Abstract

The purpose of this paper is to characterize optometrists in the United States based on race and ethnicity. A 40-year record of students enrolled in doctor of optometry programs in the United States was used to estimate proportions, which were then compared with Census 2010 data. Black and Hispanic optometrists comprise a substantially lower proportion when compared with the population. Non-Hispanic White and Asian optometrists are a higher proportion than the population. This is the first effort to estimate the racial and ethnic mix of the profession.

Key Words: optometrists, racial, ethnic, disparity, clinician, demographics

Introduction

In the medical professions, shared race and ethnicity between clinicians and patients have been shown to improve communication and result in greater patient satisfaction, improved quality of care, improved access, and higher retention in care. The literature exploring whether shared race and ethnicity in the physician/patient dyad could play a role in reducing health disparities experienced by Hispanic and Black patients shows that minority patients are likely to choose minority physicians, and minority physicians are likely to have a disproportionately large share of minority patients when compared with their non-minority colleagues. Understanding the demographics of the optometric profession, then, is important in planning the educational pipeline of future optometrists, both for recruitment of any under-represented groups and for development of curricula to bridge patient or clinician perceptions leading to unintended bias in clinical care. These biases are not only in one direction. They can originate from the patient or from the clinician.

A review of literature and government and private sources of data shows that little is available to characterize the demographics of today’s “clinician-optometrists,” i.e., optometrists who are primarily engaged in caring for patients. Throughout this paper, “optometrist” is used to refer to “clinician-optometrists,” and intended to exclude those primarily engaged in non-patient-care activities.

In the late 1960s, the National Center for Health Statistics sponsored The 1968-69 Vision and Eye Care Manpower Survey. The study estimated that there were 20,300 doctors of optometry in the United States, and 91% were in active practice. The median age was 47.5; 3% were female; nearly 90% were in private practice. The study did not collect race and ethnicity data. The American Optometric Association (AOA), an organization that frequently advocates for political issues of importance to the profession, also does not collect race and ethnicity information on its members. Its Workforce Study of Optometrists estimates 39,228 optometrists in the year 2011. Age and sex are available, but not
race and ethnicity. The U.S. Bureau of Labor Statistics also does not report race and ethnicity of optometrists, but provides this information for a broad range of healthcare providers, including dentists, physicians, pharmacists and chiropractors. The U.S. Department of Education collects extensive data on enrollment and degree attainment, but aggregates optometry into the category of “First Professional Degree,” which includes Doctor of Medicine (MD), Doctor of Optometry (OD), Doctor of Dental Surgery (DDS) and Juris Doctor (JD). Finally, it appears there are no peer-reviewed papers that estimate the current racial and ethnic composition of optometrists.

Census 2010 estimated the U.S. population at 310 million; 98% consider themselves of one race and 2% are of two or more races. Of those who are of one race, 81% are White, 13% are Black, 5% are Asian, 1% are American Indian or Alaska Native, and 0.2% are Pacific Islander. Hispanic ethnicity comprises 16% of the population. As in the total population, 98% are of one race and 2% are of two or more races. The largest racial group for Hispanics is White (92%), followed by Black (4%). Non-Hispanics are largely White (77%), Black (15%), and Asian (5%). By 2050, Hispanics are expected to become 30% of the population. Non-Hispanic Whites are expected to be the group in fastest decline, from 65% of the population today to 46% in 2050.

These changing racial and ethnic demographics raise the question of how optometrists might compare with population proportions. The Institute of Medicine revealed in 2002 that Americans differed in their ability to gain access to the healthcare system. The report showed that racial and ethnic health disparities have not improved over time and, in some cases, they worsened. In optometry, a broader understanding of demographics could serve as a basis for discussions about the role of race and ethnicity in both the recruitment and education of future optometrists. Moreover, results might stimulate research on whether patient preferences for racial and ethnic concordance are also evident in the optometrist/patient dyad.

This paper provides an estimate of the race and ethnicity of optometrists using student enrollment data reported by the Association of Schools and Colleges of Optometry (ASCO). These estimates are then compared with U.S. Census 2010 to ascertain gaps between the racial and ethnic proportions in the profession and the U.S. population.

