Are Patients Really Getting What They Want? The Routine Implementation of Decision Aids for Patients with Hip or Knee Osteoarthritis in the High Value Healthcare Collaborative and Alignment between Patient Treatment Choice and Receipt

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Abstract

Rationale, Aims and Objectives: Alignment between patients' treatment choices and treatments received is acknowledged as an important outcome of shared decision-making (SDM), yet recent research suggests that patients' choices do not always align with their actual treatment trajectories. This paper explores the alignment of patient-expressed treatment choices (for surgery or medical management) after exposure to decision aids and treatments received among patients with hip or knee osteoarthritis within High Value Healthcare Collaborative (HVHC) systems as the collaborative integrating decision aids intended to support SDM into routine clinical practice. Method: This retrospective cohort study examines data from adult (>18 years) patients with hip or knee osteoarthritis who received decision aids as part of orthopedic consultations within HVHC systems between 2012-2015. Multivariate logistic regression explored the association between patient-level characteristics with the odds of treatment choice-receipt alignment. Results: The majority of patients with knee osteoarthritis (68.3%) and hip osteoarthritis (71.9%) received treatments aligned with their choices following exposure to decision aids, but analyses reveal important differences in the odds of such alignment across patient characteristics. In adjusted models, African American patients with knee osteoarthritis had 50% lower odds of receiving treatment aligned with their choices compared with white patients (OR = 0.52, p<0.05). Medicare- or Medicaid-insured knee patients had 49% and 59% lower odds (respectively) of receiving choice-aligned treatments relative to privately insured patients. Patients with knee (OR = 0.40, p<0.01) or hip (OR = 0.75, p<0.05) osteoarthritis at earlier decision-making stages had lower odds of receiving treatments congruent with their choices. Conclusion: This work elucidates the odds of treatment choice-aligned care for patients within health care systems attempting to routinely integrate decision aids to support SDM into clinical practice and underscores the gaps in achieving this alignment among African American patients, those with public insurance and those at early decision-making stages.

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1

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Method: This retrospective cohort study examines data from adult (> 18 years) patients with hip or knee osteoarthritis who received decision aids as part of orthopedic consultations within HVHC systems between 2012-2015. Multivariate logistic regression explored the association between patient-level characteristics with the odds of treatment choice-receipt alignment.

Results: The majority of patients with knee osteoarthritis (68.3%) and hip osteoarthritis (71.9%) received treatments aligned with their choices following exposure to decision aids, but analyses reveal important differences in the odds of such alignment across patient characteristics. In adjusted models, African American patients with knee osteoarthritis had 50% lower odds of receiving treatment aligned with their choices compared with white patients (OR = 0.52, p<0.05). Medicare- or Medicaid-insured knee patients had 49% and 59% lower odds (respectively) of receiving choice-aligned treatments relative to privately insured patients. Patients with knee (OR = 0.40, p<0.01) or hip (OR = 0.75, p<0.05) osteoarthritis at earlier decision-making stages had lower odds of receiving treatments congruent with their choices.

Conclusion: This work elucidates the odds of treatment choice-aligned care for patients within health care systems attempting to routinely integrate decision aids to support SDM into clinical practice and underscores the gaps in achieving this alignment among African American patients, those with public insurance and those at early decision-making stages.

Keywords: patient-centered care, decision aids, treatment choices, learning collaborative

1. Introduction

Shared decision-making (SDM) and the use of patient decision aids are frequently highlighted as important tools for fostering patient engagement across conditions ranging from early stage breast cancer[1] to musculoskeletal conditions,[2] and are associated with positive impacts upon patient-centered outcomes including decision satisfaction and quality in multiple studies.[3-5] Research suggests that decision aids used in the context of SDM are associated with reduced anxiety, less regret and better health outcomes compared with usual care. [6] Elsewhere, decision aids have been shown to support patients in making treatment choices consistent with their values - especially when there is clinical equipoise between such choices, as is the case for preference sensitive conditions. [7]

Hip and knee osteoarthritis are two such preference sensitive musculoskeletal conditions for which current clinical evidence does not necessarily demonstrate superiority of surgery (arthroplasty) over non-surgical medical management (physical therapy, use of non-steroidal anti-inflammatory medications), [8] and the choice between these treatment options is likely to vary according to patient characteristics and personal values. [9]

Additionally, these treatment options come with differing costs, side effects, and risks, [10] further underscoring the importance of patients being provided with information that empowers them to make informed, value-aligned treatment choices.[11] As the costs of care for patients living with musculoskeletal conditions continues to rise (in 2014, direct costs for these conditions was estimated to be $980.1 billion in the United States alone) and as the prevalence of patients with hip and knee osteoarthritis continues to grow,[12] so does the imperative for health systems to engage patients in conversations about treatment option benefits and tradeoffs such as through the use of decision aids intended to support SDM.

