Published in final edited form as:

Knee. 2017 March ; 24(2): 354–361. doi:10.1016/j.knee.2016.11.009.

Poor expectations of knee replacement benefit are associated with modifiable psychological factors and influence the decision to have surgery: A cross-sectional and longitudinal study of a community-based sample

Daniel L. Riddle^{a,b,*}, Gregory J. Golladay^b, Amanda Hayes^{c,d}, and Hassan M.K. Ghomrawi^{c,d}

^aDepartment of Physical Therapy, School of Allied Health Professions

^bDepartment of Orthopaedic Surgery, School of Medicine, Virginia Commonwealth University

^cDivision of Comparative Effectiveness and Outcomes Research, Department of Healthcare Policy and Research, Weill Medical College, Cornell University

^dHealthcare Research Institute, Hospital for Special Surgery

Abstract

Objective—Total knee arthroplasty (TKA) is a highly effective surgery, but is underutilized by some patient groups. This study determined factors associated with a person's expectations with respect to pain and walking function following a TKA procedure, should they elect to undergo a TKA.

Methods—A total of 3542 people were studied with or at risk of knee osteoarthritis and enrolled in the community-based Osteoarthritis Initiative (OAI). Multivariable logistic regression analyses identified demographic, socioeconomic, osteoarthritis-related, joint replacement awareness, and psychological correlates as poor outcome expectations. Logistic regression determined if outcome expectation was associated with future knee arthroplasty utilization.

Results—Approximately 25% of the sample expected a poor outcome. Several factors were associated with poor pain outcome expectation, with the most powerful being African American race (Odds Ratio (OR) = 2.11, 95% CI = 1.69, 2.64) and an interaction between clinical depression symptoms and pain catastrophizing (OR = 3.17, 95% CI = 2.26, 4.44 when both were coded 'yes'). Whether a person had knee OA did not affect expectations. Pain outcome expectations were strongly associated with future TKA utilization (OR = 4.9, 95% CI = 2.2, 11.1).

Conclusion—A variety of modifiable psychological factors impact people's expectations of the extent of pain and walking difficulty following a potential future TKA. Expectations strongly predict future TKA utilization. Given the high prevalence of knee osteoarthritis, mass media

*Corresponding author: Department of Physical Therapy, West Hospital, Room B-100, Virginia Commonwealth University, Richmond, Virginia 23298-0224, USA. Tel.: 804-828-0234; fax: 804-828-8111. dlriddle@vcu.edu (Daniel L. Riddle).

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

educational interventions for the population may assist in better aligning expectations with evidence-based knee arthroplasty outcomes and lead to more appropriate utilization of an effective procedure.

Keywords

Knee; Expectation; Arthroplasty; Outcome

Total knee arthroplasty (TKA) is among the most common major surgical procedures conducted in the United States of America (USA), with over 4 million people currently living with a knee implant.¹ High demand for TKA is supported by strong evidence indicating that the procedure is cost-effective,² reduces pain, and improves function for approximately 80% of those undergoing the procedure.^{3,4} Given the aging population and the increasing demand for the procedure, estimates suggest that up to 3.5 million annual TKA surgeries will be conducted in the USA by 2030.⁵ However, these projections have raised concerns of potential overutilization of the procedure.^{6–10} There also is likely to be a substantial population that is underutilizing the procedure; for example, African Americans have been found to utilize TKA at a 40% lower rate than Caucasians.¹¹

Because of the elective nature of TKA, factors beyond medical necessity affect utilization. Deterrents include prior negative medical and surgical encounters, lack of awareness of the procedure, and assumptions that painful knee osteoarthritis (OA) is expected with aging.¹² These deterrents likely affect a person's expectations of the risks and benefits derived from TKA and, thus, their willingness to undergo the procedure. A person with negative expectations of pain and function outcomes of TKA may unnecessarily delay or avoid surgery, as compared with someone who anticipates a positive outcome. Recent studies have shown that in otherwise appropriate candidates for TKA, unrealistically poor pain or walking outcome expectations are powerful predictors of willingness to undergo the procedure.^{13,14} Because knee pain is the critical element driving demand, patients' pain expectations following surgical recovery play an important role in prognosis and willingness to undergo TKA.¹⁵

It is believed that, to date, no other studies have examined the factors associated with outcome expectations following a potential TKA in a large population within the complete spectrum of OA, with Kellgren-Lawrence 16 grades (K-L) of 0–4. It is important to determine factors associated with poor outcome expectations, because behavioral interventions could be developed to align patient expectations with outcomes that are supported by evidence.¹⁷ This in turn may lead to appropriate utilization of this highly effective procedure by people who initially would not have undergone TKA because of unrealistically poor expectations of outcome.

