

Equitable Imagery in the Pre-Clinical Medical School Curriculum

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Abstract

The unequal representation of women and people of color compared to men and whites in medical school textbooks has been well documented, as have inequities in health care and biases – both overt and implicit – in health care providers and access. This study investigates whether this bias is also found in slides used in didactic material for pre-clinical students at the University of Washington School of Medicine in Seattle.

Three independent coders analyzed 747 “decks” of slides for 33 preclinical courses and found that images of whites and males predominated except in the reproduction course. This study provides data to support the hypothesis that the proportion of images is not representative of the U.S. population, explores the source and impact of this bias, and proposes possible avenues for further research and resolution of this disparity in an era when the population is becoming increasingly racially and ethnically diverse.

Introduction

Racial/ethnic inequities* in health have been well described in the literature, with data demonstrating that members of minority groups disproportionately suffer from conditions such as cardiovascular disease, diabetes, asthma, cancer, and other conditions.^{1,2} The mechanisms for such inequities are multifaceted and complex, and include determinants or fundamental causes of health such as income, education, socioeconomic status, discrimination, housing, physical environment, food security, child development, social support, transportation, working conditions, and access to healthcare services.^{3,4,5,6} However, sources of inequities exist even within the medical/healthcare system. The Institute of Medicine (IOM) report, *Unequal*

* The term “inequity” is used throughout this paper to signify the unfair and adverse moral implications of the differential health outcomes or measures between groups in place of the term “disparity,” which is defined simply as a difference.

Treatment, found approximately 175 studies documenting racial/ethnic disparities in the diagnosis and treatment of various conditions that persisted even after controlling for possible confounders such as comorbidities, stage of disease, age, site of care, and insurance status.⁷ The IOM detailed strong evidence of racial discrimination in all levels of health care, from policy level to individual interpersonal interactions and posited that health care provider bias and stereotyping may contribute to disparities that result in quality of care and medical care inequities.

Regarding the use of race/ethnicity: race is not a biologically based, genetic or innate difference, but a social classification or construct that is imprecise. Nonetheless, race as a social construct has real consequences that are valid but difficult to capture.^{8,9} Ethnicity can be defined as an element within a sociocultural system that defines and structures the relations among persons by essential group differences, though the classification system will vary cross-culturally.¹⁰ Racial/ethnic categories referenced in this study are reflections of the language used in the data or articles from which they were drawn. However, given the implications of race/ethnicity, anthropologists have proposed utilizing more suitable language that does not imply a universal biological referent, such as “ethnoracial category” or “folk race.”¹⁰

Although in many ways racial bias, prejudice, and discrimination are often subconscious, inadvertent, and difficult to capture, studies using techniques such as the Implicit Association Test (IAT) as an indirect measurement of social cognition find evidence of physician bias based on race and stereotypes regarding patient race and medical non-compliance.^{11,12,13,14} Not only does this bias exist among practicing physicians, but studies document this IAT measured bias transforming into patient interaction and treatment differences.^{11,14,15} For example, implicit bias and stereotyping were found to be associated directly with patient perceptions of care as well as

observed medical visit communication.¹⁴ Another study of physicians' decision to treat patients with thrombolysis for a suspected heart attack revealed a statistically significant and predictive association between their IAT measured pro-white bias and their likelihood of treating white patients and not treating medically identical black patients.¹¹ The IAT is an example of a good tool, but there are also examples of real visit bias, such as one study of provider-patient communication that demonstrated that physicians were 33% less patient centered, 23% more verbally dominant and with a less positive affect when the patient was black as compared to white patients.¹⁶

In response to the IOM report and clear evidence of bias in medicine, there is now greater movement toward cultural competence in health care as one possible strategy to reduce or eliminate racial/ethnic disparities in health and health care.¹⁷ For example, the Association of American Medical Colleges (AAMC) convened an Expert Panel on Cultural Competence Education for Students in Medicine and Public Health, which released a report discussing cultural competence education for medical students. They defined cultural competence within the broader context of diversity and inclusion as “the active, intentional, and ongoing engagement with diversity to increase one’s awareness, content knowledge, cognitive sophistication, and empathic understanding of the complex ways individuals interact within systems and institutions.”¹⁸ Indeed, techniques and approaches from public health and other disciplines (such as social work, anthropology, sociology, psychology etc.) are now informing medical education using methods that place patients within larger environments, which allows students to consider various issues that are beyond the traditional biomedical model of individual care.^{19,20} Strategies such as group-based reflection sessions about racial bias, looking for common identities and counter-stereotypical information, and taking the perspective of a minority group patient have

