mountains (Ray).

Along these lines, one must acknowledge that the United States is part of a racialized social system, which is the idea that society is organized along racial lines and that economic, political, and social sanctions differ according to one's placement in the racial hierarchy (Gallagher). Similarly, Omi and Winant (Racial Formation Theory 2004) suggest that what is significant about one's placement in this socially constructed racial hierarchy is not necessarily one's own perception of their race, but the "recognition of social institutions of our membership in that racial category" (Ray). In addition, Omi and Winant contend that the construction of the racial hierarchy is significant because it forms from "superior" to "inferior"; consequently, the race placed in the superior position tends to "receive greater economic enumeration and access to

better occupations and prospects in the labor market, occupies a primary position in the political system, is granted higher social estimation, often has the license to draw physical as well as social boundaries between itself and other races, and receives psychological wage" (Gallager). Consequently, structural discrimination is intertwined with our racialized society, which continually places whites in the "superior" position and grants them more structural opportunity and rewards, such as access to prestigious medicine or science jobs. The sociological theory of structural discrimination also suggests that structural barriers may impede individual's (group's) life chances. This perspective guides my research and exploration to examine the presumption that minority students and students of color attend "low-quality" schools.

One of the primary ways that researchers have focused on increasing students' interest in science (especially that of underrepresented minorities) is through STEM focused schools. A STEM focused school's curriculum places further emphasis on subjects including science, technology, engineering, and mathematics, to increase a student's participation in the STEM fields as a career. For instance, Erdogan and Stuessy's study researched the college readiness of students who attended inclusive STEM schools versus traditional public high schools in Texas. This study also analyzed how student demographics correspond with student success on various achievement measures at inclusive STEM versus traditional public high schools. Erdogan et al. found that student demographics do contribute to a student's achievement success on state test scores at inclusive STEM versus traditional high schools: Hispanic students and economically disadvantaged students at inclusive STEM schools performed better than Hispanic and economically disadvantaged students at traditional high schools. These findings suggest a correlation between socioeconomic status and student achievement between students at inclusive STEM schools ("higher quality" science education) and traditional public high schools in Texas.

This study's findings are comparable to Catherine Scott's study, which examined whether STEM high schools better prepare students for careers in STEM fields than traditional high schools in the United States (Scott). Scott concluded that students who attend STEM-focused high schools out-perform their peers at comprehensive high schools on end of year assessments. Therefore, as Erdogan et al. and Scott both suggest, students who attend STEM focused high schools outperform their peers who attend traditional high schools. The data yielded from such studies promote the thinking that students who attend STEM focused programs perform better than traditional students, which is one reason why the United States policy makers have continued to fund such schools.

Another way researchers have focused on increasing the number of minority students entering science fields is through health or science focused programs. An extensive body of research suggests that students who attend Science or Health related programs are more likely to pursue a Science/Health related career. For example, Berk et al. analyzed the Harvard Medical School MEDscience course to determine how effective the medical simulation-based courses are for promoting self-efficacy among students and how these courses encourage students to continue to pursue Science or healthcare related careers after graduation. This study concluded that allowing students to engage in hands-on experiences encourages them to purse a science or health related field. Furthermore, Fleming et al. suggests that exposure to "high quality" science further encourages students to pursue a science or health related career. Fleming et al.'s study found that participation in the nine-week Cross-Cultural Education in Public Health (CCEPH) program increased students' interest in pursuing a career in a health profession. Thus, this study corroborates the findings that exposing minority students to health or science programs boosts their likelihood of pursuing a science related career. Oscos-Sanchez et al. conducted a study

utilizing a similar approach as Fleming et al. on their analysis of the Teen Medical Academy (TMA). This study found that completion of the Teen Medical Academy was associated with increased interest, confidence, belongingness, and sense of achievement as related to health careers for minority students. Similar results were obtained in a large study conducted on high school students who participated in the Summer Science Academy (SSA) program at the University of Rochester. This study surveyed approximately 100 participants of the program and found that 80% of the students indicated that attending SSA contributed to their interest in a science career (Markowitz). Furthermore, 73% of the students who graduated college pursued a science career or postgraduate education (Markowitz). Importantly, this study conducted follow-up interviews to determine if intent transitioned to action, which was something for which Berk et al., Fleming, and Oscos-Sanchez did not account. Collectively, these data support the notion that "high quality" science education increases a student's likelihood to pursue a health or science related career; thus, highlighting the importance of immersing students (especially underrepresented minorities) in "high quality" science education. Such measures represent a first line approach in beginning to close the racial gap in health and science fields.

While "higher quality" science education increases interest in pursuing a health or science related career, a significant "gap" in the literature remains. The United States has primarily addressed the low percentage of minority students entering science or health related fields by focusing on either STEM high schools or Health/Science programs, rather than analyzing and correcting the science curriculum of general comprehensive public high schools. Thus, I argue that it is more important to study comprehensive public high schools because they enroll the overwhelming majority of students. The current "state of the field" highlights the importance of the immersing students in "high quality" science education to increase the lack of

diversity in health and science careers; however, the literature primarily focuses on "high quality" science education that is located in specific STEM focused schools or extracurricular programs. Therefore, there is a "gap" in the literature because it does not analyze science education in traditional comprehensive public high schools. I argue that we should study comprehensive public high schools' science curriculum because these are the schools most students attend.