Using the community-based Osteoarthritis Initiative (OAI) dataset,¹⁸ the present study was designed to answer the following questions: (1) What factors are associated with an expectation of moderate, or worse, knee pain following recovery in people with and without knee OA who may undergo a TKA?; (2) What factors are associated with an expectation of moderate, or worse, walking difficulty following recovery in people who may undergo a

TKA?; and (3) Do pain and walking expectations predict TKA utilization in people who underwent TKA 1–3 years later?

Given that pain-coping strategies shape a person's interpretation of painful stimuli, and that pain plays a key role in driving patient demand for¹⁵ and satisfaction with TKA,^{19,20} the primary hypotheses were that: (1) worse pain coping (e.g., depressive symptoms and pain catastrophizing) would be associated with poor TKA outcome expectations; and (2) pain and walking outcome expectations would be associated with utilization of future TKA.

Methods

Participants

The present population was enrolled in the OAI, a National Institute of Health (NIH) and privately funded, multi-center, prospective, longitudinal cohort study of the natural history of knee OA. The OAI has been extensively described in literature.^{18,21} The study was approved by the Institutional Review Ethics Boards at each participating site (University of Maryland, Baltimore, MD; The Ohio State University, Columbus, OH; University of Pittsburgh, Pittsburgh, PA; Memorial Hospital of Rhode Island, Pawtucket, RI) as well as the central coordinating center of the University of California at San Francisco.

Inclusion criteria for the OAI were men and women with no history of TKA, recruited from the community, aged 49–75 years, with symptomatic knee OA, or who had one or more risk factors for developing knee OA (i.e., obesity, current knee pain, prior knee injury or surgery, or a family history of knee or hip arthroplasty). The complete study design protocol and additional information on the study is available at <http://www.oai.ucsf.edu/>. The sample of interest for the current study was people who attended the year-6 follow-up visit. The study examined a total of 3542 people.

In a longitudinal analysis, a subset of 387 people from the radiographic knee OA parent sample also had pain and OA severity scores that approximated the range of those typically seen in people undergoing TKA. Specifically, only those people who had at least mild pain with most daily activities (Western Ontario and McMaster Universities Arthritis Index (WOMAC) Pain scores of ≥ 5) and K-L knee OA grades of 3 or 4, indicating moderate-to-severe knee osteoarthritis in at least one knee.^{13,32} Because pain typically increases in the last few years prior to TKA, people with WOMAC pain scores as low as 5 were included in this subsample.²² These samples were selected because: (1) the study was interested in expectations of people with no history of TKA but at potential risk of future TKA; and (2) the study wanted to know if outcome expectations obtained at the 6-year visit were associated with actual TKA incidence over the following 3 years of data collection.

Outcome variables of interest

Self-assessed function-limiting knee pain that impairs daily function is the key driver of TKA care-seeking.^{18,19} Therefore, the two outcome variables that were selected were self-reported estimates of expectations of the extent of pain, and walking difficulty following a potential future TKA. Specifically, participants completed a questionnaire in the OAI study that asked: “How much pain do you think people will still have after they have recovered

from their knee replacement surgery?” and “How much difficulty in walking do you think people will still have after they have recovered from their knee replacement surgery?” Very similar questions have been used in other research related to TKA willingness.²³ Response options to both items were: none, mild, moderate, severe or extreme. Because substantial amounts of literature suggest that pain and walking difficulty after recovery from TKA is mild, or less, for the great majority of patients,^{24–26} responses were dichotomized to each question as either none/mild or at least moderate. Accordingly, poor expectations of pain intensity and walking status following recovery were defined as ratings of moderate or higher pain or walking difficulty.