the potential to reduce implicit bias in medical education and thus greatly contribute to cultural competence education.^{21,22} The AAMC released a statement arguing that, “perspectives and findings that flow from the behavioral and social sciences serve to prepare medical school graduates for comprehensive, patient-centered practice and provide the conceptual framework needed to address complex societal problems that have direct bearing on health and health care disparities.”²³ Furthermore, in accordance with the Liaison Committee on Medical Education (LCME) accreditation standards, schools of medicine are required to provide opportunities for students to practice “cultural competence” - to learn about racial and ethnic disparities in the health care system and to recognize and address gender and cultural biases.²⁴

Concomitant with racial/ethnic inequities in health care, and recognition of the need for increased attention on this topic in undergraduate medical education, is general agreement on the poor representation of women’s health in preclinical coursework.²⁵ Curricular gender/sex bias can be defined as the omission of gender-related issues, stereotyping, imbalance in presentation of issues (such as analysis of problems from a male perspective only), application of study results to women even if they were not included in the research, and ignoring gender inequality in health and illness.²⁶ In this paper, sex is defined as biological (genetic and anatomic) features or characteristics distinguishing women and men, whereas gender has a broader definition than sex and includes biological, social, and psychological qualities or properties of the spectrum of gender identity.^{27,28} Gender/sex bias in learning materials has been studied for decades; in fact in the 1970s several major textbook manufacturers released statements regarding the need for modifications in their materials in order to achieve more equitable, balanced, and non-stereotyped treatment of men and women in educational publications.²⁹

There are multiple studies that establish that medical textbooks are gender-biased.^{30,31} For example, a study examining Swedish medical textbooks on the subjects of dermatology, epidemiology, occupational health, and public health demonstrated that a gender bias that consisted of focusing on male health and offering a female perspective only when regarding reproductive function persisted in textbooks in both biomedical and psychosocial topics from 2004-2005.³² Another study examined textbooks from internal medicine/cardiology, pharmacology, and psychiatry and discovered a scarcity of gender-specific information.²⁶ A separate investigation reported that throughout the 20th century illustrations and text-space representing males have consistently outnumbered those representing females.³³

The authors of these studies express the concern that the underrepresentation of women in various learning materials may hinder students' education and actually lead to a false perception of the male body as the standard patient, thus diminishing familiarity with the female body. This educational deficiency persists even as women suffer illness at similar rates to men: 52% of strokes (approximately 1 million strokes a year) occur in female patients, and currently 35.9% women 20 years and older are obese (vs 33.9% of men).^{34,35} Another illustrative example is that the risk factors for coronary heart disease (CHD) are the same in men and women, but it is acknowledged that the symptoms generally recognized as indicative of a "heart attack," i.e. chest pain, more commonly apply to men, whereas women more often experience symptoms such as fatigue and stomach pain.³⁶ As with the differential treatment of people of color discussed above, this difference in symptoms can lead to an under-recognition of CHD in women and consequently higher mortality rates.³⁷ This example highlights the importance of the representation of women as patients in cardiovascular coursework, and this principle can be extrapolated to other courses. As the prolonged history of this issue suggests, gender and sex bias

trends are not unique to textbooks. Some medical education directors have expressed concern that gender-related issues, although documented, are not systematically addressed in curricular development.²⁶

In addition to research and initiatives responsive to the sex and racial bias in the formal medical curriculum, a widely recognized “hidden curriculum” is also present in medical education. This unwritten curriculum is considered to be a broader and subtler collection of knowledge, skills, attitudes, and behaviors that are neither overtly nor covertly intended by those who created the curriculum to be learned but are still perceived and/or absorbed by students.²⁵ In medical school, part of this hidden curriculum consists of messages inadvertently communicated in lectures and may be a consequence of the larger structure or culture of the institution.³⁸ For example, a study at the University of Minnesota examined clinical “case studies” within the medical school curriculum and found their results were consistent with a “standard in medical education, in which white, male, and heterosexual are placed in a central, normative position.”²⁵ Notably, neither the AAMC report on cultural competence nor the LCME accreditation requirements contain explicit references to the images presented to medical students during the pre-clinical didactic courses. However, imagery presented to students in textbooks or PowerPoint® slides, although likely considered part of the formal curriculum, in the context of possible bias may be better understood as a component of the “hidden curriculum.”