At the individual student level, factors that contribute to minority students' high attrition rates in Health/Science fields are the lack of academic rigors and scholarly challenges that are typically associated with higher education degrees (Flowers). Thus, continuing with the theory of structural discrimination, a large study of several school districts in Southern California analyzed the patterns of school segregation and the associated outcomes and opportunities for students in Southern California.

Analyzing the concentration of students by race and poverty status found that the racial composition of the classroom begins to matter when concentrations of minority students are closely overlaid with profound pockets of poverty. This creates a "double segregation" where students are isolated by both race and class (Kuscera et al.). Kuscera et al. found that poor white students make up 33% of the population; however, poor black and Latino students make up 63% and 69% of the poor student population, respectively. Of particular relevance to the data presented herein, the authors found that learning opportunities and resource disparities are linked to these segregation patterns (Kuscera et al.).

For school safety, the authors discovered that "between intensely segregated schools of color and predominantly white/Asian schools, a 17% difference on average in overcrowding existed across the six counties" (Kuscera et al.). Unfortunately, students in overcrowded environments tend to perform worse, have higher absence rates, student attention is lower, and

violence occurs more often; therefore, overcrowding creates unsafe and ineffective learning environments (Kuscera et al.). For qualified teachers, the authors found that 18% of intensely segregated schools of color experienced a severe shortage of qualified teachers; however, none of the predominantly white/Asian schools experienced a similar shortage of qualified teachers (Kuscera et. al). Teacher quality is related to educational achievement and attainment; thus, it is an important factor to consider for student achievement.

The authors also found that "intensely segregated and majority-minority schools of color experienced a greater shortage of college readiness courses, college prep teachers, and college prep mathematics teachers than majority white/Asian schools" (Kuscera et al.). For example, intensely segregated schools are three times more likely to have a severe shortage of college prep teachers than majority white/Asian schools. Overall, the results from this study indicate a "systemic trend of severe school segregation is strongly related to inequality in both opportunities and outcomes" (Kuscera et al.).

Promoting entry of underrepresented minority groups into the allied health professions is paramount to developing a balanced workforce that reflects the needs of our evolving U.S. society. Data suggest students enrolled in programs that focus on "hands on" science develop interest and self-efficacy to pursue a health/science career. The study presented herein utilizes surveys targeted to CCSD high school science teachers to analyze variation in science education between Title 1 and Non-Title 1 high schools. These surveys revealed that Title 1 schools perform significantly fewer biology experiments than Non-Title 1 schools. In addition, this study indicates a correlation between lower socioeconomic status and the absence of a school science club. Science clubs are important outlets for mentorship and further exposure to science education, especially for minority students from low socioeconomic backgrounds. These results

may provide the basis for legislative action to improve minority students' access to health/science programs. Future retrospective and/or prospective studies may determine how secondary science education influences such factors as college acceptance rate, percentage of college matriculates declaring majors in science related fields, and ultimately, rates of entry into healthcare fields.

Methods

Study population. All public high schools within the CCSD with publicly available contact information for science teacher staff were eligible for inclusion. Of the forty-eight candidate schools, fifteen schools were excluded due to the inability to identify science teacher staff, resulting in thirty-three schools that met study eligibility criteria. These thirty-three schools amassed a total of 312 high school science teachers in the CCSD. Freely available data regarding student race/ethnicity and socioeconomic status, and each school's Title 1 or Non-Title 1 status was collected.

Survey. A mixed methods survey[4] was distributed to 312 CCSD high school science teachers, representing the thirty-three eligible schools, using UNLV's Qualtrics Survey Program between January 31, 2017 and February 15, 2017. Responses from a total of 29 high schools were received, yielding an 87% response rate. These 29 schools offered a total of 85 completed individual surveys (27.24% individual response rate).

Qualitative data analyses. Responses to open ended questions were analyzed and categorized into themes using a frequency count and coding for key words/themes, yielding seven themes.

Statistical analyses. Students' *t* test and one-way analysis of variance with post-hoc testing were performed, as appropriate.

[4] See appendix for a copy of the survey.

Results[5]

Demographics of CCSD Schools. Freely available demographic data were used to analyze the characteristics of each school's student body based on Title status. **Figure 1** reveals that Non-Title 1 schools have a higher percentage of white students and a lower percentage of students of color. The Non-Title 1 race/ethnicity data demonstrate that these schools are, on average, 45.67% white, 23.50% Hispanic, 11.08% black, 9.68% Asian, and 9.64% other (**Figure 1A)**. The Title 1 race/ethnicity data demonstrate that these schools are, on average, 17.05% white, 55.84% Hispanic, 14.89% black, 6.68% Asian, and 5.53% other (**Figure 1B**). Similar trends were found across the different tiers of Title 1, with increasing percentages of students of color with progression from Tier 3 to Tier 1. Tier 3 schools are, on average, 21.44% white, 43.35% Hispanic, 16.64% black, 9.19% Asian, and 8.57% other (**Figure 2A**). Tier 2 schools are, on average, 12.89% white, 58.70% Hispanic, 20.12% black, 2.78% Asian, and 4.42% other (**Figure 2B**). Tier 1 schools are, on average, is 8.51% white, 71.23% Hispanic, 14.69% black, 1.93% Asian, and 3.50% other (**Figure 2C**).