**Data**

ASCO, as part of its mission to serve the interests of optometric education, collects and disseminates data from a number of surveys. The Annual Student Data Report aggregates applicant and enrollment data from the schools of optometry in the United States, Puerto Rico, and through 1988, also Canada.

Enrollment data have been collected for more than 40 years and now provide almost a half-century of information to harvest and analyze. In addition to race and ethnicity, the breadth of information has grown. The most recent Annual Student Data Report captures the number of applicants per program, numbers graduating with the doctor of optometry degree, enrollment in each of the 4 years in the doctor of optometry program, and extensive student characteristics, such as sex, age and financial aid received.

The data from the latest surveys are available through ASCO’s Web site. The executive director of ASCO provided printed copies of data tables for the student race and ethnicity section of annual reports from 1969 to 2008. Data extracted or calculated for this paper are: Total Enrollment and number of students who are categorized as White, Black, Hispanic, Asian, American Indian and Pacific Islander.

All schools of optometry in the United States and Puerto Rico are members of ASCO, and 100% participate in the annual survey. Early reports were written by hand. Electronic data collection and storage have improved consistency and completeness over the years. Comparable data were not consistently available throughout the period for Canadian schools of optometry and were omitted from this study. Demographic information in the U.S. Census includes Puerto Rico.

For comparability, ASCO data used in this study also include Puerto Rico.

**Methods**

**Standardizing race and ethnicity categories**

Throughout this paper, the nomenclature for “race” adheres to U.S. Census 2010 categories. “Race” refers to a respondent’s self-identified region of origin. “White” refers to peoples of Europe, the Middle East, or North Africa. “Black” refers to origins in Africa. “Asian” includes the Far East, Southeast Asia, and India subcontinent. “Pacific Islander” refers to “a person having origins in any of the original peoples of Hawaii, Guam, Samoa or other Pacific Islands. It includes people who indicate their race as ‘Native Hawaiian,’ ‘Guamanian or Chamorro,’ ‘Samoa’ and ‘Other Pacific Islander,’ or provide other detailed Pacific Islander responses.” “Hispanic” is considered an ethnicity and refers to one of Spanish, Latin American, Cuban, Mexican or Puerto Rican origin separate from race. In the ASCO data, the nomenclature for students of Hispanic descent changed over time: “Mexican American” from 1969 to 1973; “Spanish Surname” from 1974 to 1987, and “Hispanic” from 1988 to the present. For this paper, all have been reclassified as “Hispanic.”

**Total Enrollment**

Knowing the values for Total Enrollment is key to the results because they form the denominator in calculating the proportions of students by race and ethnicity. In some years, Total Enrollment numbers were missing. In others, they could be calculated with available information. All missing values occurred prior to 1999. There were a small number of years missing Total Enrollment counts (1971-1974), but a larger number of years missing annual reports, i.e., when no data were available. These were categorized into: single years, 1981

Total Enrollment numbers were calculated from information provided whenever possible. Beginning with 1975, the counts and percentage of the student body attributed to minorities (Black, Hispanic, Asian and Other) were available, but a count for Total Enrollment did not appear in the reports. Thus, Total Enrollment numbers for 1975-1980, 1982-1986, and 1992-1996 were calculated by dividing the percent of minority students into the sum of minority students. All decimals at 0.5 and above were rounded to the next larger integer.

When reports were missing for single years, the midpoint between the two adjacent years was chosen as an estimate for Total Enrollment and for each of the race and ethnicity categories. For the three periods with missing multiple-year annual reports, a linear regression using the least squares method was fitted to the four adjacent values for the period, i.e., two years before and two years after the period of missing data. The equations for each of these lines were used to estimate counts for Total Enrollment as well as each category of race and ethnicity in the missing periods.

**Estimating graduates by race and ethnicity**

The doctor of optometry program is a four-year curriculum, and typically students enroll after completing a baccalaureate degree. Annual numbers of graduates in each racial and ethnic group were estimated by taking one quarter of Total Enrollment for each year. This method assumes that attrition is already accounted for in the Total Enrollment numbers of each academic year. A systematic review of literature in medicine showed that race and ethnicity were not associated with attrition from medical school. If minority student attrition rates were higher in optometry, then the estimates for minority optometrists in this paper will be larger than actual proportions.