Recent scholarship in the field of SDM has underscored that the alignment between patients' expressed treatment choices and treatments received represents a critical component of decision quality,[13] [14] which is defined as "the extent to which patients are informed, meaningfully involved in the decision-making process, and receive tests and treatments that reflect their goals and concerns."[15] Although such alignment has been recognized as an important outcome of SDM,[16] some research shows that alignment between patient treatment choice and treatment receipt is not always achieved; in one large multi-year research trial of SDM among patients with low back pain, nearly one quarter of those patients electing for medical management received surgical interventions instead. [7]Sullivan et al examined treatment choices of patients diagnosed with stage 1 lung cancer and found a lack of congruence between patient-expressed treatment choices and treatments received among 49% (n = 114) of study

participants.[17] Scherr et al note that treatment choice may be dictated by other factors (such as physician rather than patient preferences) even where SDM has occurred.[18] In addition to the clear gaps that exist in achieving alignment with patient expressed treatment choices, much of this research has focused upon patient populations drawn from single institutions or health systems.[18,19]

This paper explores the extent of alignment between patient-expressed treatment choices after exposure to decision aids and treatments received among hip and knee osteoarthritis patients within High Value Healthcare Collaborative (HVHC) systems while the collaborative sought to integrate SDM into routine clinical practice. Specifically, this work investigates which patient-level characteristics are associated with alignment between treatment choice and treatment received among patients diagnosed with hip or knee osteoarthritis within HVHC exposed to decision aids for these conditions. These analyses importantly examine such alignment in the context of patients drawn from diverse health systems in a learning collaborative,[20] and in the context of routine implementation of decision aids to support SDM in clinical practice as opposed to a controlled trial setting. The aim of this study is to understand the associations between patient-level characteristics and alignment in expressed choices and treatments received for hip or knee osteoarthritis after a decision aid intervention.

2. Methods

2.1 Study Design and Patient Population

This retrospective study draws upon data from patients diagnosed with hip or knee osteoarthritis who received care within one of 10 High Value Healthcare Collaborative (HVHC) systems. HVHC is a provider learning collaborative of health systems from across the United States that share data pertaining to multiple quality improvement projects with the aim of elevating the provision of high value, evidence-based patient care.[21] The 10 member systems of HVHC include: Baylor Health System, Beth Israel Deaconess Medical Center, Denver Health, Eastern Main Healthcare Systems, Intermountain Healthcare, MaineHealth, Mayo Clinic, Scott and White Health, UCLA Health System, and Virginia Mason Medical Center. Data from each HVHC system was analyzed during the three-year period (from July 1, 2012 to June 30, 2015) when HVHC received a grant entitled "The High Value Healthcare Collaborative: Engaging Patients to Meet the Triple Aim" from the Center for Medicare and Medicaid Innovation (CMMI) to facilitate the routine use of decision aids to support SDM among patients with hip or knee osteoarthritis.[22]

Adult (age 18-86) patients with diagnoses of hip (International Classification of Diseases, Clinical Modification codes (ICD-9 CM) diagnostic codes 715.09, 715.15, 715.25, 715.35 or 715.95) or knee (ICD-9 CM diagnostic codes 715.09, 715.16, 715.26, 715.36 or 715.96) osteoarthritis who were exposed to decision aids

within HVHC systems and for whom complete post-decision aid surveys assessing patient choices were completed prior to the end of the CMMI grant period (June 30, 2015) were included. Among 1,791 hip and knee osteoarthritis patients who were exposed to decision aids and completed post-decision aid patient surveys, a total of 1,351 expressed a post-decision aid treatment choice of either surgical or non-surgical intervention (n = 974 knee patients and n = 377 hip patients). Since the outcome of interest was alignment between post-decision aid treatment choice and treatment received, patients who expressed uncertainty after receiving decision aids (n = 440) were excluded.