As expected, higher proportions of students at Title 1 schools are on Free or Reduced Lunch (FRL). Approximately 30% of Non-Title 1 students receive FRL, compared to approximately 70% of Title 1 students (**Figure 3A**). When Title 1 schools are categorized into their respective tiers, the percentage of students on FRL increases. Approximately 57.19%, 74.40%, and 85.4% of the students at Tier 3, 2, and 1, respectively, are on FRL (**Figure 3B**). Together, these data support the validity of the study populations, as they conform to national racial and ethnic trends and correspond to the expected rates of FRL required to meet Title 1 status.

[5] All figures and figure legends are located after References/Appendix.

The surveys revealed that Non-Title 1 schools perform significantly more biology experiments per year compared to Title 1 schools (27.71 +/- 4.26 experiments, n = 7 vs. 14.64 +/- 2.11, n = 11, p = 0.007; **Figure 4A**). Furthermore, when Title 1 schools are categorized into their respective tiers, Tier 3 schools perform approximately 16 biology experiments per year; Tier 2 schools perform 12 biology experiments per year, Tier 1 schools perform 10 biology experiments per year, and magnet schools perform 13 biology experiments per year (**Figure 4B**).

Teachers in Non-Title 1 schools seem to perform fewer teacher demos per school year compared to teachers in Title 1 schools (13.37 +/- 3.5 teacher demos per year, n = 19 vs. 13 vs. 20.55 +/- 3.689 teacher demos per year, n = 33, p = 0.20; **Figure 5A**). Although insignificant, this trend was preserved across all Tiers of Title 1, with Tier 3 schools performing a mean of 20 teacher demos per year, Tier 2 schools performing a mean of 21 teacher demos per year, and Tier 1 schools performing a mean of 19 teacher demos per year. Interestingly, magnet schools seem to more closely replicate Non-Title 1 schools, performing a mean of 10 teacher demos per year (**Figure 5B**).

Data analysis of science club presence revealed that Non-Title 1 schools seem to be more likely to have a science club than Title 1 schools (88% vs. 57%; **Figure 6A**). Furthermore, with increasing severity of Tier status within the Title 1 designation, schools seem to have a decreasing likelihood of having a science club, with actually no science club at the Tier 1-Title 1 school (n =1 for Tier 1-Title1 high schools in CCSD; **Figure 6B**). Incredibly, amongst the schools with science clubs, a disturbingly high percentage of science teachers were actually unaware of the presence of a science club at their school. Science teacher unawareness of science club presence ranged from 15-32% across Non-Title 1, Title-1, and Magnet schools (**Figure 6C-D**).

To assess the potential barriers that may impede access to high quality science education in CCSD schools, teachers were asked to respond to:

> "If you do not feel that you are provided with enough equipment/resources to have students participate in in-class laboratory experiments to meet the Nevada Academic Content Standards for Science then what equipment/resources do you wish you were provided with?"

Seven themes were discovered:

1. Lack of time
2. Adequate resources, but a desire for more
3. Lack of up-to-date Technology
4. Inadequate resources for experiments
5. Lack of science Lab Rooms
6. Out-of-Pocket Expenses
7. Overcrowded classrooms/labs

Below are selected qualitative responses to represent each of the coded themes:

1. Time: "It isn't so much that we don't have what we need, it is that we lack TIME to plan and execute."
2. Adequate resources, but a desire for more: "(We would like to have) Enough resources for all experiments/activities to have 2-3 students per lab group versus 4-5 students."
3. Technology: "Computers that work and do not take up the entire 50 min period to turn on or load a web page."
4. Inadequate resources for experiments: "We just don't have enough (equipment) for the number of students that we teach."
5. Lack of science Lab Rooms: "We need an actual lab room to conduct labs with students. It would be easier, safer and more productive."
6. Out-of-Pocket Expenses:
    a. "It would be nice not to have to purchase biology supplies with my own money."
    b. "I have a $100 budget for labs. Everything else I pay for."
7. Overcrowded Classrooms/Labs: "The class sizes are too large to do traditional labs."

Interestingly, Non-Title 1 schools qualitative responses focused on Time and being given even more resources to decrease the number students per lab group. Conversely, Title 1 schools qualitative responses focused on having Up-to-Date Technology, More supplies/equipment, Science Lab Rooms, and not having to come Out-of-Pocket for their experiment expenses (**Table 1**).

Discussion

Discussion of Results

The data presented herein confirm the hypothesis that minority students of color face inequalities in science education. In particular, it was found that in the CCSD, students of color (especially Latino minorities) are the majority in high poverty schools, whereas whites are the majority in low poverty schools. Teachers in Title 1 schools perform more "Teacher Demos" compared to Non-Title 1 schools. These data correlate with qualitative data, which found that teachers in Title 1 schools state they need more supplies, equipment, and technology to have their students perform experiments. Non-Title 1 schools in the CCSD perform significantly more Biology experiments each year than Title 1 schools. In addition, this study indicates a correlation between lower socioeconomic status and the absence of a school science club.