**Method to estimate numbers of optometrists in 2011**

The number of clinician optometrists in 2011 was estimated by using two key assumptions. First, 10% of the graduates are assumed to pursue a non-clinical career. Second, retirement is assumed to begin 30 years after graduation. The youngest age at graduation is assumed to be 25, thus retirement will begin for 10% of each year’s graduates at the age of 55.

The rate of retirement is set at a constant rate of 10% per year in the period 30 to 40 years after graduation, from age 55 to 65. At 40 years after graduation, all are assumed to have ceased clinical practice full-time. The general economic climate, the supply of clinicians relative to demand for services, and federal law raising the minimum mandatory retirement age are macro-level factors that contribute to varying rates of retirement over the years. The average retirement age in the United States was 67 in 1950, but has dropped to 62 in 2000. The economic downturn in more recent years suggests that retirement age is delayed for certain cohorts of clinicians.

For the purposes of building a model and making an estimate encompassing almost a half-century of data, the retirement rate was assumed to be a straight-line function. Attrition from the profession is assumed to be constant across racial and ethnic groups.

For reference, the estimates in the model were compared (Figure 1) with available data published by the U.S. Department of Labor, U.S. Department of Health and Human Services, and the AOA. The gap between the model and federal estimates is due to constructing a model that begins with enrollment in 1969, and assumes that there were no optometrists before that date. This was necessary because there was no information about the age of optometrists in the numbers from the federal estimates, thus making it impossible to factor in retirement.

**Comparing race and ethnicity proportions with population**

The final estimates for the race and ethnicity of optometrists were compared with U.S. Census 2010. The assumption in this paper is that primary eye care will serve all age groups and all races, so no adjustments were made to account for any variability in the need for eye care due to race or age of the population segments.

**Figure 1**

Comparing Estimates of U.S. Optometrists

![Figure 1](image-url)
In the U.S. Census, an individual falls into one of three categories: “One Race,” “Two or More Races,” or “Race Alone or In Combination.” The “Race Alone or In Combination” counts exceed the numbers of individuals in the United States by 2%. ASCO does not have a mechanism for capturing students of mixed races. Thus, a judgment was made by the author to use Census data for “One Race,” which accounts for 98% of the population, rather than “Race Alone or In Combination,” which accounts for 102% of the population. Compared with proportions in the “Race Alone or In Combination,” the Census proportions for “One Race” understates the proportions of American Indian/Alaskan Native by 0.6% and Pacific Islanders by 0.2%. There is no difference in the proportions for Whites, Blacks and Asians.18

The category of “Other” was created in this study by the author to include “American Indian/Native Alaskan” and “Pacific Islander” in the U.S. Census, and “American Indian,” “Pacific Islander,” and “Foreign Nationals” in ASCO data. The category of Pacific Islander did not come into use by ASCO until 1992. From 1969 to 2005, Foreign Nationals, i.e., students who were not U.S. citizens, appeared as a separate category within the report of minority students and captured non-U.S. students of all races and ethnicities as a mutually exclusive group. Foreign Nationals contributed only 1-2% of optometry students through the 1980s. However, their numbers grew dramatically in the 1990s, and now account for 33% of Total Enrollment. The distortions to racial proportions in the model over these past 20 years cannot be avoided due to the manner in which ASCO data were collected.

A two-proportion z-test (using STATA v.11.2) was conducted to test the null hypothesis that there is no difference between U.S. Census and optometrists proportions for each race and ethnicity category.

Results

The numbers of students enrolled in U.S. optometry schools in 2010 is 2.56 times that of 1969. There were 11 institutions in 1969, 13 by 1980, and 17 by 1990. In 2013, two more institutions will have graduates.

The proportion of Black students, accounting for 0.63% of Total Enrollment in 1969, grew to 2.71% in 2010.

Hispanic students were 1.00% in 1969, grew to 2.71% in 2010.

Asian students were 0.2% in 1969, grew to 0.6% and Pacific Islanders by 0.2%. There is no difference in the proportions for Whites, Blacks and Asians.

