AMA Journal of Ethics®
August 2022, Volume 24, Number 8: E773-780

MEDICINE AND SOCIETY: PEER-REVIEWED ARTICLE

Should We Rely on AI to Help Avoid Bias in Patient Selection for Major Surgery?

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Abstract

Many regard iatrogenic injuries as consequences of diagnosis or intervention actions. But inaction—not offering indicated major surgery—can also result in iatrogenic injury. This article explores some surgeons' overestimations of operative risk based on patients' race and socioeconomic status as unduly influential in their decisions about whether to perform major cancer or cardiac surgery on some patients with appropriate clinical indications. This article also considers artificial intelligence and machine learning-based clinical decision support systems that might offer more accurate, individualized risk assessment that could make patient selection processes more equitable, thereby mitigating racial and ethnic inequity in cancer and cardiac disease.

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Risk Assessment and Inequity

It is well documented that Black patients die more often from cancer and heart disease than do similarly matched White patients.[1,2,3,4] While multiple factors account for this disparity, given equivalent indications, Black patients are less likely to receive complex cardiac and oncologic surgical treatment than White patients.[5,6,7,8,9,10,11,12] This disparity has largely been attributed to lack of access to complex surgical care and patient refusal to undergo surgery.[5,6,7,8,10,11,12,13,14] However, these factors disregard the role surgeons play in patient selection for major surgery and the potential for biased assessments based on race or socioeconomic status to influence surgical judgment.[8,15,16] We propose that the use of artificial intelligence and machine learning (AI/ML) for clinical decision support (CDS) can reduce bias and promote data-driven decisions about patients' eligibility for major surgery.

Patient Selection

Patient selection for major surgery is a highly venerated and rarely challenged prerogative of the surgeon.[17,18,19] Surgical judgment is influenced by both objective and subjective assessments, the latter often dominating the final decision. For many types of cancer and cardiac diseases, surgery represents a patient's only possibility for long-term

survival.[5,6,7,8,9,11,12,20,21] Thus, when patients are not offered surgical treatment, they are likely to die from the underlying disease. For both cardiac disease and cancer, the failure of surgeons to offer potentially lifesaving surgery likely contributes to observed racial disparities.

One of the most common reasons surgeons give when refusing to operate on a patient with an appropriate indication is that the patient is considered to be at too high a risk for complications or death.[18] Surgeons assess the risks and benefits of operating *and* of not operating on a patient.[18] Professional responsibility requires that the benefit of operating and the risk of not operating be sufficiently skewed so as to justify performing the operation.[22,23] This consideration raises 2 important questions: (1) how a patient's risk is assessed and (2) whether concern about outcome metrics unduly affects surgical judgment.

Risk assessment. Surgical risk is an assessment of the likelihood that a patient will suffer a complication or death related to an operation.[18] Surgical risk calculators have been developed to predict the likelihood of perioperative morbidity and mortality.[24,25,26,27] In general, as patients amass comorbidities, their surgical risk increases. Recently, frailty scores have been introduced as a way to quasi-quantitatively assess what many surgeons call the "eyeball test," their subjective appraisal of how frail a patient is.[28,29] The more frail the patient, the greater is the risk of complications and death.[30] But any assessment that relies on individual observation risks introducing bias.

Indeed, surgeons have estimated similar comorbidities to be more severe in Black patients than in White patients, and Black patients have been offered aggressive treatment less often than White patients with equivalent indications.[15,20,31,32,33,34,35,36] Because of the association between race and socioeconomic status, a surgeon might assess angina in a well-dressed, upper-middle-class White man differently than in a Black man experiencing housing insecurity with a medically equivalent condition. Similarly, chronic obstructive pulmonary disease of equal severity may look very different in a White woman who was driven to the consultation than in a Black woman who took public transportation and then walked several blocks to reach the surgeon's office. Black patients who are poor and undereducated may appear on an eyeball test to be more frail and higher risk than well-nourished, well-rested patients.

Besides being biased by socioeconomic factors that may cause Black patients to be judged at higher risk for surgery, surgical decisions may also be affected by ostensibly objective data indicating that, for major cancer and cardiac surgery, Black patients have higher mortality rates, higher rates of postoperative complications, higher readmission rates, and longer lengths of stay than similarly matched White patients.[8,9,14,37,38,39,40,41,42] These reported outcomes, which are closely associated with socioeconomic status, could further justify the surgeon's subjective assessment of the patient's potential for a successful postoperative and posthospital recovery.

