Radiology

REVIEWS AND COMMENTARY • REVIEW

Narrowing the Gap: Imaging Disparities in Radiology

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It may seem unlikely that the field of radiology perpetuates disparities in health care, as most radiologists never interact directly with patients, and racial bias is not an obvious factor when interpreting images. However, a closer look reveals that imaging plays an important role in the propagation of disparities. For example, many advanced and resource-intensive imaging modalities, such as MRI and PET/CT, are generally less available in the hospitals frequented by people of color, and when they are available, access is impeded due to longer travel and wait times. Furthermore, their images may be of lower quality, and their interpretations may be more error prone. The aggregate effect of these imaging acquisition and interpretation disparities in conjunction with social factors is insufficiently recognized as part of the wide variation in disease outcomes seen between races in America. Understanding the nature of disparities in radiology is important to effectively deploy the resources and expertise necessary to mitigate disparities through diversity and inclusion efforts, research, and advocacy. In this article, the authors discuss disparities in access to imaging, examine their causes, and propose solutions aimed at addressing these disparities.

The coronavirus 2019 epidemic exposed deep and chronic health care disparities in the United States (1). Nearly 30% of coronavirus disease 2019 (COVID-19) cases occurred in Black Americans, who constitute only 13% of the U.S. population (2). In addition, as of August 2020, the death rate from COVID-19 is more than two times greater in the Black population than in the White population (3). The disproportionate effect on minority communities gained substantial coverage in the national press and is acknowledged as unconscionable.

The idea that radiology may be an important factor in the propagation of disparities may be surprising because diagnostic radiologists interpret most imaging results without a priori knowledge of a patient's race (4–7). However, imaging access and image quality issues may promote racial and ethnic differences in the quality of health care not due to clinical need or patient preference (8).

It is critical to acknowledge the existence of imaging disparities and understand the causes if the field of radiology aims to reduce their severity. Herein, we highlight patient, systemic, and provider factors that impact racial disparities. Our discussion will focus primarily on racial disparities between Black and non-Hispanic White individuals.

Business Case for Addressing Health Care Disparities

Although insurance coverage for low-income Americans has increased because of the passage of the Affordable Care Act, racial disparities in access to care persist (9). It is not only ethical, humane, and necessary to address these persistent racial and ethnic disparities, it is also economically advantageous (10). For example, a 2014 study of diabetes in North Carolina showed that the prevalence of diabetes was 9% in the overall population but 76% among adults enrolled in Medicaid. The study authors estimate that $225 million could be saved each year by the North Carolina Medicaid program if racial and economic disparities in diabetes prevalence were eliminated (11). If not adequately addressed, the economic consequence of disparities will only be exacerbated in the future, as the United States becomes increasingly diverse. By 2044, people of color are projected to comprise more than 50% of the population (12). Therefore, in addition to social justice promotion, it is evident that reducing health disparities is important in combatting rising health care expenditures (13).

Conflation with Socioeconomic Status

One of the challenges in accurately assessing the role of race in health care disparities is secondary to the effect of the confounding variable of socioeconomic status. Although public health statistics in the United States are historically reported according to racial or ethnic groups, health differences across groups defined by socioeconomic factors, such as income or educational attainment, are often unreported and have been examined less frequently (14). Nearly every chronic medical condition—from heart disease to diabetes to chronic arthritis—increases in prevalence with decreasing income (15).

Given the paucity of class data in many routine sources of health statistics, many studies use race as a proxy for class. However, this practice is not accurate, as in 2019, the majority of individuals and families below the poverty line in the United States (42%) were White (16). Indeed, it has been noted that even if racial disparities in health outcomes were eliminated, most Black people would still have worse health than the average person in the United States because of their class position (17). Many, including the authors, argue that racial disparities cannot be accurately analyzed without simultaneously considering the contribution of socioeconomic factors (17).