Covariates of interest

Key potential covariates from the knee OA and arthroplasty literature^{25,27–31} were selected and organized into demographic, socioeconomic, OA disease-related, joint replacement awareness, and psychological categories. For demographic variables, age, race, and sex were used. Race was dichotomized into either African American or non-African American subgroups, because of the very small sample of people from the total sample (n = 85) not fitting either of these two categories. Evidence suggests that African Americans are less likely to be willing to undergo knee arthroplasty. As such, it was hypothesized that people of different races may have different expectations of pain and walking outcomes following TKA.¹¹

Socioeconomic variables were: work status (currently working or not), highest education grade completed (trichotomized to include high school graduation or less, some college, or college degree), and extent of social support. Extent of social support was judged using two variables: whether a participant indicated that he or she lived alone (yes or no), and the extent to which he or she took part in organized social activities (dichotomized as either never/almost never, or at least sometimes). It was suspected that people who had social support via either living with others or via organized social activities would be more likely to have a positive outcome expectations.

For disease-related variables, the worst (K-L) knee OA grade 16 reported in OAI, and a rating of whether the participant had frequent knee pain were included. Participants were asked to answer yes or no to the following question: “During the past 30 days, have you had this pain, aching, or stiffness in your right or left knee on most days?” In order to account for participants who may have been closer to considering TKA, knee OA grades were dichotomized (grade 2 indicating radiographic knee OA in at least one knee, or a K-L grade 1 indicating no knee OA in either knee). A variable that accounted for whether a participant had a family member who had undergone knee or hip replacement surgery was also included. It was reasoned that if a participant had a family member who had a joint replacement procedure, they would be at least somewhat familiar with the procedure and subsequent recovery, which could influence the expectation ratings. Family history of prior TKA was collected at the 4-year follow-up visit. All other variables were collected at the 6-year follow-up visit, because OAI did not collect this data during the year-6 visit. Finally, the previously validated modified Charlson comorbidity score³² was included to account for other comorbidities that may influence a person’s expectations of arthroplasty outcome.

Because comorbidity scores were severely skewed to the right (i.e., two-thirds of the sample has a score of 0) scores were dichotomized such that a score of 0 was coded as 0 and 1 was coded as 1.

For psychological variables, a dichotomized and previously validated Center for Epidemiologic Studies Depression Scale (CES-D) depressive symptom scale score³³ of 16 (yes or no) indicating clinical depression symptoms was included. The seven subscales of the two-item version of the Coping Strategies Questionnaire (CSQ) was also used.³⁴ Three of the subscales (Ignoring Sensations, Coping Self Statements, and Increased Behavioral Activities) were normally distributed (i.e., skewness and kurtosis of < 1 or > -1) and were scored as originally defined (from 0–6), with higher scores equating to greater usage of each construct. The other four scales (praying and hoping, reinterpreting pain sensations, diverting attention and catastrophizing) were severely skewed to the right, with the majority of people scoring a 0 or 0.5 on each scale (never use or rarely). These scales were therefore dichotomized as 0 (a score of 0 or 0.5) or a 1 (a score of 1). Depressive symptoms and other psychological distress constructs, including catastrophizing, negatively impact outcome following TKA.^{35,36} As a result, it was suspected that these variables might negatively influence TKA outcome expectations.

Statistical analysis

Separate univariate logistic regression analyses for the pain expectation outcome and the walking expectation outcome were first conducted. Multivariable analyses were then used and all significant variables from the univariate models with $P < 0.10$ were included as the criterion for inclusion. All possible two-way interactions of variables included in the multivariable analyses were tested for. For the multivariable analyses, the Hosmer-Lemeshow goodness-of-fit test was used to describe adequacy of model fit, and Nagelkerke R^2 was used to estimate explained variance. The study used univariate logistic regression and reported the odds ratio (OR) with 95% confidence (95% CI) limits to assess the association between 6-year visit pain or walking expectation and actual future (7-year to 9-year visit) TKA in the subset of 387 patients who were at risk for TKA in the subsequent 3 years. All analyses were completed using IBM SPSS, version 23.