From literature regarding visual media (i.e. movies or television) representation of race and gender, a theme emerges regarding the idea that repeated exposure to images may alter our perceptions, expectations, and acceptance of others along with perpetuating or endorsing stereotypes.³⁹ A thorough literature search and a careful exploration of public health databases and medical education journals reveal that research using PowerPoint® slides as the data source

has not been performed to investigate this visual aspect of the medical curriculum. In this research we will analyze the images presented to first and second year medical students at the University of Washington School of Medicine during the pre-clinical didactic coursework. We will describe the proportion of representations of individuals by gender and racial/ethnic group. This represents a novel approach to looking critically at an important element of the medical school curriculum with regard to gender/racial bias. The conceptual model explains visually the theory supporting this research (Figure 1).

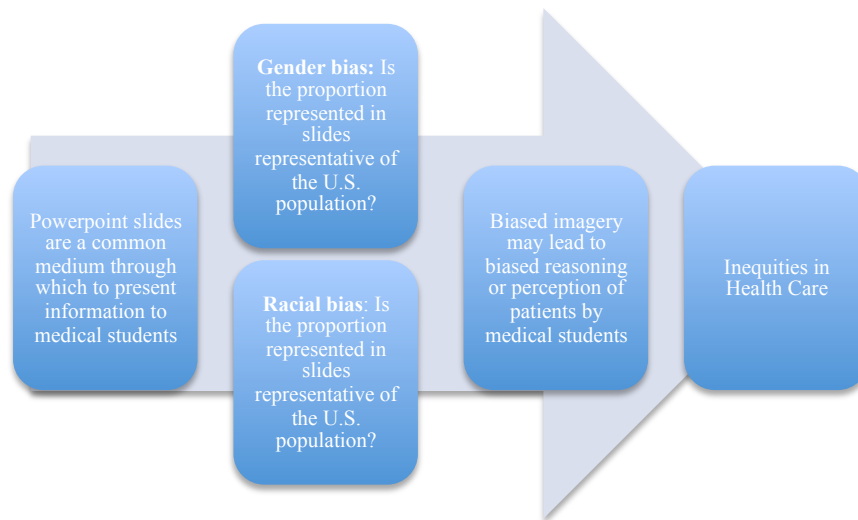


Figure 1 - Conceptual Model

Objectives

Main Research Question: Is the representation of humans in lecture material presented to preclinical medical students at the University of Washington biased in the gender/race/ethnicity of persons used in materials pictured in lecture slides?

Specific Questions and Hypotheses:

- What proportion of images depict white persons vs. persons of color?

- Null Hypothesis – The proportion of images will be representative of the U.S. population
- Alternative Hypothesis - The proportion of images will over-represent white males (i.e. the proportion of images will not be representative of the U.S. population)
- What proportion of images present male vs. female individuals?
 - Null Hypothesis – The proportion of male:female images will be 50:50.
 - Alternative Hypothesis – The proportion of male:female images will not be 50:50, and will be predominantly male.

Methods

Two coders examined the PowerPoint® presentations available from course websites for 33 (out of a total of 36, see Appendix 1) courses in the pre-clinical medical school curriculum at the University of Washington School of Medicine, Seattle campus. All slides were viewed from the first and second year didactic courses (pre-clinical years) for their sex- and race-specific images. Two trained coders independently analyzed half of the data set each after establishing reasonable interrater reliability. A third coder participated to establish further interrater reliability, as detailed in Appendix 2.

Images included were illustrations (including clip art and other renderings) and photographs with a “human form,” defined as an outline or silhouette of a person or otherwise recognizable human body or external body part such as face or facial features, external genitalia, an arm, or foot. Images excluded were single internal organs (such as a liver, stomach, or brain); internal anatomy cross-sections without a clear segment of skin, hair, or other surface markings; and depersonalized schematic diagrams. Those images were counted initially as “human” and

were then, if possible, further categorized into either male or female. Any human images were also coded into further categories, white or person of color, if possible, regardless of ability to code for a sex category.*

To categorize sex, human images with indicators such as the presence of genitals, reproductive organs, structures relating to sex-specific features (for example, the testicular artery or presence of a placenta), secondary sex characteristics, “figure” (i.e., noticeable narrow or wide hips or shoulders), or any indication in the accompanying text that the subject was male or female.⁴⁰ Most coding decisions were ultimately made on the basis of more than one indicator. Images in which sex was indeterminate (either gender-neutral, ambiguous, or unclear/without enough information) were not assigned a category, though the image was still classified as “human.”