Causes of Imaging Disparities

The Institute of Medicine presents a framework for understanding the cause of racial disparities, which can oc-

Summary

Radiology needs comprehensive solutions to provide equitable access to imaging and contribute to decreasing health disparities between Black and White individuals in the United States.

Essentials

- Reducing health care disparities between population groups is an important aspect of combatting rising health care expenditures.
- Inadequate technology diffusion promotes racial and ethnic differences in the quality of health care and subsequent outcomes because higher-technology procedures often have increased accuracy for medical conditions compared with their lower-technology counterparts.
- Differences in the tendency of physicians to order imaging examinations in Black patients function as unwritten de facto race-based guidelines with resultant outcome disparities.
- Racial disparities propagate through the entire imaging cycle, and organizations, in conjunction with radiologists, must deploy comprehensive interventions targeted at patients, systems, and providers to reduce long-standing health disparities between Black and White patients.

cur at three levels: the patient, the provider, and the system (8). Otherwise, "minimal" potentially inconsequential disparities are additive and can cumulatively result in disparate outcomes (18).

Patient-related Factors

A patient's interaction with the health care system is complex, with factors such as health literacy, medical mistrust, cultural differences, and communication or linguistic barriers all playing a role (15). For example, not only is there is a lack of awareness in the general public about the option to screen for a number of conditions, there are additional barriers to patients' compliance with screening recommendations, including embarrassment, low income, and lack of health insurance (15,19,20).

System-related Factors

Disparities can manifest in the general technologic expertise of an institution and technologic diffusion—the process by which innovations, new products, processes, or management methods spread within and across economies (21). Racial disparities in imaging access may be at least partially related to the complexity of imaging. As Black patients disproportionally receive care at lower-quality hospitals (as assessed by patient safety indicators) (22) they may not readily have access to newer high-technology imaging modalities (23).

Disparities in imaging access are problematic, as higher-technology procedures often have increased accuracy for medical conditions compared with their lower-technology counterparts. Therefore, preferential use of lower-technology imaging can lead to decreased accuracy and undertreatment. For example, the 2016 practice parameter for the performance of cardiac CT states that for diagnostic-quality cardiac CT, the scanner should "meet or exceed a 64-detector scanner" (24) secondary to the challenge of imaging a moving object. If an institution only has a 16-channel scanner, an attempt to perform cardiac imaging would likely yield nondiagnostic studies because of motion artifacts. As clinical indications emerge for newer technologies like 3-T MRI and PET/MRI, the fact that not every institution has these technologies will exacerbate disparities, ultimately resulting in disparate outcomes (25,26). Further, some modalities, such as low-dose CT for lung cancer screening (27) and coronary CT angiography in patients with stable chest pain (28), are directly associated with improved patient outcomes.

When compared with White patients, Black patients more often receive care at hospitals that disproportionately serve vulnerable minority and low-income communities that face financial and cultural barriers to health care—so-called safety net hospitals (29,30). Unfortunately, these hospitals are more likely to rank poorly on quality measures and are often associated with poorer outcomes secondary to a combination of financial strain and limited hospital resources in conjunction with worse overall health and more advanced disease at time of presentation in their patient population (31–34).

Medical practice has both written and unwritten (de facto) race-based diagnostic algorithms. Although there is no consensus on the meaning of race, a recent study notes that many current diagnostic algorithms and practice guidelines adjust their output based on the patient's race or ethnicity (35). Many of these race-adjusted algorithms guide decisions in ways that may direct more attention or resources to White patients than to members of a racial or ethnic minority (35). Often, algorithm developers do not explain why racial or ethnic differences might exist or they proffer rationales that, when traced to their origins, lead to outdated suspect racial science or biased data (35). For example, the Vaginal Birth after Cesarean Section calculator uses race as a factor and systematically assigns a lower chance of successful vaginal delivery after cesarean delivery in Black women than in White women; however, this is not supported by science or biologic plausibility (36).