Table 1

<table>
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<th>Asian</th>
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Source: Association of Schools and Colleges of Optometry. Data estimated by linear regression are in bold.
The model estimates 39,445 clinician-optometrists in 2011. The U.S. Census estimated that in 2010, 16% of the population were Hispanic, 12% were Non-Hispanic Black, 65% were Non-Hispanic White, and 5% were Asian. The percentage of White and Asian optometrists exceeds their proportions in the population by 7.3% and 11.6%, respectively. Black and Hispanic optometrists are substantially smaller in proportion than the population by 9.7% and 11.3%. The two-proportion z-test for each category of race and ethnicity consistently reveals that the probability of finding no difference in proportions is < .001. (Table 2)

When looking at the race and ethnicity proportions of optometry school graduates compared with those achieving their first professional degrees, the Hispanic share of graduates from optometry schools is consistent with the percentage achieving first professional degrees across the nation. For example, the ratio of Hispanic optometry school graduates to Hispanics attaining first professional degrees is approximately 1:1 over the past 10 years. (Figure 2) Over the same period, that ratio is closer to 0.5:1 for Blacks and 2:1 for Asians.

Careers in the patient care professions are longer than the average U.S. worker’s, so the educational pipeline affects the race and ethnicity of clinicians for many decades. When compared with other healthcare professions requiring at least four years of post-baccalaureate training, optometry seems to do slightly better than dentistry in attracting Black individuals, about the same for Hispanics in dentistry, but not as well as medicine in attracting Blacks or Hispanics. (Table 3) Still, the gap between Black and Hispanic clinicians and their proportions in the population remains large regardless of profession.

These gaps will persist, as the percent of Black and Hispanic students enrolled in U.S. optometry schools has remained below 5% each, while the percent of Asians now exceeds 28%. The Hispanic population in the United States is expected to reach 30% in 2050, and Non-Hispanic Blacks are anticipated to remain steady at 12% over the next 40 years. Non-Hispanic Whites are ex-
expected to drop to 46% in 2050, and Asians will grow to 8%.”

**Limitations**

The model begins with 1969 enrollment data and assumes there were no optometrists prior to that date. Although federal estimates of optometrists were available sporadically from 1969 through 1979, and consistently from 1980 through 2000, no information was available about the age of optometrists, thus making it difficult to estimate retirement. As a result, the model is a poor estimator of the numbers of optometrists in the early years, but converges with other published estimates by the late 1990s (Figure 1).

A more typical method of measuring demographic characteristics is to conduct a national survey of a random sample of optometrists across the nation. Such a study is already planned in a partnership between ASCO and the AOA. In the absence of survey data, the model outlined in this paper is a method to estimate race and ethnicity using data already collected on an annual basis. In any data set collected over a span of time exceeding 40 years, imperfections will be found, requiring some adjustment before meaningful analysis can take place.

The inclusion of “Foreign Nationals” in the category of “Other” assumes this group stayed in the United States rather than returned to their home countries after graduation. Until the end of the 1980s, Foreign Nationals accounted for 1-2% of students, and this assumption would not have made a large difference in the results. By 1992, however, this group accounted for more than 4% and grew to 33% of Total Enrollment in 2010. Canadian students were 93% of Foreign Nationals enrolled in U.S. optometry programs in 2010. Future research should analyze this group in greater detail, but the data collected must have more granularity in order to understand their race and ethnicity and whether these graduates leave or remain in the United States.

Excluding the population of mixed race individuals (2%) has no impact on proportions of the largest racial groups in 2010, i.e., White, Black and Asian. However, by 2050, individuals of mixed races are expected to account for nearly 4% of the population. Future studies may wish to take this growth into account.

The inconsistent availability of Total Enrollment data is less likely to occur in the future because electronic record-keeping began in 1999. Estimates using linear regression provided 16% of the data in this paper. To minimize the effect of variance over a long period of time, a separate regression analysis was conducted for each segment with missing data. Separate regression analyses were conducted for each racial and ethnic group for missing periods to take into account differences by group. The regression coefficient for each model is shown in Table 4.

Attrition rate in the model is assumed to be the same for all students throughout optometry school and throughout their careers. In one study, race and ethnicity did not predict dropout from medical school. Optometry school students may be different. ASCO data capture race and ethnicity by enrollment year beginning in 1989. Attrition by race and ethnicity in optometric education should be studied as a separate issue in the future.

