Case2
Transcript

#Slide1
This second case for the algorithmic bias module is on racial disparities in knee osteoarthritis pain.

#Slide2
While Black patients are likely to have more severe osteoarthritis on standard radiographic measures such as Kellgren-Lawrence Grade (KLG), the level of pain remains higher even when controlling for severity of osteoarthritis based on radiographs. A dataset of bilateral knee radiographs was obtained from a diverse sample of 4172 patients who had or were at high risk of developing knee OA were viewed and scored by radiologists on standard measures of radiographic severity (KLG) and the patients reported a knee-specific pain score (KOOS). This dataset represented 36,369 observations (one for each knee at each time point).

#Slide3
KLG is a system for assessing radiographic severity of osteoarthritis that was developed decades ago in a non-diverse group of white patients. The grades range from 0 with no evidence of osteoarthritis to 4 being the most severe. KOOS, or knee injury and osteoarthritis outcome score, is a self-reported measure of knee pain from osteoarthritis based on a 42-item questionnaire with scores ranging from 0 to 100 where a lower score is associated with more pain.

#Slide4
Black patients experienced severe pain 58% of the time compared with 38% for patients overall. The median Black patient had worse pain than 75% of non-Black patients. And, similar to prior studies, in this data set, Black patients did have more severe osteoarthritis, with 56% of knees having KLG ≥ 2 versus 46% of knees overall with similar trends across socioeconomic groups. But controlling for KLG scores did not fully account for the higher pain levels experienced by Black patients. The racial disparity in pain was 10.6 KOOS points, without controlling for any severity measures, compared with 9.7 points when controlling for KLG, meaning that KLG accounted for only 9% of the pain disparity.

#Slide5
Now, consider an algorithm that was developed to generate an alternative radiographic severity measure of knee osteoarthritis. For this algorithm, the developers were aware the disparity in the levels of knee pain from osteoarthritis where Black individuals tend to report more severe pain. The algorithm was trained to predict the reported pain score for each knee using a randomly selected training dataset of 25,049 radiographs (2,877 patients). This model was then used to generate predictions in an independent validation set of 11,320 radiographs 1,295 patients.

#Slide6
The resulting severity measure, denoted by algorithmic pain prediction (ALG-P) was at least as good as that of the KLG measure in predicted level of knee pain, but disparities in osteoarthritis pain were better accounted for by differences with the algorithmic measure compared to the standard measure KLG. ALG-P accounted for 43% of the racial pain disparity, 4.7 times more than did KLG.

#Slide7
There are clinical implications in this algorithm for determining who receives arthroplasty for knee pain. While radiographic severity is not part of the formal guideline in allocations for arthroplasty empirically, patients with higher KLGs are more likely to receive surgery. Underserved patients with disabling pain but without severe radiographic disease could be less likely to receive surgical treatments and more likely to be offered non-specific therapies for pain. This approach could lead to overuse of pharmacological remedies, including opioids, for underserved patients and contribute to the well-documented disparities in access to knee arthroplasty. When looking at a subset of patients with severe knee pain and KLG ≥ 3 who were likely under most active consideration for arthroplasty compared with patients identified using severe ALG-P instead of severe KLG the potential eligibility for arthroplasty for Black patients would double from 11% to 22%. As arthroplasty is known to reduce pain, this reallocation of surgery could potentially narrow the racial and socioeconomic disparities in pain as well as reduce the use of opioids for those in severe pain.

#Slide8
Based on this information about using an algorithm to address racial disparities in knee pain, answer at least one of the following questions linked below the case video...
Can you point out and describe some positive aspects of this algorithm?
What are some other clinical scenarios where algorithms might be helpful in reducing bias?