Similarly, differential use of imaging in Black patients functions like unwritten de facto race-based clinical evaluation and practice guidelines. Medical practice in the United States varies widely, and some studies have found that clinicians both treat and diagnose disorders in patients from racial and ethnic minority groups differently unrelated to differences in need (33,37–39). For example, the likelihood that a diagnostic imaging examination will be ordered during U.S. emergency department encounters differs significantly by patient race and ethnicity, even when controlling for other patient and hospital characteristics (40). A combination of general inaccessibly of high-technology imaging and patterns of care reflective of local practice patterns likely leads to very different diagnostic and treatment patterns between Black and White patients, contributing to outcome disparities.

Provider-related Factors

Bach et al found that White patients' visits are mostly to physicians who provide only a small amount of care to Black patients and that Black patients were significantly more likely than White patients to see Black physicians (22.4% vs 0.7%, respectively) (41). In other words, the care of Black and White patients rests largely in the hands of different physicians. Physicians who attend to a larger proportion of Black patients provide more charity care, practice more often in low-income

neighborhoods, and are less likely to be board certified than those taking care of primarily White patients (41). Specific to radiology, physicians who take care of Black patients more often report that they cannot provide access to high-quality (undefined) services, including diagnostic imaging, compared with those taking care of White patients (41). Although not specific to radiology, a more recent study reports challenges in referral coordinators obtaining specialty services for their minority patients (42). Disparities in access to interventional radiology procedures, such as nonsurgical or minimally invasive options to manage gynecologic conditions, such as fibroids, have also been noted (43). In conjunction, access to accredited imaging centers for services such as lung cancer screening are the lowest in states with the highest proportion of Black individuals (44,45).

In addition, there is some evidence that clinicians' ordering practices differ based on socioeconomic status. For example, primary care physicians' tendency to intervene in various patient conditions, such as ordering MRI for back pain, has been shown to differ between clinicians practicing in low- versus high-spending regions (46). Physicians may adopt the standard of practice of the community where they work. In conjunction, implicit bias and concerns about malpractice litigation may be additional factors in determining clinicians' ordering practices (47).

Impact of Disparities on the Imaging Cycle

The Institute of Medicine models the diagnostic process from patient presentation to outcomes. In conjunction with laboratory imaging and pathology findings, medical imaging plays a major role in the information-gathering phase of this model (48,49) (Figs 1, 2). Given its central role in the diagnostic process, racial variations in access to and use of medical imaging can promote disparate outcomes at every stage of the radiology imaging cycle. We review a few radiology-specific examples of disparities and, when possible, relate them to phases of the imaging cycle.

Women's Imaging

Perhaps nowhere in radiology have disparities between ethnic groups been as thoroughly documented as in women's imaging. Compared with White women, Black women have lower rates of breast cancer (incidence rate) but higher mortality (death rate) (50). Breast cancer death rates are 40% higher among Black women compared with White women (50), partly reflecting that breast cancer tends to be more biologically aggressive in Black women and partly because breast cancer is disproportionately diagnosed at a later stage in Black women (51,52). Racial differences in survival are, however, apparent even after accounting for disease stage and tumor characteristics; thus, they are demonstrative of the role of social forces, such as cultural beliefs discouraging women from seeking care for a potential breast problem and poor access to health care (51).

Preprocedural Disparities

Underuse of screening mammography among Black women contributes to racial disparities in outcomes and mortality. In a meta-analysis, Ahmed et al found that Black women have significantly lower odds of using screening mammography when compared with White women (20). This underuse may be partly secondary to lack of physician recommendation. O'Malley et al found that Black women are significantly less likely than White women to report physician recommendation for mammography; physician recommendation accounts for 60%–75% of the racial differences in mammography use (53).

Protracted travel time and clinic wait times are further burdens in obtaining care and can exacerbate disparities. Onega et al found that Black women are more likely to travel farther for breast MRI services, suggesting that geographic distribution of advanced imaging may exacerbate disparities (54). In addition, Ray et al found that clinic wait times are significantly longer for racial and ethnic minorities (55). Because the time spent with a physician was no longer for those with longer clinic wait times, this suggests that differences are due to time spent in other activities, such as completing paperwork, interacting with nonphysician staff, and waiting (55).