To elaborate, first, in the CCSD, students of color (especially Hispanic/Latino minorities) are the majority in high poverty schools, whereas whites are the majority in low poverty schools. Therefore, this data recapitulates national data. These data indicate that a school's poverty level is directly proportional to its percentage of students of color. These findings are significant because there is a correlation between the patterns of school segregation and associated outcomes and opportunities for students as Kuscera et al. suggests:

> The social capital differences between impoverished minority schools and whiter and wealthier schools potentially play out in important ways, such as hiring and retaining

> more highly qualified and experienced teachers, normalizing a school and community climate that encourages homework completion, academic achievement, regular attendance and college enrollment, and offering students more advanced and challenging curricula. These disparities, as well as others, tend to produce lower education achievement and attainment (which in turn limits lifetime opportunities) for students who attend high poverty, high minority school settings.

Furthermore, prominent sociologists, such as Joe Feagin, corroborate these findings by suggesting black (and Hispanic) students who remain in schools composed predominantly of students of color lack first-rate educational opportunities and resources (Feagin 194). Feagin states, "They never have gotten the level of socioeconomic resources invested in their educations that typical white children have received" (Feagin 194). Given these findings, it was important to understand if the correlation between the patterns of school segregation and associated opportunities for students was translatable to science education. My work demonstrates that in reference to science education in high schools in the CCSD, students of low income *and* color receive lower quality science education compared to more affluent (predominantly white) high school students.

Non-Title 1 schools in the CCSD perform significantly more Biology experiments than Title 1 schools. Lab experiments, access to laboratory equipment and space, and a qualified teacher define "high quality" science education. Non-Title 1 schools perform significantly fewer biology experiments per year. After finding this result, the Title 1 schools were analyzed by their individual tier status, which revealed a trend suggesting that an increase in poverty and over-representation of minority students decreases the number of biology experiments the school conducts each year.

Several studies (Scott, Berk et al., Fleming et al., Oscos-Sanchez et. Al, Salto et al.) confirm that students who are exposed to "higher quality" science, such as "hands on" experiences, have increased interest in pursuing a health or science related career. Furthermore,

data (Hunt) suggest that students who frequently conduct "hands-on" experiment score significantly higher on science-standardized tests. According to my research results, schools that are populated primarily by minorities and exhibit higher levels of poverty conduct significantly fewer "hands-on" experiments than the more affluent, predominantly white Non-Title 1 schools. This raises the question as to whether this finding is one of the factors that impedes minorities' pursuit of health or science careers. Many minority students attend schools whose exposure to "hands on" science is half the rate of more affluent schools. Since "hands on" experiences have been confirmed to increase interest in the health and sciences, one must wonder if this lack of "hands on" experiments directly relates to the underrepresentation of minorities in the health and science fields. Poor minority students of color are not being given the tools to foster science aspirations at the same rate as more affluent white schools.

To compensate for the inequities in biology resources, it appears that teachers in Title 1 schools are instead performing science demonstrations themselves in lieu of allowing students to perform experiments. Title 1 teachers perform more "Teacher Demos" compared to Non-Title 1 schools. These data correlate with qualitative responses, which found that teachers in Title 1 schools state they need more supplies, equipment, technology, lab space, and less out-of-pocket costs to allow their students to perform more "hands-on" experiments. Overall, the primary themes for Non-Title 1 schools were more time to plan and execute experiments and more resources for smaller-sized lab groups. The primary themes for Title 1 schools were more supplies, equipment, technology, science lab rooms, and not having to pay out-of-pocket for their students to perform experiments. A potential pitfall of performing teacher demonstrations instead of allowing students to perform hands-on experiments is failure to foster students' self-interest in the sciences.

The CCSD's Non-Title 1 schools are more likely to have a Science Club. Furthermore, as a schools' percentage of students on FRL increases, which corresponds to increased racial minority group populations of the school, the less likely the school is to have a Science Club. This finding is significant because data (Sahin) demonstrates that students who participate in a science club in high school have a higher percentage of matriculation into a post-secondary science major than the national average. Not only are Title 1 schools less likely to have a Science Club, but Title 1 science teachers are more likely to be unaware that their school has a science club. This finding is alarming because Title 1 schools are more likely to have predominantly students of color, and mentorship in science is important for minority students, especially those from low socioeconomic backgrounds (Boekeloo et al.). As we know, Science Clubs are important outlets that help foster students' interest and aspirations to pursue a health or science related field. Families in lower socioeconomic classes likely have financial constraints; thus, they may not be able to afford extracurricular science exploration. Thus, it is imperative that minority students from lower socioeconomic backgrounds are provided access to school sponsored extra-curricular science exposure, especially exposure at the same rate as Non-Title 1 schools.

Implications

The literature reviews conducted for this project revealed that students who are exposed to "higher quality" science, such as "hands on" experiences, have increased interest in pursuing a health or science related career. Yet, significant underrepresentation of minority groups in health care persists despite targeted efforts to bolster science education with special programs and magnet schools. The purpose of my project was to study the delivery of science education in comprehensive public high schools because they enroll the majority of disadvantaged and minority students.