HVHC's grant-funded project made use of decision aids (specific for hip or knee osteoarthritis) meant to support SDM conversations between clinicians and patients and pre- and post-decision aid web-based questionnaires. For both hip and knee osteoarthritis patients, HVHC provider systems utilized Health Dialog-produced decision aids. Health Dialog decision aids meet standards set by the International Patient Decision Aid Standards Collaborative [23] and provide balanced information about treatment options for conditions including hip and knee osteoarthritis. Patients were invited to view decision aids online, on DVD, or on a tablet in the orthopedic surgeon's office either prior to or following their consultations. Before and after viewing the decision aids, patients completed surveys that assessed their treatment choices, decision-making stage, and gathered information including patients' education, insurance status, and self-assessed pain (as measured by the pain sub-scale of the Knee Injury and Osteoarthritis Outcome Score (KOOS) and Hip Injury and Osteoarthritis Outcome Score (HOOS) for knee and hip osteoarthritis patients, respectively).

For patients who viewed decision aids in the medical office prior to their appointment, health coaches - who in most cases were registered nurses – were available to answer questions regarding the decision aids and patient surveys. Health coaches received decision support training sponsored by the collaborative through a 4-week distance learning course that incorporated "active learning assignments" building upon the Ottawa Personal Decision Guide tools and framework.[24]During the patient's orthopedic appointment, the orthopedic surgeon could review survey responses, clarify questions, and address patient concerns that may not have been answered by the decision aid alone. The adoption of decision aids among HVHC systems was motivated by the collaborative's focus upon improving overall functioning of patients considering hip or knee surgery and ensuring that rates of such surgeries reflected patient treatment preferences.

2.2 Outcome and Data Collection

System-reported clinical and administrative data from HVHC's Unified Data Extract included information about which patients underwent arthroplasty within the grant period. Encounter-level data encompassing demographic information, administrative claims, and health status measures from HVHC system sites between 2012-2015 were integrated with the Unified Data Extract and analyzed. Decision aid exposure was documented in administrative data at the patient level. Patients' post-decision aid treatment choices were assessed via patient survey data. Patients were asked the following question after viewing decision aids: "At this time, what treatment are you leaning toward for your [hip/knee] pain?" Response categories included [hip/knee] surgery, non-surgical treatment, or not sure.

The patient surveys also captured most patient-level independent variables included in the final analyses – patient sex, age, marital status, race, health insurance, education, HOOS/KOOS pain score, and decision-making stage. The Hip Disability and Osteoarthritis Outcome Score (HOOS) and Knee Disability and Osteoarthritis Outcome Score (KOOS) 10-item and 9-item (respectively) pain subscales were each normalized on a 0-100 scale for analysis (in which 0 indicates no pain and 100 indicates extreme hip or knee pain) and subsequently divided into even terciles corresponding to "low," "medium," and "high" categories. The HOOS and KOOS instruments have both been shown to reliably and validly assess short- and long-term pain experienced by patients with osteoarthritis.[25,26] To assess decision-making stage, patients were asked the following question after viewing decision aids: "How far along are you with this decision?" Possible responses included the following: [1] "Not yet thought about all of the options," [2] "Considering the different options," [3] Close to choosing an option," and [4] "Already chose an option." Due to small cell sizes for response [1], responses [1] and [2] were collapsed into a single category to facilitate analysis (renamed "Still considering options" to distinguish it from the original response categories).

4

The HVHC Unified Data Extract included ICD-9 procedure codes 81.54 (knee arthroplasty) or 81.51 (hip arthroplasty) which were used to classify patients as having received surgery within 6 months of their orthopedic consultations. The Charlson Comorbidity Index (CCI) was also constructed using data drawn from the Unified Data Extract to determine the comorbidity burden of the hip and knee osteoarthritis patients included in the final analytic sample. The CCI is a continuous measure that weights the sum of 17 common comorbid conditions.[27]

2.3 Statistical Analysis

Patient-level characteristics for the hip and knee osteoarthritis patient cohorts were compared via analysis of variance (ANOVA) for continuous variables and chi square tests for categorical variables where appropriate. These analyses accounted for patient clustering within HVHC systems through the use of robust standard errors. Multivariate logistic regression examined the association between patient-level characteristics and alignment between patient-expressed post-decision aid treatment choices and treatments received among patients with hip and knee osteoarthritis who were exposed to decision aids across HVHC systems between 2012-2015. The outcome of interest – alignment between post-decision aid treatment choice and treatment received – is a dichotomous variable where alignment = 1 if patients chose surgery and received surgery or chose non-surgical treatment and received non-surgical treatment, and alignment = 0 if patients' treatment choices did not match received treatments (e.g., chose non-surgical treatment and received surgery). Another multivariate logistic regression was run to explore the association between patient-level characteristics and choice-treatment alignment for hip or knee patients who specifically chose surgery since the majority of both patient cohorts preferred surgery after exposure to decision aids. Patient-level characteristics included in all final models are age, sex, race, marital status, health insurance type, educational attainment, Charlson comorbidity score, HOOS or KOOS pain score and decision-making stage.