Procedural Disparities

Given the dependency radiologists have on imaging quality, the lack of skilled technologists to perform high-quality examinations can contribute to disparities. In a study of mammography quality and urban residents with breast cancer, Rauscher et al found that technologist-associated image quality indicators—such as positioning, compression, and sharpness—varied with socioeconomic factors. Lower household income was associated with worse image quality, which was associated with later breast cancer stage at diagnosis (56).

With the advent of newer screening technologies that purport to improve cancer detection over that with mammography alone—such as digital breast tomosynthesis, screening US, and breast MRI (57–60)—some authors caution that already existing disparities can worsen as vulnerable populations are historically the last to benefit from new health care technologies (61). For example, Richman et al found that although digital breast tomosynthesis use increased significantly between early 2015 and late 2017, from 12.9% to 43.2% of screening examinations, it has been adopted more rapidly in areas with higher incomes, greater educational levels, a larger White population, and a smaller Black population (62). Wernli et al found that the overall breast MRI rate from 2005 through 2009 nearly tripled from 4.2 to 11.5 examinations per 1000 women. When compared with women who received screening mammography alone, women who underwent screening breast MRI were more likely to be White and non-Hispanic than they were to be Black (63). Haas et al found that, among those at average risk for breast cancer (<20% lifetime risk), non-Hispanic White women were 62% more likely than non-White women to undergo screening breast MRI (64).

Postprocedural Disparities and Clinical Action

The performance of interpreting radiologists may vary with differing patient populations. In one provocative study of women with breast cancer, Rauscher et al retrospectively analyzed both the index mammogram, on which a malignancy was detected, and at least one prior mammogram interpreted as negative and obtained within 2 years of the index mammogram (65). Upon

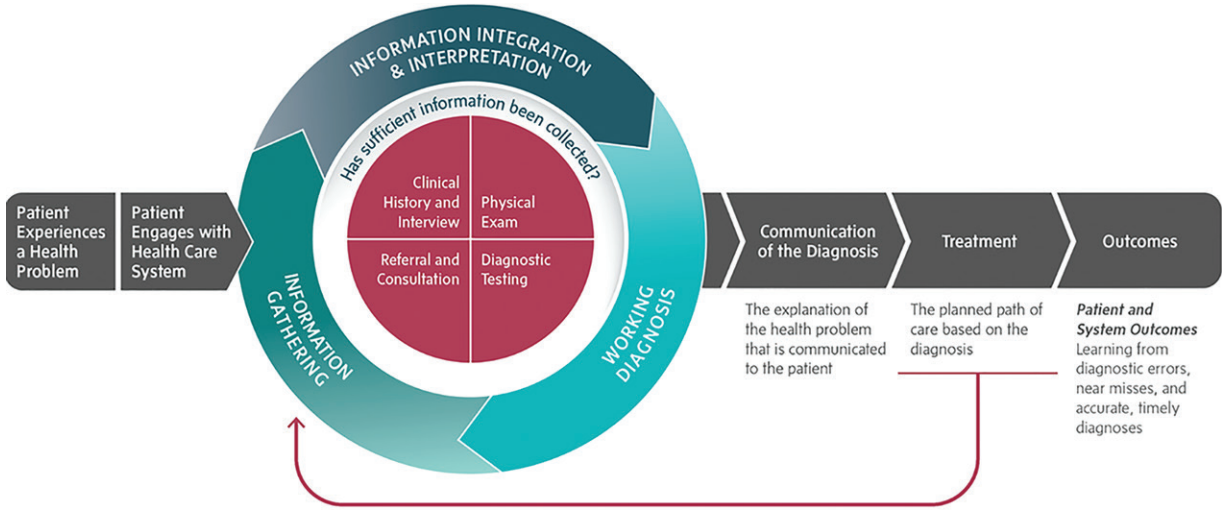

Figure 1: Diagram shows the Institute of Medicine conceptualization of the diagnostic process with outcomes. This process extends from patient presentation to treatment and outcome measurements. The goal of information gathering, such as with medical imaging, is to reduce diagnostic uncertainty and narrow diagnostic possibilities. The result is several outcomes that can be analyzed for system improvement. (Reprinted, with permission, from reference 49.)