The retirement assumptions in the model, a constant 10% annual rate beginning 30 years and ending 40 years after graduation, have not been validated. Further, the assumption that retirement from the profession is the same across racial and ethnic groups in optometry needs to be tested. Overall economic conditions, job satisfaction, age, retirement income and insurance reimbursement are among the many factors that can affect retirement.

Comparing different estimates for the numbers of optometrists in the United States is one approach to help gauge the overall soundness of the retirement assumptions in the model. Figure 1 shows that the numbers in this model for 2011 and the projections from the AOA are very close, if not statistically the same.

Finally, all data were obtained by survey, thus self-reported error is inherent in the information. For this paper, however, self-reported error is not a large concern because the data reflect how optometry students self-identify on the issue of race and ethnicity. Census 2010 race and ethnicity information also is based on respondent self-identified group. This is a window to the respondent’s perception of identity, which is arguably more accurate than an observer-assigned approach.

**Discussion**

The reasons for improving racial and ethnic diversity among optometry students can be argued from a social justice perspective, i.e., Blacks and Hispanics are under-represented in optometry. As a profession, optometry is a high education attainment and well-compensated profession. Injustices in our social structure are, in part, responsible for the disparity. Thus, the advantaged members of society should make an effort to reduce those disparities. Another reason for reducing racial and ethnic disparities is tied to patient care. Concordance research conducted in medical and dental settings has shown that minority practitioners see a disproportionate share of minority patients, they tend to locate in areas with large numbers of minority patients, and

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**Table 4**

Regression Coefficients ($R^2$) for Linear Regression Models

<table>
<thead>
<tr>
<th></th>
<th>Total Enrollment</th>
<th>Black</th>
<th>Hispanic</th>
<th>Other</th>
<th>Asian</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971-1974</td>
<td>.9592</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>1997-1998</td>
<td>.9305</td>
<td>.3529</td>
<td>.9885</td>
<td>.9221</td>
<td>.9943</td>
</tr>
</tbody>
</table>
when given a choice, patients subconsciously prefer and choose a clinician of the same race. Giving patients choice often reveals unspoken sex, race and ethnicity preferences. Racial and ethnic concordance, then, could have positive outcomes in patient access and retention in care. In optometry, offering patients the opportunity for provider and patient concordance could reduce racial disparities in primary eye care. However, these opportunities are less available when the gap in proportions of optometrists compared with the population is large.

Post-secondary-school educational attainment data may lead one to conclude that the small numbers of Black and Hispanic students in optometry school is a result of racial and ethnic disparities in higher education. Indeed, Blacks and Hispanics are more likely to attend two-year colleges than four-year colleges. Nonetheless, important gains have been made in increasing the proportion of Blacks and Hispanics completing first professional degrees. In academic year 1976-1977, 4% of first professional degrees were awarded to Blacks; 1.7% to Hispanics. By 2008-2009, 7.1% were awarded to Blacks; 5.5% to Hispanics. While these gains are important, the gaps compared with their proportions in the population are still very large.

Optometry is not alone; other health professions face similar disparities. While some steps have been taken to bridge race and ethnicity gaps, the optometric profession has an opportunity to make a deep impact. Educators, serving the beginning of the professional pipeline, logically should take the lead. Perhaps optometric educators could consider establishing an optometry program at one of the historically Black colleges or at a college serving primarily Hispanic students. Given that Blacks and Hispanics have a greater tendency to attend two-year institutions, perhaps a pathway could be developed for those with a two-year degree.

Conclusion
This paper provides a current estimate of the race and ethnicity of optometrists using optometry school enrollment data. The model estimates fill a void in federal sources of data, which stopped in 1999. As a reference point, the 2011 estimate of the total number of optometrists in the United States is consistent with the number used by the AOA.

The race and ethnicity of optometrists, like physicians and dentists, are disproportionately White and Asian compared with the U.S. population. Measuring gaps, whether sex, race, income or educational attainment, helps society to decide where to allocate resources. It serves as a benchmark to chart progress if change is desired.

The rationale for bridging these gaps can be argued from a social justice perspective as well as from the point of view of improving patient access and quality of care. That is, disparities in eye health may be reduced and patient satisfaction increased if Black and Hispanic patients were offered more opportunity to choose a racially and ethnically concordant optometrist.

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