All regression models utilized organization-level fixed effects to account for clustering of patients within systems. The output of these models is reported as odds ratios (OR) with corresponding 95% confidence intervals (CI). Any missingness across variables of interest was assumed to be random and these observations were excluded from final analyses. Analyses were conducted using SAS version 9.4.

3. Results

3.1 Patients' Post-Decision Aid Choices and Treatment Receipt

Of the total sample of patients with hip or knee osteoarthritis, just over two-thirds (n=936/1,351) received treatments that aligned with their choice (whether for surgery or non-surgical treatment) after exposure to decision aids, while the remaining one-third (n=415/1,351) received treatments that were not aligned with their choice. There are important differences across hip and knee patients preferring surgery versus non-surgical treatment and receipt of choice-aligned (or non-aligned) treatments. Among patients with hip or knee osteoarthritis who expressed a post-decision aid choice of non-surgical treatment, the overwhelming majority (88.6% and 95.3 % of hip and knee patients, respectively) received non-surgical treatments. Comparatively, the relative percentages of patients who chose and received surgery are smaller, although they still represent a majority of that respective sample (67.4% of hip patients and 52.3% of knee patients). Notably, the majority of both patients with hip or knee osteoarthritis who received decision aids within HVHC systems chose surgery as their preferred treatment (79% and 62.8%, respectively). Figures 1 and 2 illustrate in bar graph form the distribution of patients with knee or hip osteoarthritis who received surgery according to their post-decision aid treatment choice (surgery or non-surgical treatment).

3.2 Descriptive Statistics

The mean age of all hip patients included in analyses was 58.3 (standard deviation (SD) = 10.0) while the mean age among all knee patients was 59.2 (SD = 9.6). The majority of both patients with hip osteoarthritis or knee osteoarthritis were female (54.4% and 64.2%, respectively) and white (81.7% of knee patients and 84.1% of hip patients). Just over half of both the knee (53.1%) and hip (56%) cohorts were comprised of patients who had completed some college or had graduated from college. There was also a similar proportion

of Medicare-insured patients across the two cohorts (36.8% of knee patients and 37.1% of hip patients). Roughly 20% of both hip and knee osteoarthritis patients reported that they were close to a decision after viewing decision aids, while just over half of both hip and knee patients reported that they had made a decision about their treatment choice (58.6% and 53.8% for hip and knee patients, respectively). Full descriptive statistics are reported in Table 1.

3.3 Key Findings

Although the majority of knee patients (68.3%) and hip patients (71.9%) received treatment aligned with their post-decision aids choices, regression analyses reveal important differences in the odds of such alignment by patient characteristics. In final models (reported in Table 2), knee patients who were Medicare beneficiaries had 49% lower odds of receiving choice-aligned treatments after exposure to decision aids compared with privately insured patients (OR = 0.51, p<0.01, Confidence Interval (CI): 0.32-0.80), while knee patients who were Medicaid beneficiaries had 59% lower odds of receiving treatment aligned with their choices (OR = 0.41, p<0.01, CI: 0.22-0.76). A similar association was found among hip osteoarthritis patients who were Medicare beneficiaries, but this finding did not reach statistical significance (OR = 0.83, p>0.05, 95% CI: 0.41-1.68). Knee and hip patients who were dual eligible (Medicare and Medicaid) had 59% and 92% lower odds (respectively) of receiving treatments aligned with their choices relative to privately insured knee and hip patients (OR = 0.41, p<0.05, 95% CI: 0.19-1.38 and OR = 0.08, p<0.05, 95% CI: 0.01-0.80).

Black or African American patients with knee osteoarthritis had nearly 50% lower odds of receiving treatment reflective of their post-decision aid choices compared to white patients with knee osteoarthritis (OR = 0.48, p<0.05, 95% CI: 0.26-0.81). Hip patients with high pain scores had greater odds of receiving treatment aligned with their post-decision aid choices compared with patients reporting low pain scores (OR = 1.59, CI: 0.70-3.65). Although this finding did not achieve statistical significance (p =0.3), the magnitude of the odds ratio is noteworthy. Compared with patients at a more advanced decision-making stage after viewing decision aids, patients at an earlier stage ("close to a decision" versus "already decided" also had lower odds of receiving treatments aligned with their post-decision aid treatment choices (OR = 0.40, p<0.01, 95% CI: 0.28-0.58 for knee patients and OR = 0.75, p<0.05, 95% CI: 0.22-0.75 for hip patients).