expert review, they found that 46% of the 149 prior mammograms originally read as nonmalignant had a "potentially detectable/missed lesion"—a lesion retrospectively identified as abnormal and actionable (65). Further analysis noted that minority patients were 17% more likely to have a potentially detectable or missed lesion than White patients. They attributed this finding to the fact that black women are less likely than White women to undergo screening mammography at academic medical centers or centers with breast imaging specialists (52).

The low-resource institutions that minorities visit may rely more on generalists, who may read screening mammograms with less sensitivity, contributing to a higher false-negative screening rate than at higher-resource institutions (65). Elmore et al found that fellowship training in breast imaging was the only variable associated with improved accuracy in mammographic interpretation (66). Because specialists often work in academic settings and minorities more often undergo imaging at low-resource institutions, this can be associated with increased interpretive error, contributing to outcome disparities.

Other system-based disparities exist after mammography is performed. Some authors cite data suggesting that mammography use is now comparable between Black women and White women and attribute inadequate follow-up of abnormal mammogram results as a cause for the disparities between Black and White patients (67). Karliner et al found that the time between abnormal mammography findings suspicious for or highly suggestive of cancer and biopsy (follow-up time) was longer in mammography facilities serving a high proportion of minorities (68). These facilities report processes of care that demonstrate fewer resources, fewer radiologists, longer wait times for biopsy appointments, and less direct communication than facilities with shorter follow-up times (68). Unfortunately, this longer follow-up time is associated with a higher likelihood of diagnosis of advanced breast cancer (68). Nguyen et al found that direct telephone communication with patients who had abnormal mammographic findings increased the percentage of patient presenting for diagnostic follow-up within 60 days. All racial groups demonstrated increased follow-up; Black women's adherence to follow-up mammography increased from 69% before to 85.9% after a standardized telephone call process was implemented (69).

Lung Cancer Screening

Lung cancer is the leading cause of cancer death for both men and women in the United States, but certain high-risk populations experience even greater morbidity and mortality. Black men have the highest rates of age-adjusted lung cancer incidence among all U.S. racial and ethnic groups (19). Black men also have the highest lung cancer mortality compared with other racial and ethnic groups, despite the fact that smoking rates among Black men and White men are similar (19). Black individuals develop lung cancer at an earlier age than White individuals and are more likely to present with advanced disease (70).

The National Lung Screening Trial (NLST) demonstrated that screening for lung cancer with annual low-dose CT allows for early detection when surgical options are available to improve outcomes and can reduce mortality attributable to lung cancer by 20% (27,71). As a result, the U.S. Preventive Services Task Force set forth screening guidelines based on age (55–80 years) and smoking history, targeting smokers with a 30-pack-year history who either currently smoke or who quit within the previous 15 years based on NLST data and simulation models. These models, however, do not consider important racial differences in smoking patterns between racial groups (72) because Black individuals comprised only 4.4% of participants in the NLST (71).

Although Black patients in the NLST had more comorbidities, were more likely to be unmarried, and were more likely to be current smokers—variables generally associated with poorer outcomes—they demonstrated the greatest reduction in lung cancer mortality of any racial or ethnic group (73). This finding affirms that lung cancer screening can improve survival in even the most vulnerable high-risk populations and is an important

Figure 2: Diagram shows the stages of the radiologic imaging cycle with typical actions taken in each phase. The cycle is composed of three phases that center on medical imaging (preprocedure, procedure, and postprocedure phases) and a fourth phase that focuses on clinical action by the referring practitioner. Racial and ethnic disparities can occur in all four phases.

opportunity for radiologists to directly address health care disparities (70,73).