Results

Participant characteristics

Characteristics of the total sample are reported in Table 1. A majority of the 3542 participants were female and averaged 66.4 years of age. A total of 16.9% of participants were African American. A total of 1215 participants (34.3%) had no radiographic knee OA in either knee and 1913 (54.0%) had a K-L grade of 2 in at least one knee. A total of 414 participants (11.7%) had missing K-L grades at the year-6 visit, but were included in all analyses.

Expectations in the total sample

A total of 26% (95% CI = 24.6%, 27.4%) of the total sample expected moderate pain or worse, and 21.8% (95% CI = 20.4%, 23.2%) expected moderate walking difficulty or worse

following recovery from TKA. For pain outcome expectations, a number of variables were found in the univariate models to be associated with poor expectations, defined as expecting moderate pain or worse. These variables included items from all major covariate categories, as reported in Table 2. The presence of radiographic knee OA was not significantly associated with TKA outcome expectations. This indicates that people with and without knee OA had similar expectations for pain and walking difficulty outcomes following TKA. Dichotomous variables with the largest OR were race, clinical depression, and pain catastrophizing. In a multivariable analysis, the variables significantly associated with poor pain outcome expectations were: age; race; minimal or no organized social activity; the presence of clinical depressive symptoms; pain sensation reinterpretation; and catastrophizing. One two-way interaction was found between clinical depression and catastrophizing. Participants with both clinical depression and catastrophizing had odds of poor outcome expectation that was 3.2 times higher than those with no clinical depression or catastrophizing (see Table 3 for interaction results).

Similar results were found for walking expectations, except that there were no depressive symptoms by pain catastrophizing interaction in the multivariable analysis. The largest ORs for poor walking expectation associations in the multivariable analysis were for race, clinical depression symptoms, and catastrophizing. Hosmer-Lemeshow tests were > 0.7 for both models, suggesting good model fit, and the Nagelkerke R^2 was 0.11 for both models. See Table 4 for a complete summary of findings for walking expectations.

Associations between outcome expectation and potential future TKA

A total of 387 participants were identified from the original sample who had a K-L grade of 3 or 4, a WOMAC pain score of ≥ 5 in one knee, and no prior arthroplasty at the year-6 data collection session. Of these, 19.1% had a TKA in the following 3 years (visit years 7–9). A total of 6.4% of participants with moderate or worse pain expectations at year 6 had a TKA during the 3-year follow-up period, while 24.9% with expectations of either no pain or mild pain at year 6 had a TKA. In addition, those with expectations of either no or mild pain were almost five times more likely (OR = 4.9, 95% CI = 2.2, 11.1, $P < 0.001$) to have a future TKA, as compared with those with moderate or worse pain expectations. Participants with expectations of either no or mild walking difficulty were over twice more likely (OR = 2.6, 95% CI = 1.3, 5.4, $P = 0.009$) to have TKA in the following 3 years, as compared with those with moderate or worse walking difficulty expectations.

Discussion

This study examined expectations of pain and walking difficulty following a potential future TKA, and their correlates in a large community-based non-surgical sample. More than a quarter of the sample had poor expectations of pain, and one in five had poor expectations of walking difficulty. Age, race, pain catastrophizing, and depression were significantly associated with expectations of poor outcomes. Osteoarthritis disease-related factors were not associated with poor outcome expectation. Importantly, strong associations were also found between poor outcome expectations and lower TKA usage during the 3 years following outcome expectation assessment. People with poor pain outcome expectations, for

example, were over five times less likely to undergo TKA as compared to those who expected mild pain or less following a potential TKA, in spite of having function limiting knee pain and substantial knee OA.

It is believed that this is the first study to examine pain and walking expectations associated with potential future TKA use, and their correlates, in people who are presumably not currently planning on this treatment. Most prior literature on outcome following TKA have focused on understanding expectations of pain and function following TKA and their predictors in patients actually undergoing TKA.^{20,25,31,37–40} By studying expectations of poor outcomes of a potential TKA among people not currently scheduled for surgery, this study provides further insights into the potential determinants of expectations of TKA. It shows that expectations of outcomes of TKA are likely formulated early in the disease stage, and independent of a person's knee arthritis presence or severity.