In analyses that explore the association between patient-level characteristics with the odds of alignment between treatment choices and treatments among patients who chose surgery (reported in Table 3), Black or African American patients with knee osteoarthritis had 72% lower odds of such congruence compared with white patients (OR = 0.28, p<0.001, CI: 0.13-0.62). Medicare beneficiaries who chose knee surgery also had lower odds of alignment between their choice and treatment received relative to patients with private insurance (OR = 0.36, p<0.001, CI: 0.20-0.64). Patients with knee osteoarthritis who chose surgery but were still considering their options (OR = 0.28, p<0.001, CI: 0.15-0.51) or close to a decision (OR = 0.31, p<0.001, CI: 0.20-0.48) had lower odds of alignment between their choice and treatment received compared with knee patients who reported having already decided upon surgery. Among patients with hip osteoarthritis who chose surgery, those who were still considering their options and those close to a decision also had lower odds of alignment between their choices and treatments received (OR = 0.44, p<0.05, CI: 0.20-0.99 and OR = 0.42, p<0.05, CI: 0.21-0.83, respectively) compared with patients who reported having decided upon surgery.

4.0 Discussion

In light of growing calls to consider the important outcome of care reflective of patients' preferences, this work contributes to the patient engagement literature by examining the odds of alignment between patient-expressed treatment choices and treatments received among patients within systems belonging to a learning collaborative that sought to integrate the utilization of decision aids to support SDM into routine clinical practice. The majority of patients with hip (71.9%) or knee (68.3%) osteoarthritis in this study who chose surgical or non-surgical treatment after exposure to decision aids received treatment aligned with their preference. These findings echo other musculoskeletal-focused research by Sepucha et al, who found that 73% of patients with hip or knee osteoarthritis who were considering surgical intervention received treatments that were aligned with their personal goals and values.[28]

6

Notably, this study highlights that the odds of patients with hip or knee osteoarthritis receiving treatments aligned with their post-decision aid treatment choices differ across patient-level characteristics. Among patients with knee osteoarthritis, those who were Medicare or Medicaid beneficiaries had lower odds of alignment between their treatment choices and treatments received compared with patients who were privately insured. Another important finding was that Black or African American patients with knee osteoarthritis had lower odds of choice-treatment receipt alignment relative to white patients, and this finding persists when looking at the regression findings limited to the patients who chose surgery. Although it is beyond the scope of this study to determine why these gaps may exist, research that has investigated patient preferences in the context of osteoarthritis has shown that disparities in access to care, treatment expectations and socioeconomic factors play critical roles in treatment trajectories - especially for diverse patient populations and those with public health

insurance. [29,30] Several studies have underscored persistent gaps in the likelihood of Black or African American patients receiving arthroplasty compared with white patients,[31,32] with some research pointing to the cost of surgery as a major barrier to care for Black patients.[33] Elsewhere, a longitudinal survey of respondents to the U.S. Health and Retirement Study found that Medicare recipients with supplemental coverage were more likely to receive knee arthroplasty than patients with traditional Medicare only, suggesting that the lack of such additional coverage may pose a barrier to the financial feasibility of receiving surgery.[34] These factors may also underlie the gaps in choice-treatment receipt alignment among Black or African American patients or those with Medicare whose preference was for surgery, although additional research is needed to confirm this. It is worth highlighting that the representative sample of Black or African American patients with hip or knee osteoarthritis cohorts among HVHC systems was small (8% of the knee osteoarthritis population and 6.4% of the hip osteoarthritis population within HVHC), which underscores the importance of studying these questions within the context of more diverse patient population as systems determine how best to integrate tools such as decision aids into routine clinical practice.

Among patients with knee or hip osteoarthritis, this study also found that those at earlier decision-making stages after viewing decision aids had lower odds of receiving treatments congruent with their choices compared with patients at later stages. For patients who were still considering their options after viewing decision aids, there may be more opportunities to be swayed toward alternative treatment choices by physicians, family or friends, or through additional research. More advanced decision-making stages have been linked with higher decision quality and greater confidence in treatment choices[28]; conversely, there may be an association between earlier decision-making stages and less confidence in treatment choices that could prompt additional conversations to discuss preferences (whether the patient's or the physician's) and expectations about treatment outcomes that in turn alter final treatment choices.