Within Clark County, there are approximately 2100 physicians, which represents the following racial demographics: 1307 white, 503 Asian, 150 black, and 130 Hispanic or Latino. Thus, our physician demographics are 62.5% white, 24% Asian, 7.1% black, and 6.2% Hispanic or Latino. On a Clark County population level, we are approximately 48% white, 8.7% Asian, 10.5% black, and 29.1% Hispanic or Latino (Census). This indicates that in Clark County, our physician population for whites and Asians are overrepresented, while our black and Hispanic/Latino physician population is underrepresented. Furthermore, within the Clark County School District, whites represent approximately 16% and Asians represent 6.6% of Title 1 students, while black and Hispanic/Latino students are 15% and 55% (respectively) of Title 1 schools (CCSD Accountability Data). This indicates that within Clark County, we have an overrepresentation of students of color in Title 1 schools for their population levels.

Given the findings from my project (Title 1 schools are less likely to have Science Clubs and perform significantly fewer biology experiments), it is imperative that we begin to address these inequities in science education in our schools. In order to address the underrepresentation of physicians of color in our own backyard, we must provide equitable science education for all students in our public schools. Furthermore, UNLV's new School of Medicine will enroll its inaugural class for Fall of 2017. These results may help the UNLV School of Medicine understand the inequalities in science education in the CCSD, which may aid in further exposing students of color in Title 1 schools to "hands on" health and science education. Some of the UNLV School of Medicine's 10-year goals are to educate and train doctors for urban practice and increase the number of doctors who practice in Las Vegas (UNLV). Recruiting students from within the CCSD is imperative because these students are more likely to have ties to Las Vegas and to want to return to Las Vegas to practice medicine. To increase diversity in medicine,

the UNLV School of Medicine will hopefully recruit students of color from low socioeconomic backgrounds, i.e. those found in Title 1 schools.

Many compounding oppressive factors likely impede a disadvantaged minority student from pursuing higher education. Therefore, we must ensure a level playing field at the institutional level of public education. Doing so may foster aspirations of minority students, and provide them with the proper tools, to enter a health or science career, ultimately increasing the rates of entry of minority students into health and science fields. This will, ultimately, begin to change society's perception of what a doctor historically looks like, so that the discrimination Dr. Cross experienced on her Delta flight will be never have to be felt by another doctor or scientist of color again.

Limitations and Further Inquiry

This study utilized data from general comprehensive public high schools; therefore, these data are not generalizable to the entire Clark County School District. Furthermore, my data represents 29/48 high schools so my results are not generalizable because data was not received from every public high school in the CCSD. It should also be noted that there is only one Title 1-Tier 1 high school in Las Vegas, and therefore only one represented in this study. Also, there may be "recall" bias, as my surveys asked respondents to provide the average number of the objective measures performed over an entire school year. Some may argue that the reason that students of color from low socioeconomic backgrounds do not pursue health/science fields at the rates of whites and Asians is not because of their inferior schools, but because of the culture of poverty, oppositional culture, disadvantaged neighborhoods, lack of familial support, etc. These variables are likely important contributing factors, but their evaluation was beyond the scope of my study.

Repetition of my study over multiple academic years is expected to strengthen my determinations by providing repeated measures. Furthermore, retrospective and/or prospective studies may determine how secondary science education influences such factors as college acceptance rate, percentage of college matriculates declaring majors in science related fields, and ultimately, rates of entry into healthcare fields.

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Appendix

Survey Questions:

1. On average, how many in-class experiments do your students perform each school year?
2. On average, how many off-campus field trips related to science do your students partake in each year?
3. Do you feel that you are provided with enough equipment/resources to have students participate in in-class lab experiments to meet the Nevada Academic Content Standards for Science?
4. Do you feel that you are provided with enough funding to have your students participate in off-campus science exploration to meet the Nevada Academic Content Standards for Science?
5. Do your students participate in any science related programs outside of the normal school day (weekend or summer programs)? If so, how many? Percentage?
6. On average, how many science demonstrations (teacher only) do you do in class each school year?
7. Does your school or department support a science club?
8. Does your school or department support an annual science fair?
9. Do you or your school have any outside guest speakers come to your class to discuss science or health related field career opportunities for your students?

Figures

Figure 1

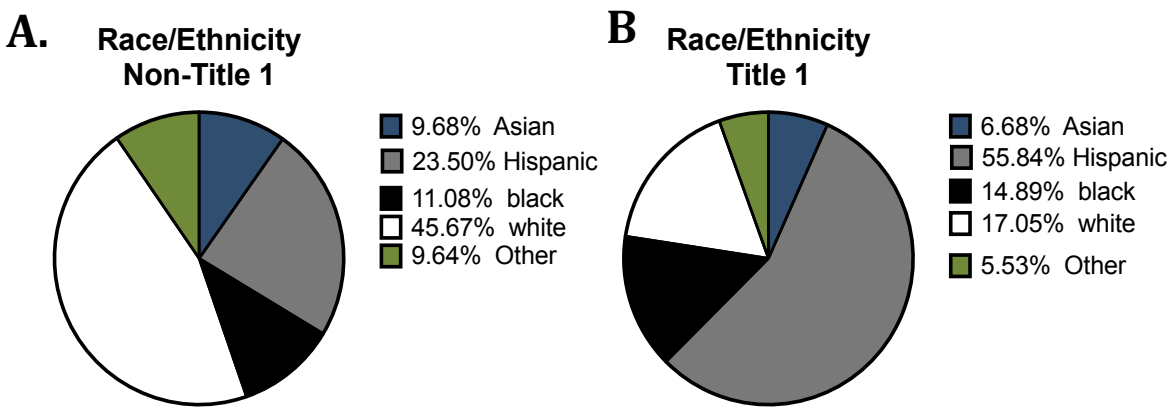

Figure 1: Race/ethnicity data by Title Status. Clark County School district (CCSD) high school student race and/or ethnicity displayed as a percentage of total student body population for Non-Title 1 (**A)** and Title 1 **(B)** status**.**