Coders categorized race in two categories, white or person of color (POC), based on physical characteristics such as skin color/complexion, facial features, hair type, or textual cues, and this led to a determination. The category POC includes black/African-American, Chicano/Latino, Native American, and Asian. The category white includes Anglo, European, light skinned individuals who could not otherwise be identified as a POC. Again, most coding decisions were ultimately made on the basis of more than one indicator. Images for which this was indeterminable (either ambiguous or unclear/without enough information) were not assigned a category, though consistent with methods for gender, the image was still classified as “human.”

* While images were not categorized based on the self-identification of the subjects, this approach reflects real-life experience, namely, that individuals frequently make race- and gender-based assessments of others based exclusively or predominantly on appearance, as explored in the introduction and discussion.

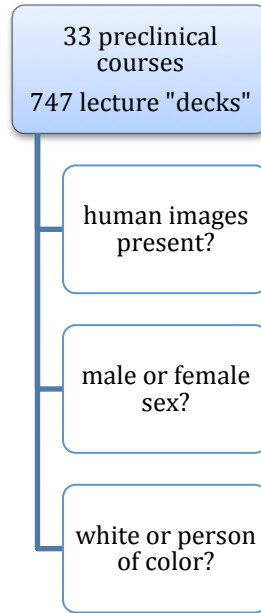


Figure 2 - Methods Flow Diagram and Coding Tree

See Appendix 3 for sample images.

Data was cataloged and results were tallied using Microsoft® Excel® for Mac 2011, v.14.3.2. In the final analysis, in order to determine which data to include for lectures that were coded in duplicate for interrater reliability purposes, a coin was flipped for each PowerPoint lecture deck.

Several courses were chosen for sub-analysis: Hormones/Nutrients, Reproduction, and Anatomy and Embryology. The first two were chosen to investigate the gender representation in courses with a general emphasis on the female reproductive endocrine function and organ/organ systems (such as uterus, ovaries, and breasts) respectively. The third course was selected because of its status as a foundation in medical science as well as being the subject of other studies on this topic (anatomical textbooks).

Results

In total, 34,219 slides were analyzed. In the analysis of interrater reliability, the number of “human” images coded were found to be statistically significantly different from one another (See Appendix 2), and thus agreement for this category was not reached. However, the total human images category was the least pertinent to the study objectives. In the final data analysis, of the 4033 images that could be coded by sex, 39.55% (1595) were female and 60.45% (2438) were male. Of the 5230 images that could be coded by race/ethnicity, 78.39% (4100) were white and 21.61% (1130) were persons of color (Table 1).

Table 1: Total Numbers (and Percentages) by Sex and White/POC of Human Images

	Number (N)	Percentage (%)
Female	1595	39.55
Male	2438	60.45
Total	4033	100.00
White	4100	78.39
POC	1130	21.61
Total	5230	100.00
Total Human Images	7760	100.00

Table 2: Hormones and Nutrients Course Numbers (and Percentages) by Sex and White/POC of Human Images

	Number (N)	Percentage (%)
Female	105	40.5
Male	154	59.5
Total	259	100.00
White	245	73.4
POC	89	26.6
Subtotal	334	100.00
Total Human Images	351	100.00

Table 3: Reproduction Course Numbers (and Percentages) by Sex and White/POC of Human Images

	Total	Percentage
Female	226	62.4
Male	136	37.6
Total	362	100.0
White	377	82.9
POC	78	17.1
Total	455	100.0
Total Human Images	555	100.0

Table 4: Anatomy and Embryology Course Numbers (and Percentages) by Sex and White/POC of Human Images

	Total	Percentage
Female	99	36.8
Male	170	63.2
Total	269	100.0
White	369	92.5
POC	30	7.5
Total	399	100.0
Total Human Images	465	100.0

Table 5: Total without Reproduction Course Numbers (and Percentages) by Sex and White/POC of Human Images

	Total	Percentage
Female	1369	37.29
Male	2302	62.71
Total	3671	100.00
White	3723	77.97
POC	1052	22.03
Total	4775	100.00
Total Human Images	7205	100.00