For conditions such as hip and knee osteoarthritis, shared decision-making can play an important role in facilitating alignment between patients' expressed choices and treatments reflective of those choices. Although critical to the SDM process, the use of decision aids to support shared decision-making and to help patients make informed treatment decisions does not necessarily guarantee alignment between patient-expressed treatment choices and the treatments they receive. Decision aids represent "only one part of the shared decision making process, and the provider plays a key role in helping patients synthesize information so they make the most informed, appropriate decision in the context of their own values and goals."[2] Elsewhere, it has been noted that even in situations where high quality decision aids are utilized, communicating "patient-accessible information" may not always result in alignment between patient preferences and treatment plans.[35] Importantly, other factors beyond information shared via decision aids can ultimately influence patients' treatment trajectories, including physicians' treatment

preferences.[18] Additionally, conversations with family, caretakers, or clinicians may highlight patient characteristics (such as comorbidities that might make patients unsuitable candidates for surgery) or other factors (such as concerns about the length and difficulty associated with recovery time) that could nudge patients toward treatments that differ from their original choices after use of decision aids.[8]

Understanding how decision aids and related patient engagement strategies facilitate outcomes of interest in-

cluding congruence between treatment choice and treatment receipt across important sub-groups of patients remains an important question related to this research. Embedding value-clarification exercises with decision aids has been suggested as an important tool to ensure that prior to treatment receipt, patients' treatment choices are truly reflective of their personal values and goals.[36] Patient-centered strategies including motivational interviewing and health coaching may also play pivotal roles alongside decision aids in ensuring better understanding of treatment options as well as other key outcomes such as decisional regret or satisfaction.[37] Recently, there is particular interest in studying how decision aids can be used to support effective doctor-patient communication to bridge gaps in care for racial or ethnic minority patient groups.[38] Longitudinal, prospective studies that examine the impact of routinely implemented decision aids complemented by value clarification or motivational interviewing could further shed light upon important patient-reported outcomes including choice-congruent treatment[39], and would be especially valuable if studied in the context of diverse patient populations to provide insight into how such tools could best be tailored to meet the needs of these groups.

Since this analysis examined alignment between treatment choices after exposure to decision aids and treatments received among patients within 10 health systems belonging to a learning collaborative, there are important limitations of this research. First, the findings may not be reflective of health systems beyond this sample – especially smaller systems or those with less experience with patient-centered quality improvement. Nonetheless, the relative dearth of work examining alignment between patient treatment choices and treatment receipt after the routine integration of a decision aid intervention across multiple geographically diverse systems underscores the novelty of this research. Since this data was collected as part of an implementation study, it was not feasible to measure the *extent* to which patients engaged in SDM with nurses or clinicians alongside exposure to decision aids due to a lack of documentation by participant systems, nor was it possible to construct a comparison group since patient treatment choices were only assessed for those exposed to decision aids. Finally, since system-reported clinical files were utilized to determine receipt of treatment, this analysis cannot account for patients potentially receiving treatments (whether aligned or not aligned with their choices) at non-HVHC systems. However, given that this sample of patients completed patient surveys pertaining to their viewing of decision aids and had documented consultations with orthopedists within HVHC systems, the likelihood that many such patients would have received orthopedic treatments at non-collaborative health systems is likely low.

This study elucidates the association between patient-level characteristics and the odds of alignment between patients' expressed treatment choices and treatments received after exposure to decision aids that were routinely implemented across a learning collaborative of health systems. For the population of patients with hip or knee osteoarthritis who were the focus of this study, being Black or African American (compared with white patients), being Medicare beneficiaries (compared with those who were privately insured), and not being certain of a treatment choice following exposure to decision aids were associated with lower odds of alignment between patient treatment choices and treatments received. Specifically examining the odds of alignment between treatment choice and receipt among patients who chose surgery for either hip or knee osteoarthritis uncovered similar results. Taken together, these findings underscore the important role of patient-level characteristics in determining congruence between patients' choices after a decision aid and receipt of aligned treatments. As health systems seek to integrate decision aids into routine practice, understanding why certain patient-level characteristics are associated with such congruence while others are not and how decision aids and shared decision-making conversations could realistically be tailored to meet the needs of different patient groups should be a key area for future research. Such a question is central to implementing patient-focused strategies to bridge current gaps and to better align all patients' preferences with the treatments they ultimately receive.

References

1. Obeidat R, Finnell D, Lally R. Decision Aids for Surgical Treatment of Early Stage Breast Cancer: A Narrative Review of the Literature. *Patient Education and Counseling.* 2011;85(3):e311-e321.