Preprocedural Disparities

Black patients diagnosed with lung cancer are more likely to be intermittent or light smokers with fewer accumulated pack-years and are more likely to start smoking later in life than White patients (70,72). The current lung cancer screening inclusion criteria of a smoking history of 30 pack-years can, therefore, exclude a large portion of Black smokers due to their lower average consumption of cigarettes per day. In addition, Black smokers are at greater risk of developing lung cancer at an earlier age, further excluding black smokers at high risk (72). Affirming this concern, among individuals diagnosed with lung cancer, 67.8% of Black smokers were ineligible for screening compared with 43.5% of White smokers (72).

Even when eligible, Black patients are less likely than White patients to undergo screening. In a 2018 study, Japountich et al found that only 21% of eligible patients were screened and eligible non-Black patients were 2.8 times more likely than eligible Black patients to have been screened (30% vs 12%) (74). This study shows that use of lung cancer screening is low, despite coverage provided through the Affordable Care Act and that even when Black patients qualify for screening, they are disproportionately less likely to be screened for lung cancer when compared with non-Black patients.

Lewis et al found that clinicians' knowledge of lung cancer screening guidelines was proportional to their ordering rate (75). Doctors who take care of predominantly Black populations may be uninformed about screening recommendations, further exacerbating disparities intrinsic in the current screening guidelines.

Procedure and Postprocedure Disparities and Clinical Action

There are system-level barriers to the effective implementation of a lung cancer screening program that affect its availability and subsequent patient care.

Low-dose CT must be performed using certain technical specifications, and scans must be interpreted using a standardized approach, such as the Lung Imaging Reporting and Data System, or LI-RADS, (76). In addition, the American College of Chest Physicians policy statement notes that, for qualification as a lung cancer screening facility, the facility must have integrated smoking cessation services for enrolled patients and must collect data related to outcomes (77).

A lung cancer screening program coordinator often performs many of these functions, including shared decision making, tobacco treatment counseling, and tracking of program participants. Spalluto et al found that adherence to follow-up recommendations increased from 21.7% before hiring a program coordinator to 65.6% after the program coordinator's hire date (78).

Insufficient infrastructure, staff, or information technology to efficiently schedule patients and track screening test completion, results, and follow-up testing are limitations for fledgling screening programs, as nodule evaluation requires considerable system level resources to facilitate appropriate care (76,79).

In addition to optimizing early detection of lung cancer, a concurrent goal of lung cancer screening is to minimize potential harm primarily caused by unnecessary invasive procedures (80). To provide quality assurance, the International Early Lung Cancer Action Program developed a process whereupon the first 100 examinations performed at participating institutions were read independently by radiologists with no screening experience at both institutions and by radiologists with over 6 years of experience at the coordinating center. Thirteen percent of interpretations were discordant, the majority of which were secondary to not following the established follow-up and treatment protocol (80). After feedback, most of the institutions demonstrated decreased positive results, limiting unnecessary work-up (80). Similarly, as minorities more often undergo imaging outside of academic settings, their image interpretations, follow-up intervals, and intervention may not be as accurate as those at academic institutions with dedicated thoracic radiologists.

Oncologic Imaging

The 2017 National Comprehensive Cancer Network guidelines recommend PET/CT for patients with non-small cell lung cancer (81). However, Morgan et al found that for all tumor types, Black patients were only 54% as likely as non-Hispanic White patients to undergo PET/CT (81). As PET/CT is relatively specialized and expensive, vulnerable populations undergoing treatment at safety net hospitals may not readily have access (82).

In addition, the probability of survival at 12 months was over 20% higher in patients imaged with PET/CT versus those imaged with CT alone (81). Equitable use of PET may enable more accurate staging of lung cancer, leading to more appropriate guideline-concordant care, thereby reducing the survival gap between ethnic groups (81).