The sub-analysis showed some variation from the overall results. Of the images coded by sex in the Hormones/Nutrients course, 59.5% (154) were male and 40.5% (105) were female. This is similar to the distribution of the overall results. However, of the images coded by race/ethnicity, 26.6% (89) are persons of color, the highest of any of the sub-analyzed courses (Table 2). The Reproduction course is the only course of the three to demonstrate a majority of female images, with 62.4% (226) female and 37.6% (136) male. The distribution of white persons and persons of color is similar to the overall results with 82.9% (377) white and 17.1% (78) persons of color (Table 3). The Anatomy and Embryology course showed a greater difference between female and male images, 36.8% (99) and 63.2% (170) respectively, than the overall results. There was also a greater disparity between racial/ethnic coded images as well, with white images making up 92.5% (369) and persons of color consisting of just 7.5% (30) (Table 4). Finally, in order to evaluate potential influence of images from reproductive coursework, the reproduction course results were subtracted from the overall results. Of the images coded by sex the modified total was 37.29% (1369) female and 62.71% (2302) male. The modified total for images coded by race/ethnicity was 77.97% (3723) white and 22.03% (1052) persons of color (Table 5).

Discussion

This study represents the first investigation of PowerPoint® slides as didactic material examined for equity. These results compare with studies of medical (and general) education materials, such as anatomy and other texts that demonstrate a gender bias.^{25,26,31,32,33,40} The findings demonstrate not only a majority of male images but also of white images, which has not previously been formally studied in the medical curriculum. While some earlier studies excluded

reproductive focused materials out of concern that the emphasis on female subject material would skew the sample, this study included reproductive and other female focused subject matter and nevertheless discovered a majority of male images. In the sub-analysis for this potential bias in the Reproduction and Hormones/Nutrients courses, a female predominance of images was seen in Reproduction, but not in Hormones/Nutrients. Moreover, in Anatomy and Embryology there was an overrepresentation of male images, despite the potential for greater material on female reproductive anatomy (for example, breast tissue requires special discussion in women with very little equivalent discussion for men). In fact, after subtracting the reproductive course from the overall results, a gender bias was more pronounced. Since the entirety of the first and second year course images were viewed and not simply a small sample, results cannot be dismissed as sample bias or error.

It is important and meaningful to consider why the numbers in the results are so unequal. Gender and racial bias have historically been present in the medical field, and the physician population has been predominantly white and male since 1910 when the Flexner report led to the closing of all women's and all but two black medical schools.⁴¹ Thus, it is likely that there is a preponderance of white, male images available for selection in teaching slides in comparison with other images. As discussed previously, this has been documented in anatomical textbooks, and those results were reproduced in the sub-analysis of the Anatomy and Embryology course. However, faculty also include images from their own clinics, from local hospitals, or of themselves, which could suggest that the images might be more representative of patient/physician demographics. Communities of color, specifically African Americans, Latinos, and Native Americans make up only 3% of medical school faculty and fewer than 2% of senior leadership roles in health care management.¹⁷ Considering another possible source of images,

one study examining the construction of patienthood in drug advertising demonstrated that there were 2.5 times as many male patients in drug ads than female patients, replicating results from previous studies noting gender imbalances in drug advertisements.⁴² However, with the advent of Google and other image search engines, and the number and range of possible human images to choose from, a major question that arises from this research is what should the representation of women and persons of color optimally be in medical education?

Currently in the U.S., women represent 50.79% of the population and men 49.21%.⁴³ As mentioned above, women and men suffer many common illnesses at relatively similar rates, though inequities may still be seen in the treatment of women for stereotypically “male” conditions, such as myocardial infarction. Furthermore, women’s reproductive health requires far more attention than male reproductive health, and the entire field of obstetrics and gynecology is a testament to this fact. Thus, it can be reasoned that there should be a considerably greater proportion of female than male images in medical school didactics, beyond what was found in the reproductive course. Perhaps the less controversial proposal is that the images should be representative of the general population, reflecting the census data. More difficult to assess is what the representation of images for white versus persons of color should be. According to the U.S. Census, white persons make up 78.1% of the U.S. population. While the U.S. Census defines a minority as anyone who is not single-race white and not Hispanic (the proportion of white persons who are not Hispanic is 63.4%), this study included Hispanic and Middle-Eastern individuals (for which there is currently no census category) as persons of color. Therefore, this study may even over-represent those in the POC classification, and yet the distribution of white images was still found to be greater than the U.S. census. In preparing medical students to be the

practicing physicians of the future, medical schools should consider not just the current patient demographics but those of the U.S. in future years.