2. Bowen E, Nayfe R, Milburn N, et al. Do Decision Aids Benefit Patients With Chronic Musculoskeletal Pain? A Systematic Review. *Pain Medicine.* 2020;21(1):951-969.

3. Wieringa T, Rodriguez-Gutierrez R, Spencer-Bonilla G, de Wit M, Ponce O, Sanchez-Herrera M. Decision Aids that Facilitate Elements of Shared Decision Making in Chronic Illnesses: A Systematic Review. *Systematic Reviews.* 2019;8.

4. Stacey D, Legare F, Lewis K, Barry M, Bennett C, Eden K. Decision Aids for People Facing Health Treatment or Screening Decisions. *Cochrane Database of Systematic Reviews.* 2017;12.

5. Allen LA, McIlvennan CK, Thompson JS, Dunlay SM, LaRue SJ, Lewis EF. Effectiveness of an Intervention Supporting Shared Decision Making for Destination Therapy Left Ventricular Assist Device: The DECIDE-LVAD Randomized Clinical Trial. *JAMA Internal Medicine.* 2018;178(4):520-529.

6. Lee E, Emanuel E. Shared Decision Making to Improve Care and Reduce Costs. *New England Journal of Medicine.* 2017;368(1):6-8.

7. Weinstein J, Tosteson T, Lurie J, et al. Surgical versus Nonoperative Treatment for Lumbar Spinal Stenosis: Four-Year Results of the Spine Patient Outcomes Research Trial. *Spine.* 2010;35(14):1329-1338.

8. Slover J, Shue J, Koenig K. Shared Decision-Making in Orthopaedic Surgery. *Clin Orthop Relat Res.* 2012;470(4):1046-1053.

9. Boss E, Mehta N, Nagarajan N. Shared Decision Making and Choice for Elective Surgical Care: A Systematic Review. *Otolaryngol Head Neck Surg.* 2016;154(3):405-420.

10. Veroff D, Ochoa-Arvelo T, Venator B. A Randomized Study of Telephonic Care Support in Populations at Risk for Musculoskeletal Preference-Sensitive Surgeries. *BMC Medical Informatics and Decision Making.* 2013;13(21).

11. Fraenkel L. Incorporating Patients' Preferences into Medical Decision Making. *Medical Care Research and Review.* 2013;70:80S-93S.

12. Yelin E, Cisternas M, Watkins-Castillo S. *The Burden of Musculoskeletal Diseases in the United States.* United States Bone and Joint Initiative;2014.

13. Blumenthal-Barby J, Opel D, Dickert N, Kramer D, Edmonds B, Ladin K. Potential Unintended Consequences of Recent Shared Decision Making Policy Initiatives. *Health Affairs.* 2019;38(11):1876-1881.

14. Sepucha K, Borkhoff C, Lally J, Levin C, Matlock D, Ng C. Establishing the Effectiveness of Patient Decision Aids: Key Constructs and Measurement Instruments. *BMC Medical Informed Decision Making.* 2013;13:S12.

15. Sepucha K, Scholl I. Measuring Shared Decision Making A Review of Constructs, Measures and Opportunities for Cardiovascular Care. *Circulation: Cardiovascular Quality and Outcomes.* 2014;7:620-626.

16. Sepucha K, Ozanne E. How to Define and Measure Concordance Between Patients' Preferences and Medical Treatments: A Systematic Review of Approaches and Recommendations for Standardization. *Patient Education and Counseling.* 2010;78(1):12-23.

17. Sullivan D, Eden K, Diekmann N, et al. Understanding Patients' Values and Preferences Regarding Early Stage Lung Cancer Treatment Decision Making. *Lung Cancer.* 2019;131:47-57.

18. Scherr K, Fagerlin A, Hofer T, et al. Physician Recommendations Trump Patient Preferences in Prostate Cancer Treatment Decisions. *Medical Decision Making.* 2017;37(1):56-69.

19. Latenstein C, Thunnissen F, Thomeer B, et al. The Association Between Patients' Preferred Treatment After the Use of a Patient Decision Aid and their Choice of Eventual Treatment. *Health Expectations.* 2020.

20. Elwyn G, Frosch D, Kobrin S. Implementing Shared Decision-Making: Consider All the Consequences. *Implementation Science.* 2016;11.

21. Tomek I, Sabel A, Froimson M, et al. A Collaborative of Leading Health Systems Finds Wide Variations in Total Knee Replacement Delivery and Takes Steps to Improve Value. *Health Affairs.* 2012;31(6).