Figure 2

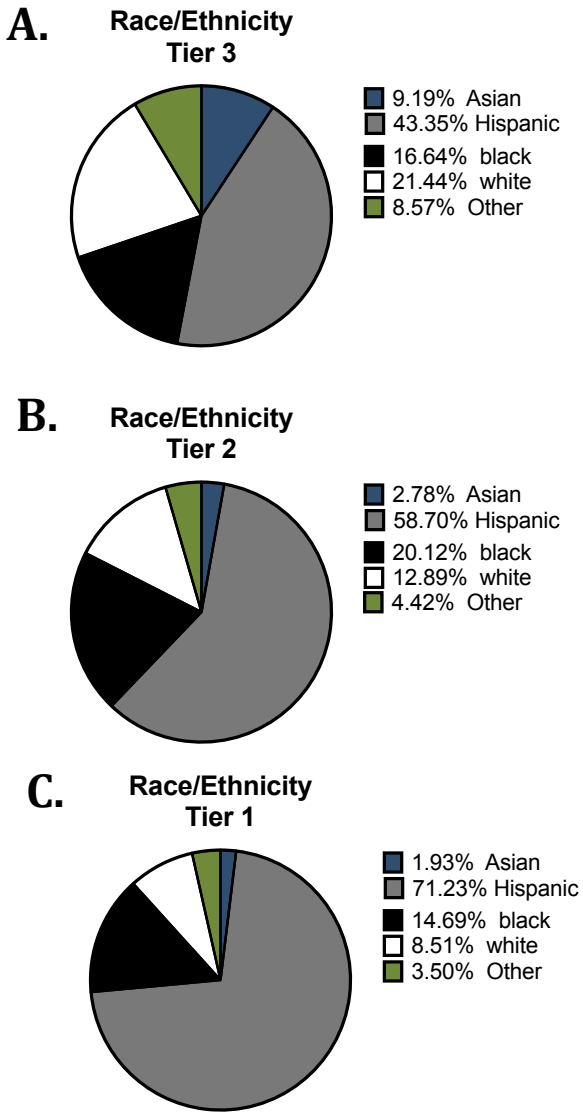

Figure 2: Race/ethnicity data by Tiers within Title 1 Status. CCSD high school student race and/or ethnicity displayed as a percentage of total student body population for Title 1- Tier 3 (**A)**, Title 1- Tier 2 **(B)**, and Title 1-Tier 1 status**.** Tier 3 represents the least socioeconomically disadvantaged group within the Title 1 designation, while Tier 1 represents the most socioeconomically disadvantaged group.

Figure 3

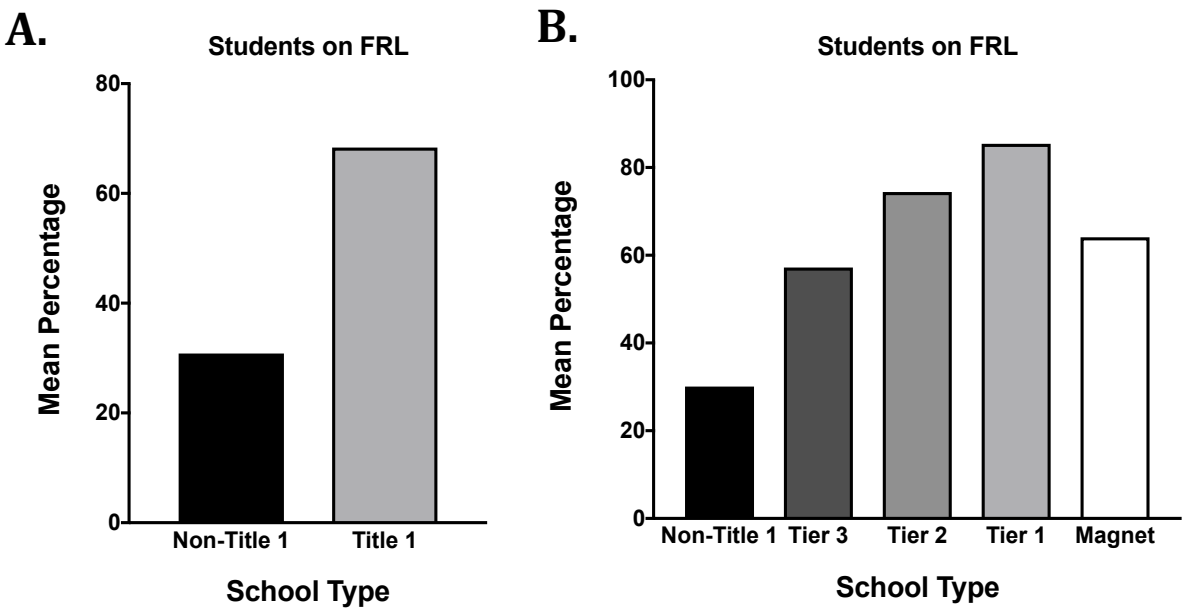

Figure 3: Percentage of CCSD high school students on free or reduced lunch. Data are displayed based on Title status (**A)** and as individual sub-groups within the Title 1 designation, including Magnet programs **(B).** FRL, free and reduced lunch; Magnet, magnet programs and technical programs; Title 1, all tiers within Title 1 designation pooled.