The U.S. population has become increasingly racially and ethnically diverse over time. The non-Hispanic white population is growing at the slowest rate; Hispanic, Asian, and black population growth is the fastest. The U.S. Census Bureau recently released a set of estimates showing that 50.4% of those younger than age one were minorities as of July 1, 2011.⁴⁴ Thus, the U.S. is projected to become a “majority-minority” nation by 2043. The largest single group will continue to be the non-Hispanic white population, but no group will be a majority.⁴⁵

Currently, more than 11 percent (348) of the nation's 3,143 counties were majority-minority as of 2011.⁴⁴ Minority population growth has been concentrated in counties in the Pacific Northwest as well as in areas of the interior West.⁴⁶ This is particularly pertinent since this university, like many public universities, serves a large and increasingly diverse population. Consequently, it is especially important to be cognizant of the changing demographics and respond accordingly with regard to learning materials.

Another factor to contemplate when considering what an equitable image distribution might be is the historical and current disadvantages and inequities persons of color face in health and medical care. Given that the structure and barriers in the health care delivery system impact minorities and persons of color in distinct ways, the concept of cultural competence or humility must not only be part of the curriculum but also based in the values and reflected in the design of an institution. The requirements of cultural humility emphasize the need for greater self-reflection and self-awareness to help change attitudes toward diverse patients.⁴⁷ An intersectional framework would likely be helpful in the institutional process in that it focuses on societally structured inequalities and power differentials that help to sustain disadvantage among socially

devalued groups.⁴⁸ One attempt to specifically address racial/ethnic disparities in health and health care is “clinical cultural competence,” which is a term that has been coined to describe educational initiatives that give health care providers a variety of skills and tools with the goal of delivering quality care to diverse populations.¹⁷ However, the importance of addressing the hidden curriculum and moving students beyond stereotypical inferences about patients is summarized best in the following statement by Turbes, Krebs, and Axtell in their paper on the topic: “[I]t would help students become prepared to address the full range of health concerns encountered by their patients. It would allow them to see a gay man dealing with diabetes, rather than with HIV, or an African American mother dealing with her child’s otitis media, rather than with sickle-cell disease.”²⁵

There are several limitations in this study. The data collection was restricted to one school and contained only PowerPoint® slide images for those lectures presented at the Seattle campus. At UW, the first year of medical school is also presented to students in Eastern Washington, Montana, Idaho, Wyoming and Alaska. The curriculum is expected to be congruent across sites; however, conclusions cannot be made for any additional slide sets that may be shown at the first year sites located outside of Seattle. Any slide sets that are out of date or have been changed since we acquired them were also outside the scope of this study. Additionally, we are limited in that our racial/ethnic data collection of “persons of color” does not represent the true diversity of various general subcategories (such as African American, Latino, Southeast Asian, etc.). It is pertinent to note that both coder 1 and coder 2 are white females, and thus represent a single sex from the majority ethnoracial category in the U.S. Coder 3 is an Asian male and thus provides a different perspective though certainly does not account for the range of perspectives each individual could bring to a study such as this. Another limitation involves the

classification of sex as male or female in the typical binary approach that historically has provided context for feminist theory and praxis. However, it is becoming increasingly obsolete in social sciences, secondary to the understanding of gender identification as a spectrum and the inability to categorize transgender, intersex, and other individuals using only sex categories of male and female.⁴⁹ In this study the decision was made not to sub-categorize further than male or female, and thus capturing the nuances of gender was not attempted.

The results of this study highlight implications for further research, for example in analyzing the context and narrative in the images. There have been studies on the racial content of newsmagazine coverage of poverty that demonstrate black individuals are overrepresented as being poor.⁵⁰ Similarly, a qualitative analysis could be performed on images in the medical school curriculum, focusing on common stereotypes, for example. The images could be analyzed to see how often persons of color are shown to be sicker or poorer than their white counterparts. Construction of both patient and physician identities could be examined as well, asking what the representation of non-white and women physicians is in the images presented compared with the patient imagery. Finally, other medical schools around the country and abroad could analyze their didactic materials using this method, and perhaps a regional or other pattern might appear.