Although use of PET/CT has significantly increased since the first commercial scanner was available in early 2001, racial differences in use widened between 2004 and 2008 (83,84). This suggests that even when the use of new technologies increases over time, their broad adoption does not always narrow disparities in access (84).

Although there have been minimal studies in this regard, Sultan et al found that the age-adjusted odds of Black patients undergoing treatment at National Cancer Institute–designated comprehensive cancer centers were significantly lower than those of White patients (85). This may be an additional cause of ordering disparities, as Morgan et al found that treatment facility type is predictive of PET/CT use, with National Cancer Institute centers more likely to use PET imaging compared with nonteaching, non–National Cancer Institute facilities (81).

Overuse in White Patients

Overuse refers to the concept that some patients receive care they do not need, that does not improve their health outcomes, and that may expose them to harm (86) (Fig 3). A theory advocated to partially explain disparities is that "white patients are at greater risk for overdiagnosis and overtreatment" because they are often more optimistic about the ability of health care workers' to diagnose and treat them and because they have more financial resources (86). This premise is supported by results from Natale et al, who found that White children undergo head CT more often than children of color in the setting of low or moderate trauma when imaging is not clinically indicated (87). In addition, a systemic review of 59 studies found that 43% of studies reported either overuse of care among White patients or higher rates of appropriate nonuse in non-White patients (86). When devising solutions to reduce racial disparities, it is important to ensure that any corrections do not lead to inappropriate care among minority patients (86).

Overuse among White patients may consume scarce resources and thus contribute to underuse among minorities, exacerbating disparities in care. Problems with the fairness of systems and practitioners must be identified and corrected, and minority patients' distrust of physicians and health systems must be addressed (86).

Differential use patterns mandate that a number of questions regarding interpersonal dynamics in the patient-provider interaction be asked. Do providers perceive or interpret patient need or anxiety differently based on race? Does communication differ based on racial concordance with the provider? Do providers fear legal action or patient complaints based on the race of their patients, and is this what drives their perception of the utility of imaging (47)?

Methods to Decrease Disparities in Imaging Access

Solutions to reduce disparities in access to radiologic imaging must be comprehensive and specifically target patient-, systemic-, and provider-related factors that promote racial disparities.

Patient-related Interventions

Physicians and hospitals can reduce disparities by partnering with local and state organizations to develop outreach and education programs to improve health literacy regarding conditions that disproportionately affect disadvantaged communities (eg, lung cancer) (19).

Glover et al found that Black patients were at increased risk of missing appointments compared with White patients and note that the impact of these "imaging missed care opportunities" includes delayed diagnosis and increased morbidity and mortality (88). Assessing and addressing social determinants of health, for example by means of transportation-based solutions, cost transparency, and increasing staff diversity and cultural competency, can help patients capitalize on imaging services (12,88,89).

System-related Interventions

Payne et al found that standardized race-neutral evaluation algorithms could help mitigate racial disparities. When institutions used the Children's Head Injury Algorithm for the Prediction of Important Clinical Events, or CHALICE, algorithm to determine the need for radiologic testing in patients with a head injury, there were no racial differences in radiologic imaging (90). Such algorithms may diminish subjectivity, thereby improving consistency of treatment.

Additional evaluation algorithms for common problems both in the emergency department and in other settings may similarly reduce racial disparities (90). In conjunction, provider education with reinforcement by means of clinical reminders and decision support programs using electronic medical records can be useful (15,75).

Revision of the current the U.S. Preventive Services Task Force lung cancer screening guidelines by reducing the smoking pack-year eligibility requirement from 30 to 20 pack-years for Black smokers would increase the percentage of patients eligible for screening from 17.4% to 28.5%, which is similar to the percentage of White smokers (72). In addition, reducing the minimum age to 50 years old would further increase the eligibility of Black smokers (70,72).