Key predictors of poor outcome expectations in the total sample were race, depression, and poor pain-coping strategies, particularly pain catastrophizing. African American race was the strongest predictor, with over twice the odds of having poor pain and walking expectations as compared with other races, with a potential future TKA. Numerous other studies also have shown that African Americans are less willing to consider TKA than Caucasians.^{13,41} Mechanisms underlying these racial disparities, however, remain poorly understood and additional work is needed on the role of race/ethnicity and willingness for arthroplasty. For example, the role of healthcare access and interactions with socioeconomic status, as well as healthcare beliefs for populations of different races and ethnicities are complex, but may influence outcome expectations and other healthcare decisions. In a recent study by Parks et al., the authors conducted a qualitative study of African Americans' perceptions of TKA and found that these perceptions were not only affected by self-assessment of fit for surgery based on age and comorbidity, but also by other social and cultural factors such as faith and spirituality.⁴² Further work is needed to determine the underlying causes of these disparities.

Depression is associated with poorer pain and function scores, and lower satisfaction following TKA.^{43,44} Recent literature also has identified catastrophizing as a key negative pain-coping strategy that, similar to depression, adversely affects function in people with osteoarthritis,⁴⁵ as well as patient-reported function following TKA.^{35,46} These findings, in combination with those of the current study, suggest that these potentially modifiable factors may be driving expectations of poor outcomes observed in OA and TKA patients. Recognizing these factors in patients with OA and treating them may improve patients' expectations, and lead to more appropriate and timely use of TKA.

While the vast majority of patients are satisfied with their outcome and have either no pain or mild pain after TKA, more than a quarter of the non-surgical sample in this study anticipated pain outcomes that are worse than what is typically observed clinically. It is likely that a substantial proportion of these people have unrealistically poor expectations should a TKA be needed in the future, and may not consider TKA as a viable treatment option for their knee OA.

Approximately 13.5 million people aged 45 years in the USA had symptomatic knee OA in 2012, and an additional 8 million had advanced symptomatic knee OA, defined as having a K-L grade 3 or 4 in at least one knee.⁴⁷ Based on present data, about 26% of these people (approximately 5.6 million) will have a poor pain outcome expectation. While it cannot be guaranteed that the present sample matches the characteristics of the USA population, these estimates highlight the need for educating at-risk populations about the evidence-based benefits of TKA. Prior research in low back pain has shown that mass media-based educational interventions are effective in realistically setting people's expectations, including psychologically based constructs like fear avoidance and pain beliefs, and in leading to robust positive outcomes.^{48,49} The present authors are unaware of evidence linking media-based interventions to reductions in depressive symptoms, however, they suggest that similar interventions may have value for at-risk knee OA populations. By disseminating information regarding the benefits of TKA at a community level, and addressing key psychologically based issues related to pain, people who may be candidates for the procedure, but have poor expectations, may benefit. This is likely to have a wider reach and may be more effective in helping people seek care pathways that ensure more timely utilization of TKA. Second, the present results emphasize the role of depression and pain catastrophizing in negatively impacting expectations of potential future TKA outcomes. These risk factors may be potentially modifiable with educational, counseling and other intervention approaches.

Results from this study have important implications for addressing underutilization of TKA by appropriate potential candidates. The longitudinal associations that were found between expectations of poor outcomes and actual future use of TKA provide reasonably strong evidence to indicate that outcome expectations have important practical consequences in future years. It is believed that these findings are compelling for considering approaches that could potentially change expectations in ways that better align outcome expectations with current evidence, especially given the high prevalence of these poor expectations.

This study had a number of strengths and limitations. The major strength was the large sample size and rigorous prospectively collected data from the OAI. A limitation was the relatively small sample of 387 participants with K-L grades of 3 or 4 and WOMAC pain scores of 5 who had TKA in follow-up years 7–9 ($n = 74$). However, these longitudinal analyses suggested strong associations between outcome expectations and actual future TKA, and provides support for the argument that pain and walking expectations of a potential future TKA may actually influence future decisions to undergo the procedure. Additionally, K-L grades were missing for 11% of the sample, but because K-L grades did not influence the findings, these missing data likely had negligible effects. Another limitation was the ordinal measures of pain and walking expectations reported in the OAI data. These non-numeric scales may have contributed error to the measurement of expectations in the study. A third limitation was the use of living alone as a surrogate of low levels of social support. It is acknowledged that there may be instances where living alone may not reflect such status. Fourth, the models explained a relatively small amount of variance in expectations, and the source of additional unexplained variance is unknown. Future research should focus on this substantial unexplained variance. Finally, people with a family history of both hip and knee arthroplasty were included, and while both are major arthroplasty procedures, recovery is different and this could have influenced the subjects'

judgments. Of note, this variable was not collected in year 6 of OAI, and while it is not believed that this influenced the results, there may have been some families with either hip or knee arthroplasty between years 4 and 6 that were not accounted for.