Nonetheless, a possible solution at this institution includes not only increasing awareness of image content among faculty, but also providing access to alternatives. One option would be to create and make available an image repository or bank with a diverse selection of skin pigmentation, gender representation, and other characteristics. These images would be offered without copyright issues and would also be selected to minimize stereotypes or stigmatization of vulnerable or underserved populations (Appendix 4). Additionally, a campaign could be initiated with textbook publishers and medical illustrators to increase awareness and the likelihood of

addressing this issue, perhaps through community advisory boards. Lastly, engaging with the populations underrepresented in medicine and underserved in general to determine what they would like their presence to be in learning materials and how best to present their pertinent health issues takes into account the respect and spirit of community oriented research and practice of medicine. Ideally, students trained as doctors in future decades will serve patients whose images they will be familiar with from their coursework, namely, representative of an ever-changing general public.

Internal Review Board: This study does not involve the study of human subjects. As such, it is not under the purview of IRB, and no forms were submitted. Email correspondence clarifying this exemption between Julie McNalley (committee member) and HSDinfo@uw.edu is available upon request.

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Appendices

Appendix 1: List of Courses Analyzed (From the Academic Year of 2010-2011)

1. Histology
2. Biochemistry (Fall)
3. Biochemistry (Winter)
4. Anatomy and Embryology
5. Systems of Human Behavior
6. Introduction to Clinical Medicine 1 (Fall)
7. Introduction to Clinical Medicine 1 (Winter)
8. Introduction to Clinical Medicine 1 (Spring)
9. Medical Information and Decision Making
10. Cell Physiology
11. Musculoskeletal System
12. Immunology
13. Nervous System
14. Microbiology
15. Cardiovascular System
16. Pathology (Fall)
17. Pathology (Winter)
18. Pathology (Spring)
19. Respiratory System
20. Ethics
21. Urinary System
22. Pharmacology (Fall)
23. Pharmacology (Spring)
24. Epidemiology
25. Medicine, Health, and Society
26. Hormones/Nutrients
27. Hematology
28. Genetics
29. Problem Based Learning
30. Gastro-Intestinal Systems
31. Reproduction
32. Brain and Behavior
33. Skin System

**Introduction to Clinical Medicine 2 is offered in the fall, winter, and spring of 2nd year, but slides could not be analyzed as they were unavailable.

Appendix 2: Interrater reliability

Two coders developed and agreed upon the coding criteria initially and compared results of preliminary coding. In order to ensure a reasonable inter-rater reliability, approximately 10% of the decks were randomly selected for a third coder to evaluate. Coder 3 underwent training to ensure consistent criteria were used. The totals for each of the five categories (human, female, male, white, person of color) were compared for each set of two coders (i.e. coder 1:coder 2, coder 1:coder 3, coder 2:coder 3) and a 2-sample t-test assuming unequal variance was performed (using Microsoft[®] Excel[®] for Mac 2011, v.14.3.2) to test for a significant difference in the number of images rated in a particular category for each rater-pair. Thus, comparing the p-values to an *a priori* established p-value of 0.05, a p-value > 0.05 of the totals across slide decks indicates that totals in each category are not significantly different from each other and are consequently accepted as having good interrater reliability. While the number of images in each set may be the same, the actual images rated may differ; however, considering that all coders were trained and looking at the same slides, it is reasonable to conclude that good interrater reliability was achieved.

	C1:C2	C2:C3	C1:C3
Human	0.88	0.019**	0.84
Female	0.65	0.42	0.38
Male	0.80	0.25	0.85
White	0.80	0.56	0.18
POC	1.0	0.68	0.54

Figure 3 - Interrater reliability chart – p-values

** Denotes significant difference. It is pertinent to mention the Bonferroni correction here, which is an adjustment made to *P* values when several dependent or independent statistical tests

are being performed simultaneously on a single data set.⁵¹ Although the Bonferroni correction is generally used to reduce the chances of obtaining false-positive results (type I errors) when multiple pair wise tests are performed on a single set of data, here the correction is used to demonstrate the odds of finding a single statistically significant test among the t-tests for interrater reliability. Put another way, the probability of identifying at least one significant result simply due to chance increases as more ‘hypotheses’ are tested. Thus, the calculation can be performed as follows: $P(\text{no significant differences in all these tests}) = (1 - \alpha)^k$ and $P(\text{at least one significant result}) = 1 - (1 - \alpha)^k = 1 - (1 - 0.05)^{15} = 0.54$, meaning there is a 54% chance of yielding a significant result. This is not to dismiss the finding of a difference in interrater reliability in human images between rater C2 and C3, which may be real and due to differences in interpretations of images that would be considered human (for example cartoons, stick figures, etc.). The calculation is noted simply to state the drawbacks of this type of statistical testing.