Wang et al leveraged screening mammography visits to engage smokers with tobacco cessation services and identify smokers eligible for lung cancer screening. By using a questionnaire

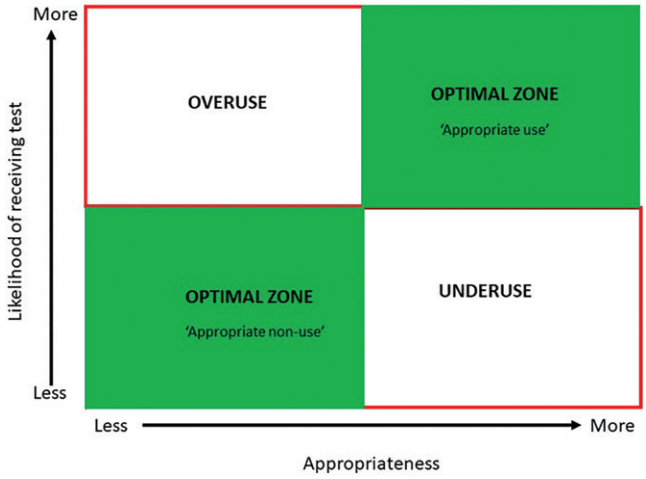

Figure 3: Grid represents a systemic representation of health care appropriateness. The y axis depicts the likelihood of receiving needed care. The x axis depicts the degree of need or clinical appropriateness of the care. Optimal care occurs when patients do not receive unwarranted care and when they do receive needed care. Overuse is when patients receive unneeded or inappropriate care, and underuse is when patients do not receive needed or appropriate care. (Modified, with permission, from reference 86.)

administered during screening mammography patient intake, they found that 10.5% of respondents were current smokers, 26.4% of whom requested referral to a tobacco cessation program. In all, 9.2% of those who ever smoked met eligibility criteria for lung cancer screening and, of these, only 31.4% underwent low-dose CT within 13 months before the visit. Such initiatives allow radiology practices to advance population health goals (91). In addition, bundling screening appointments, offering off-hours imaging, and extending service hours can help accommodate hourly wage workers' schedules.

Radiology departments can leverage their critical position in patient care to prioritize new technologies for their communities in conjunction with hiring and retaining skilled radiologists and technologists. Departments are well positioned to make the financial and ethical case for these measures by analyzing and highlighting the immediate and downstream financial benefits to institutions as well as evidence demonstrating improved patient outcomes (92).

Provider-related Interventions

Recent articles have noted the stark underrepresentation of minorities amongst diagnostic radiology physicians (93–95). Only 2% of diagnostic radiology faculty in 2010 were Black (95). More recently, the 2017 Medscape Lifestyle report notes that only 1.3% of the radiologists surveyed identified as Black (96). Increasing the training, recruitment, and retention of Black faculty in radiology might help mitigate disparities to the extent that Black physicians might be more keenly aware of health care disparities and push for affirmative changes in the health care system.

Despite decades of antibias and diversity training in universities, hospitals, and businesses, the persistence of systemic bias leaves some to conclude that diversity training is the most expensive and least effective method to reduce bias (97). We are not advocating the abolition of educational efforts to combat bias at the provider level; instead, we encourage radiology departments to favor systemic interventions, particularly in resource-constrained institutions. For example, radiologists should ensure that clinicians are informed and knowledgeable about screening recommendations that can impact their ordering rate and diminish disparities intrinsic in current screening guidelines. Radiology departments should make it a part of their mission statement to keep abreast of updates in technology and techniques and be prepared to work interdepartmentally to ensure that these are available to providers. Furthermore, radiologists should help contain health care costs by actively initiating interdepartmental efforts to curb inappropriate imaging use and improve efficiency through performance improvement efforts (48,98,99). We believe that ultimately this approach would prove more effective than focusing on addressing individual biases.

Conclusion

Every profession has a commitment to serve and promote the common good of the community they serve, and radiology has an important role in meeting the health care needs of the underserved and inadequately served (100). To contribute to decreasing longstanding disparities, radiology departments must promote the principle that all patients should be able to take advantage of our technology. Knowledge, research, and advocacy are the keys to implementing affirmative changes in the system. The time for action is now.

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