Figure 4

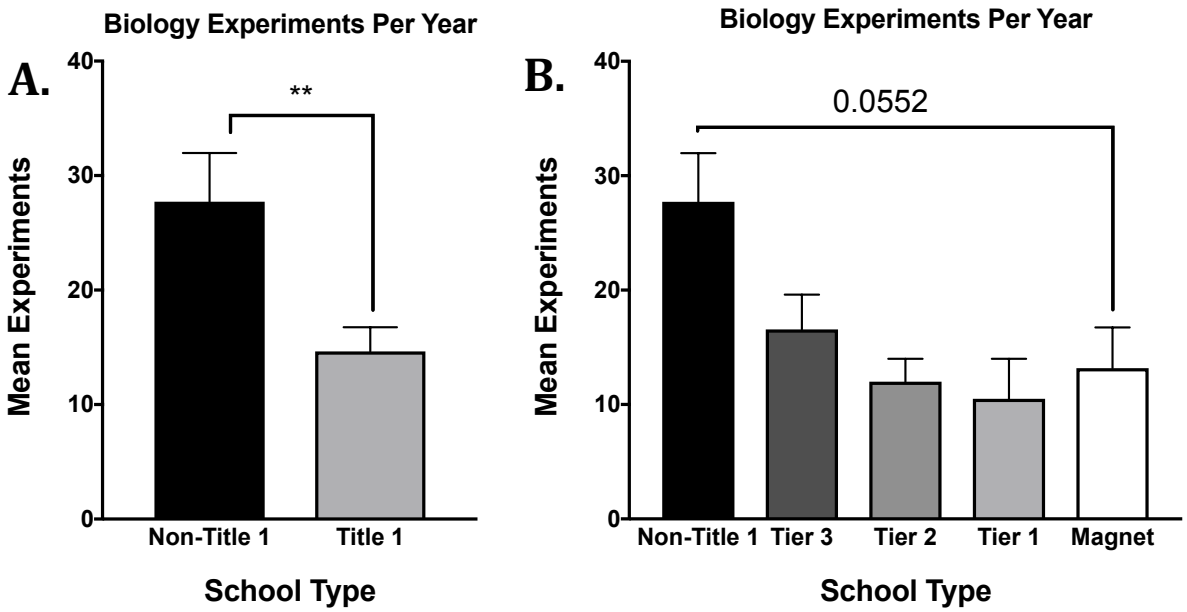

Figure 4: Mean number of biology experiments performed yearly by school type. Mean experiments in Non-title 1 vs. Title 1 schools (**A)** and as individual sub-groups within the Title 1 designation, including Magnet programs **(B).**

Figure 5

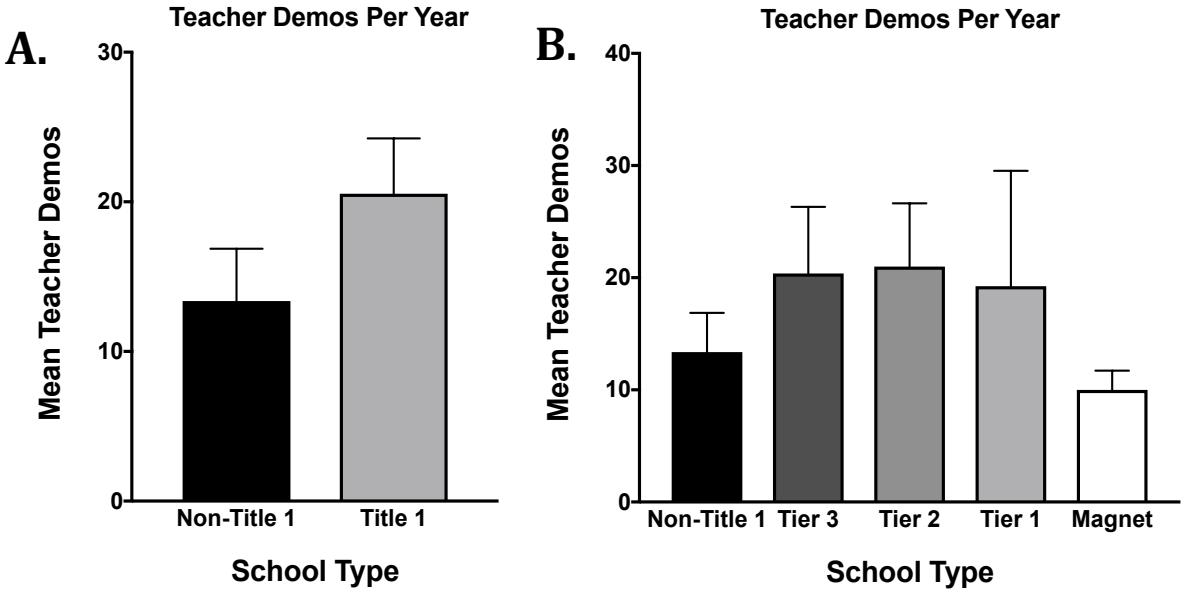

Figure 5: Mean number of teacher demonstrations performed yearly by school type. Mean teacher demos in Non-title 1 vs. Title 1 schools (**A)** and as individual sub-groups within the Title 1 designation, including Magnet programs **(B).** Demos, demonstrations.