Elevated mortality rates of Black patients undergoing major surgery are often attributed to these patients' lack of access to high-quality surgical care.[8,9,38,41,43] The typical reasoning is that Black patients often seek care at lower quality hospitals and by less experienced surgeons, and thus they suffer complications and death more frequently.[38,39,41,43] This line of reasoning presumes that Black patients themselves choose lower-quality surgical care, disregarding the distinct possibility that these hospitals and surgeons may be the only ones who are willing to accept those Black

patients whom higher-quality hospitals with more experienced surgeons have deemed too high risk. A plausible scenario that deserves further investigation is whether Black patients are cared for in lower quality hospitals because the surgeons at those hospitals do not judge Black patients to be as high risk as do their colleagues at higher quality medical centers.

One proposed solution to the problem of unequal access is the take the "Access Pledge," whereby high-quality, high-volume medical centers assure equal access to all patients.[44] However, Black patients who have access to high-volume hospitals can still experience bias in selection for surgery, prompting some to seek treatment where they can access unbiased surgical assessment.

Outcome metrics. In addition to a biased subjective risk assessment, outcome metrics may affect a surgeon's objectivity in deciding whether to recommend a patient for major surgery. As a result of excessive iatrogenic injury among hospitalized patients, the late 1990s saw the introduction of quality metrics, including surgeon-specific measures of operative mortality and major complications.[45,46,47,48] While the aim was to improve the quality of surgical care, these metrics could also disincentivize some surgeons from operating on patients they perceive as too high risk. Such decisions in part reflect surgeons' own self-interest in not having their outcome metrics "look bad" before their peers and hospital administrators. A surgeon could thus decide that there is less risk and greater benefit in not operating or greater risk and less benefit in performing the operation. Furthermore, there is no system of accountability for a surgeon's refusal to operate on a patient, regardless of the underlying reason.[49]

Use of AI/ML CDS

How can potential surgeon bias in patient selection for major surgery be remedied? While interventions such as race-specific feedback on treatment completion rates and the use of nurse navigators have been shown to reduce racial disparities in care for early-stage lung cancer,[50] such interventions are downstream of the potentially biased clinical decisions that directly affect patient outcomes. What is needed is an objective system that can share agency with a surgeon in selecting patients for complex surgery. The use of AI/ML CDS systems holds great promise for debiasing surgical decision making.

Implementing AI/ML CDS could debias patient selection for complex surgery in 3 ways. First, the system could provide an objective, accurate, and individualized assessment of surgical risk based on information from the patient's medical record rather than subjective appraisals.[51,52] In other settings, standardizing clinical decisions and postoperative pathways has been shown to reduce racial disparities among surgical patients.[33,53,54,55] Second, the system would not be affected by concern for reported outcome metrics that might otherwise bias surgical judgment. Finally, the system could track not only the patients accepted for surgery but also those declined for surgery, thus providing a mechanism for recognizing biased trends.

Although AI/ML systems have been associated with perpetuating rather than resolving bias,[56] they are neither inherently biased nor essentially unethical. One way to debias AI is by carefully examining the assumptions the algorithm uses to make predictions and the data on which the system is trained. In one study, an algorithm was used to predict which patients would have the greatest future health care needs.[56] The system used data from past health care expenses and assumed the data would reflect the severity of

underlying illness to predict future health needs. The algorithm systematically underestimated future health care needs for Black patients because they utilized health care resources less often than did White patients, regardless of severity of underlying illness, and thus had overall lower historic health care expenses. The algorithmic assumption was wrong in that past health care expenses did not predict future health care needs.

In the same way, AI/ML surgical risk calculators could perpetuate racial bias if the algorithm assumes that operative morbidity and mortality are due entirely to underlying patient comorbidities and inherent patient risk. Nonpatient-controlled factors, such as hospital and surgeon volume, can also affect operative morbidity and mortality.[57] To make accurate predictions, an algorithm would need to weigh these other factors and not assume that operative outcome is entirely patient dependent.

An AI/ML system that is trained to make predictions based on assumptions that rely on historically biased data will perpetuate those same biases. If the assumptions can be corrected, then the predictions will become more reliable.[58,59] In debiasing AI/ML CDS, it is imperative to differentiate association and causation. It may be true that being Black is associated with increased morbidity and mortality and worse long-term survival after major cancer surgery, but these outcomes are not caused by being Black. For AI/ML CDS to debias patient selection for major surgery, race-associated outcomes should be assumed to be based not solely on inherent patient risk but on inequitable health care structures as well.[60]

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Citation
AMA J Ethics. 2022;24(8):E773-780.

DOI
10.1001/amajethics.2022.773.

Conflict of Interest Disclosure
The author(s) had no conflicts of interest to disclose.

The viewpoints expressed in this article are those of the author(s) and do not necessarily reflect the views and policies of the AMA.

ISSN 2376-6980