Appendix 3: Example images for categorization



Figure 4 – Human, Male, White



Figure 5 – Human, Male, POC



Figure 3 – Humans, Females, POCs

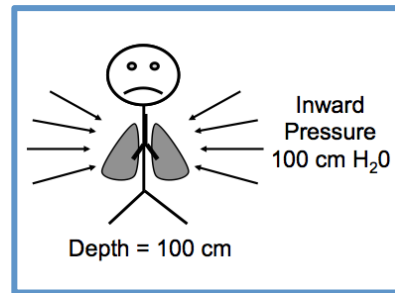
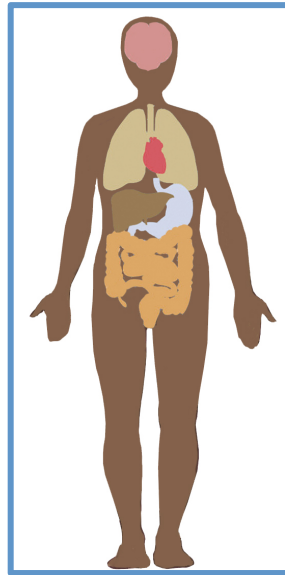
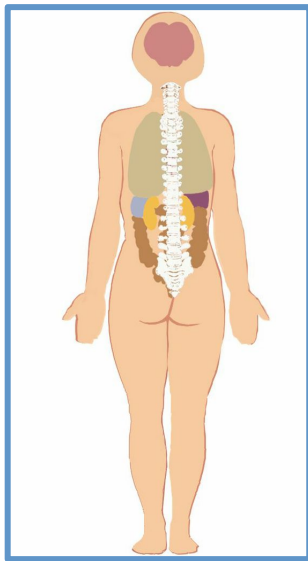
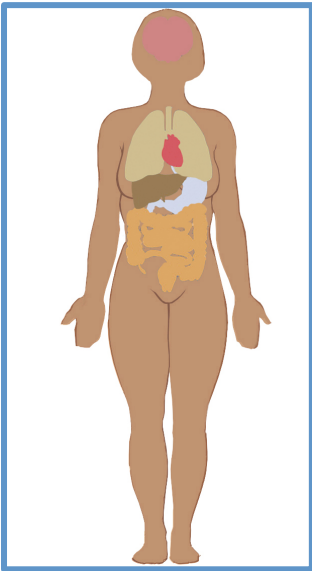
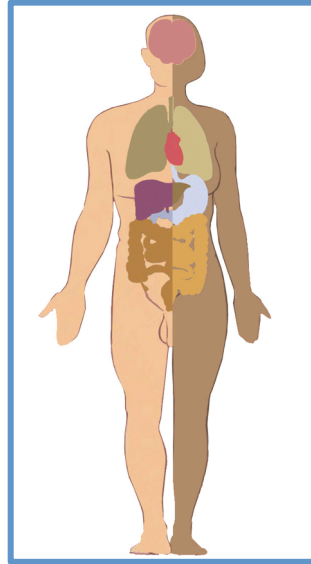
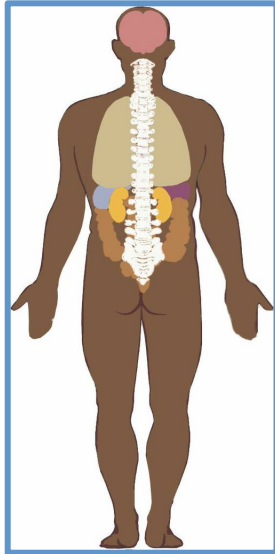
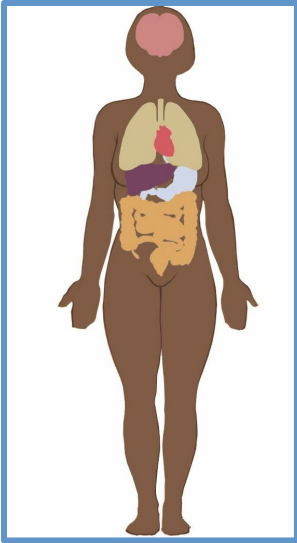


Figure 4 – Human, otherwise non-codable



Figure 5 – Human, Female, White (deidentified)

Appendix 4: Examples of future images that could be utilized by the school of medicine



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