Figure 6

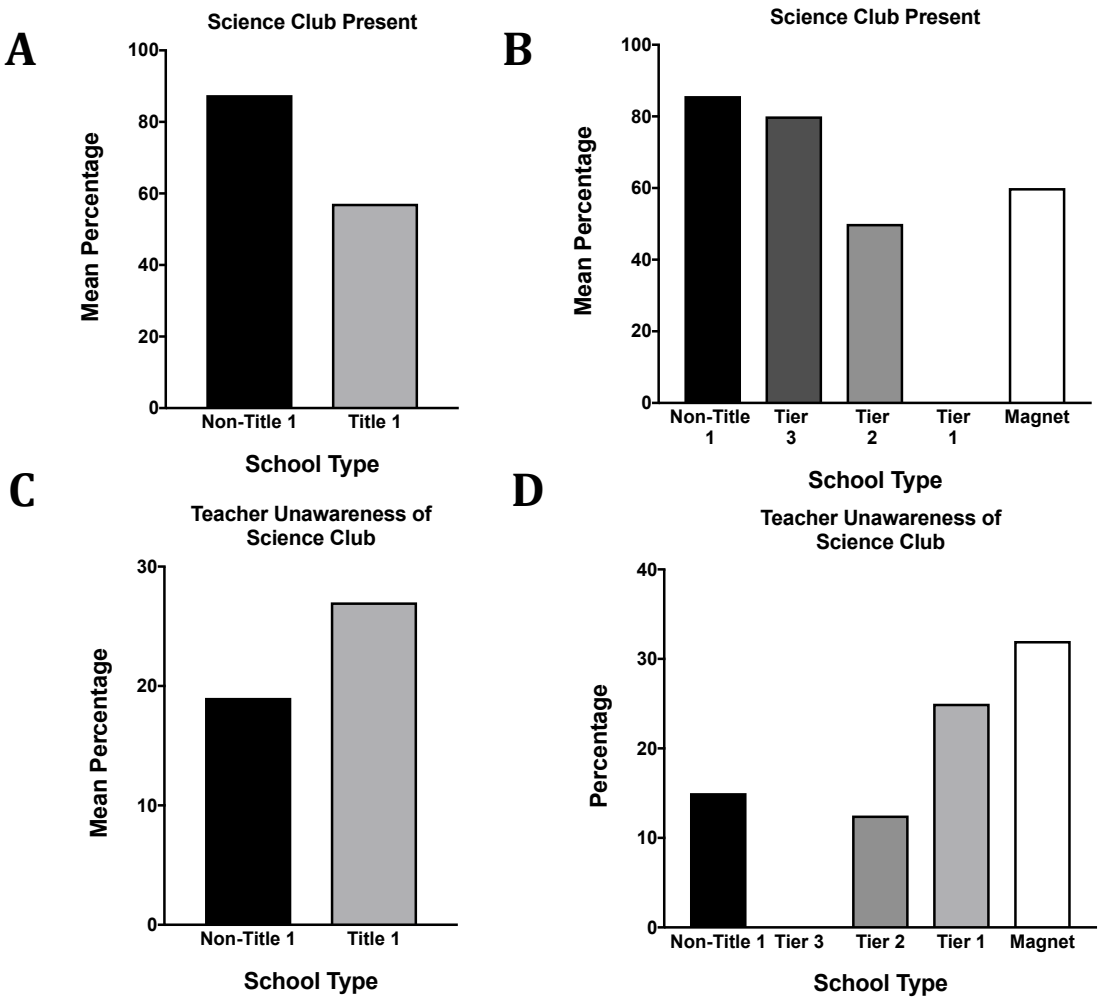

Figure 6: Science club presence and awareness by school type. Mean percentage of schools with a science club present based on title status (**A)** and as individual sub-groups within the Title 1 designation, including Magnet programs **(B).** Mean percentage of science teachers that were unaware of the presence of a science club at their school based on title status (**C)** and as individual sub-groups within the Title 1 designation, including Magnet programs **(D).**

Table 1

THEME	NON-TITLE 1	TITLE 1
TIME	43%	6%
ADEQUATE RESOURCES, BUT A DESIRE FOR MORE	43%	6%
CURRENT TECHNOLOGY	7%	19%
INADEQUATE RESOURCES FOR EXPERIMENTS	7%	31%
LACK OF SCIENCE LAB ROOMS	0%	16%
OUT-OF-POCKET EXPENSES	0%	13%
OVER-CROWDED CLASSES	14%	9%