Skin Color Representation in Ophthalmology Textbooks

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Abstract

Objective Inadequate diversity in dermatologic images has been associated with diagnostic delays and poorer health outcomes. This underrepresentation of darker skin tones has also been demonstrated across various fields of medicine, including rheumatology, urology, and in the COVID-19 pandemic. The distribution of skin tones has not been examined in educational ophthalmology texts. The authors aimed to quantify the representation of skin tones across three leading ophthalmology textbooks.

Methods Two independent investigators utilized the Fitzpatrick’s skin phototype scale to code images containing skin as either “light” (Fitz. I–IV) or “dark” (Fitz. V–VI) in three fundamental ophthalmology textbooks: Clinical Ophthalmology (Salmon and Kanski), Ophthalmology (Yanoff and Duker), and the 13 Basic and Clinical Science Course texts by the American Academy of Ophthalmology. Images without discernible skin color were excluded.

Results Of the 9766 images reviewed, 2305 images met inclusion criteria. The three textbooks combined were found to have 2123 (92.1%) images of light skin tones and 182 images (7.9%) of dark skin tones. When compared to national data that found 12.6% of individuals to have dark skin tones, the proportion of images with darker skin tones in ophthalmology textbooks was statistically significantly lower ($\chi^2_{corr}(1, N = 4996) = 211.7, p < 0.001$).

Conclusions Darker skin tones are statistically significantly underrepresented in textbooks that are central to education of trainees in ophthalmology. Acknowledgement and inclusion of skin tone diversity in ophthalmology educational materials are necessary to ensure that physicians in the field are equipped with the knowledge and training to provide the highest level of care to all patients.

Keywords Inclusion · Racial disparities · Representation · Education

Introduction

Nearly four of ten Americans identify with a race or ethnicity other than non-Hispanic white [1]. While the US population is becoming increasingly diverse, medical school faculty and textbooks have failed to adequately represent these changes. Previous studies have demonstrated that compared to their white counterparts, Black, Indigenous, and People of Color (BIPOC) are underrepresented in medical schools’ pre-clinical curricula [2], clinical trials leading to FDA ophthalmology drug approvals [3], as well as in the ophthalmology workforce [4]. This underrepresentation in both medical literature and among trainees contributes to unconscious bias, perpetuating racial disparities in patient care, diagnoses, and treatment [5].

Lack of diversity can result in diagnostic delays due to the varying presentation of certain diseases depending on skin tone [6]. Presentation differences based on skin color have been demonstrated across multiple disciplines, including dermatology [7], urology [8], rheumatology [9], and most recently — in the COVID-19 pandemic [10]. Trainee education in these fields, as well as in ophthalmology, is mainly centered around select prevailing books and resources, as well as materials prepared and edited by respective professional societies. Therefore, inadequate diversity of images in these core texts represents a two-tiered issue: (1) the direct diagnostic delays, which result from inadequate education of variable disease presentations, (2) the implication that medical education should focus on patients of lighter skin color or that model physicians and educators have lighter skin. While previous studies examined
skin color representation in dermatologic and general medicine textbooks, this is the first to examine the distribution of skin colors in ophthalmology textbooks.

**Methods**

This study was Institutional Review Board exempt, as all resources utilized in the analysis are widely available to ophthalmology trainees in the USA. All patient photographs utilized in Supplementary Figures were obtained with written informed consent adherent to the principles of the Declaration of Helsinki and HIPAA compliant.

The three ophthalmologic textbooks selected were *Clinical Ophthalmology*, 9th edition, by John Salmon and Jack Kanski; *Ophthalmology*, 5th edition, by Myron Yanoff and Jay Duker; and the 13 *Basic and Clinical Science Course (BCSC)* texts, 2020–2021 edition, by the American Academy of Ophthalmology. In accordance with previous studies, skin tone was assessed by two independent researchers (TC and MC) utilizing the Fitzpatrick skin phototypes, with skin types I–IV classified as light and V–VI classified as dark [7]. Discrepancies between researchers were resolved by a third investigator (AB). Photos without discernible background skin types (i.e., conjunctiva only, poor lighting or picture quality, black-and-white pictures, histology, and diagrams without skin) were excluded. Researchers were blinded to figure captions to limit bias. Percentages of each Fitzpatrick skin type were compiled. To assess inter-observer reliability, 10% of the images (N = 231) were re-classified by the two researchers; inter-observer agreement was 99%, categorizing photos as light vs. dark (Cohen’s kappa = 0.88, 95% CI 0.72–1.0, p < 0.0001). The percent of images found to be of dark skin tone was then compared to the classification of a representative group of individuals from the USA based on Center of Disease Control data from the National and Nutritional Examination Survey (NHANES) [11].