22. Weeks W, Schoellkopf W, Sorensen L, Masica A, Nesse R, Weinstein J. The High Value Healthcare Collaborative: Observational Analyses of Care Episodes for Hip and Knee Replacement. *Journal of Arthroplasty.*2016;32(3):702-708.

23. Elwyn G, Burstin H, Barry M, et al. A Proposal for the Development of National Certification Standards for Patient Decision Aids in the US.*Health Policy.* 2018;122(7):703-706.

24. Clay K, Riley J. *Scaling Up - A Report from the High Value Healthcare Collaborative Distance Learning Program for Decision Coaching.* Lebanon, NH: The Dartmouth Institute for Health Policy and Clinical Practice;2016.

25. Nilsdotter A, Lohmander L, Klassbo M, Roos E. Hip Disability and Osteoarthritis Outcome Score (HOOS) - Validity and Responsiveness in Total Hip Replacement. *BMC Musculoskeletal Disorders.* 2003;4(10).

26. Roos E, Lohmander L. The Knee Injury and Osteoarthritis Score (KOOS): From Joint Injury to Osteoarthritis. *Health and Quality of Life Outcomes.* 2003;1(64).

27. Austin S, Wong Y, Uzzo R, Beck J. Why Summary Comorbidity Measures Such as the Charlson Comorbidity Index and Elixhauser Score Work.*Medical Care.* 2015;53(9):e65-e72.

28. Sepucha K, Feibelmann S, Chang Y, et al. Factors Associated with the Quality of Patients' Surgical Decision for Treatment of Hip and Knee Osteoarthritis. *Journal of the American College of Surgeons.*2013;217(4):P694-701.

29. Vina E, Ran D, Ashbeck E, Kaur M, Kwoh C. Relationship between Knee Pain and Patient Preferences for Joint Replacement: Healthcare Access Matters. *Arthritis Care and Research.* 2017;69(1):95-103.

30. Kwoh C, Vina E, Cloonan Y, Hannon M, Boudreau R, Ibrahim S. Determinants of Patient Preferences for Total Knee Replacement: African-Americans and Whites. *Arthritis Research & Therapy.*2015;17.

31. Katz J. Persistence of Racial and Ethnic Differences in Utilization and Adverse Outcomes of Total Joint Replacement. *Journal of Bone and Joint Surgery.* 2016;98(15):1241-1242.

32. Singh J, Lu X, Rosenthal G, Ibrahim S, Cram P. Racial Disparities in Knee and Hip Total Joint Arthroplasty: An 18-year Analysis of National Medicare Data. *Annals of the Rheumatic Diseases.*2014;73(12):2107-2115.

33. Byrne M, O'Malley K, Suarez-Almazor M. Ethnic Differences in Health Preferences: Analysis Using Willingness-to-Pay. *Journal of Rheumatology.* 2004;31(9):1811-1818.

34. Hanchate A, Zhang Y, Felson D, Ash A. Exploring the Determinants of Racial and Ethnic Disparities in Total Knee Arthroplasty. *Medical Care.* 2008;46(5):481-488.

35. Taylor L, Johnson S, Nabozny M, Tucholka J, Seffens N, Kwekkeboom K. Barriers to Goal-Concordant Care for Older Patients with Acute Surgical Illness: Communication Patterns Extrinsic to Decision Aids. *Annals of Surgery.* 2018;267(4):677-682.

36. Hazelwood G, Marshall D, Barber C, et al. Using a Discrete-Choice Experiment in a Decision Aid to Nudge Patients Toward Value-Concordant Treatment Choices in Rheumatoid Arthritis: A Proof-of-Concept Study.*Patient Preference and Adherence.* 2020;14:829-838.

37. Elwyn G, Dehlendorf C, Epstein RM, Marrin K, White J, Frosch DL. Shared Decision Making and Motivational Interviewing: Achieving Patient-Centered Care Across the Spectrum of Health Care Problems.*Annals of Family Medicine.* 2014;12(3):270-275.

38. Nathan A, Marshall I, Cooper J, Huang E. Use of Decision Aids with Minority Patients: A Systematic Review. *Journal of General Internal Medicine.* 2016;31(16):663-676.

39. Forcino R, Meinders M, Engel J, O'Malley J, Elwyn G. Routine Patient-Reported Experience Measurement of Shared Decision-Making in the USA: A Qualitative Study of the Current State According to Frontrunners.*BMJ Open.* 2020;10(6).

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