**Results**

Of the total 9766 figures reviewed, 2305 were included in this study’s analysis based on the aforementioned inclusion criteria of having discernible skin type (see Fig. 1a, b). *Clinical Ophthalmology* (Kanski) was found to have 815 and 80 images of lighter (Fitzpatrick type I–IV) and darker skin tone (Fitzpatrick type V–VI), respectively, with dark skin types representing 9.4% of included images. *Ophthalmology* (Yanoff, Duker) was found to have 494 and 51 images of lighter and darker skin tones, respectively, with dark skin types representing 9.36% of included images. The *BCSC* texts were reviewed individually with a total of 814 and 51 images of lighter and darker skin tones, respectively, with dark skin types representing 5.89% of included images. Pooled data from all of the textbooks analyzed in the study revealed that 7.9% of total images represented darker skin tones (see Supplemental Table 1). This value was compared to the findings published of a review of a representative sample of individuals from the USA, which found 12.6% of 2691 total participants to have type V–VI skin tone [11]. Comparing our study’s distribution to this published finding of national data, the proportion of images with darker skin tones in ophthalmology textbooks is statistically significantly lower ($\chi^2_{corr}(1, N=4996) = 211.7, p < 0.001$).

**Discussion**

Darker skin tones are significantly underrepresented in medical educational materials, a finding that has been shown across various subspecialties and disciplines [7–10]. In dermatology, this has been shown to be related to diagnostic and treatment delays [7, 12]. As an example, erythema in darker skin tones can be more difficult to perceive, especially in those not accustomed to examining diverse skin tones. This is also important in ophthalmology, where eyelid findings, such as angiofibromas in tuberous sclerosis, can lead to diagnosis of intraocular pathology. Periocular skin tones also play a role in the misconception that darker skin tones preclude a diagnosis of ocular rosacea [13]. The results of this study demonstrate a similar underrepresentation of skin tones in core ophthalmology textbooks and training materials. While current census data estimates that approximately 43% of the US population identifies as a BIPOC, and a review of a representative sample of the US population revealed 12.6% of individuals with darker skin tones, our analysis revealed that only 7.9% of images in ophthalmology textbooks reflect darker skin tones (Fitzpatrick V and VI) [11, 14]. While the racial and ethnic makeup of the USA is ever-evolving, medical textbooks and educational resources continue to provide inadequate heterogeneity in representation of darker skin tones. The implications of inadequate skin tone representation affect both patients and future medical providers.

Beyond direct diagnostic delays from lack of familiarity with pathology among a diverse range of skin tones, uncertainty surrounding diagnosing diseases in skin of color may damage the patient-physician relationship and further perpetuate physician mistrust. This is of particular concern for patients from racial and ethnic minority groups who have historically experienced mistreatment by health care institutions and have reported feeling less respected by their physicians compare to their white counterparts [15, 16]. These concerns underscore the importance of ensuring that physicians and medical trainees alike are exposed to disease presentations in different skin tones and are taught to
consider all possible diagnoses upon encountering a patient, regardless of their skin tone.

Finally, overrepresentation of lighter skin tones in ophthalmology training materials sends an implicit message about the types of patients who are to be treated [5]. For example, even in diseases that do not involve skin color, like corneal ulcers, it is important to provide equitable representation of the community to remain inclusive of all racial groups. The lack of representation of diverse skin tones affects patients and may also be detrimental to residents and trainees of color, as it can be taken to imply that white people are the ideal patient. As Lester et al. so aptly stated: “The content of our teaching materials reflects what we value [17].” Appropriate and equitable representation of BIPOC may encourage future generations of medical students to enter a specialty that is inclusive of all races and ethnicities.

Limitations to this study include the subjective nature of categorizing skin tones utilizing the Fitzpatrick skin phototype scale. This subjectivity was minimized by re-coding 10% of the images. Additionally, differences in photographic technique (e.g. flash, saturation, exposure)
may have altered the image quality and thus perceived Fitzpatrick skin phenotype. Another limitation to this study is that skin tone does not necessarily represent the race or ethnic origin of a person. As skin color can be highly variable, even among the same race, the authors could not comment on the specific racial and ethnic distribution in ophthalmologic literature. For this reason, our results were compared to a similar review and grading of skin tone based on NHANES data. While this data may not be a perfect sampling of the US population, the authors believe that it is more likely to underestimate the true percentage of darker skin tones. This is due to the increase in national diversity since collection of the NHANES survey images in 2003–2004, as well as the previously cited tendency for underrepresentation of individuals with darker skin tone.

Conclusions

Acknowledgements and inclusion of skin tone diversity in ophthalmology images in major educational resources is a necessary component of improving both the quality of medical education trainees receive and the level of care that is provided to all patients. Further studies are needed to analyze representation based on specific ophthalmologic pathology, as well as to determine the impact of diversity in images on diversity in the medical field itself.

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Declarations

Ethical Approval All patient photographs utilized in our Supplementary Figures were obtained with signed informed consent.

Conflict of Interest The authors declare no competing interests.

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