In conclusion, this study identified previously unknown correlates of expectations of poor outcomes in people, the great majority of whom were not planning for near-term future TKA. The study underscored racial differences in these perceptions, and highlighted the importance of addressing depression and poor pain-coping strategies and, in particular, pain catastrophizing as a potential way of re-setting expectations so that they align with current evidence of TKA outcome. The data suggest that educational interventions via mass media,^{48,49} including at the community level, may have potential to enhance appropriate TKA utilization.

Acknowledgments

Funding Statement

The OAI is a public-private partnership comprised of five contracts (N01-AR-2-2258; N01-AR-2-2259; N01-AR-2-2260; N01-AR-2-2261; N01-AR-2-2262) funded by the National Institutes of Health, a branch of the Department of Health and Human Services, and conducted by the OAI Study Investigators. Private funding partners include Merck Research Laboratories; Novartis Pharmaceuticals Corporation, GlaxoSmithKline; and Pfizer, Inc. Private sector funding for the OAI is managed by the Foundation for the National Institutes of Health. This manuscript was prepared using an OAI public use data set and does not necessarily reflect the opinions or views of the OAI investigators, the NIH, or the private funding partners.

References

1. Weinstein AM, Rome BN, Reichmann WM, Collins JE, Burbine SA, Thornhill TS, Wright J, Katz JN, Losina E. Estimating the burden of total knee replacement in the United States. *J Bone Joint Surg Am.* 2013; 95:385–392. [PubMed: 23344005]
2. Daigle ME, Weinstein AM, Katz JN, Losina E. The cost-effectiveness of total joint arthroplasty: a systematic review of published literature. *Best Pract Res Clin Rheumatol.* 2012; 26:649–658. [PubMed: 23218429]
3. Beswick AD, Wylde V, Gooberman-Hill R, Blom A, Dieppe P. What proportion of patients report long-term pain after total hip or knee replacement for osteoarthritis? A systematic review of prospective studies in unselected patients. *BMJ Open.* 2012; 2:e000435.
4. Katz JN, Mahomed NN, Baron JA, Barrett JA, Fossel AH, Creel AH, Wright J, Wright EA, Losina E. Association of hospital and surgeon procedure volume with patient-centered outcomes of total knee replacement in a population-based cohort of patients age 65 years and older. *Arthritis Rheum.* 2007; 56:568–574. [PubMed: 17265491]
5. Kurtz S, Ong K, Lau E, Mowat F, Halpern M. Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *J Bone Joint Surg Am.* 2007; 89:780–785. [PubMed: 17403800]
6. Cram P, Lu X, Kates SL, Singh JA, Li Y, Wolf BR. Total knee arthroplasty volume, utilization, and outcomes among Medicare beneficiaries, 1991–2010. *JAMA.* 2012; 308:1227–1236. [PubMed: 23011713]
7. Ghomrawi HM, Schackman BR, Mushlin AI. Appropriateness criteria and elective procedures--total joint arthroplasty. *N Engl J Med.* 2012; 367:2467–2469. [PubMed: 23268663]
8. Ghomrawi HM, Alexiades M, Pavlov H, Nam D, Endo Y, Mandl LA, Mushlin AI. An Evaluation of Two Appropriateness Criteria for Total Knee Replacement. *Arthritis Care Res (Hoboken).* 2014
9. Riddle DL, Jiranek WA, Hayes CW. Use of a validated algorithm to judge the appropriateness of total knee arthroplasty in the United States: a multicenter longitudinal cohort study. *Arthritis Rheumatol.* 2014; 66:2134–2143. [PubMed: 24974958]

10. Riddle DL, Perera RA, Jiranek WA, Dumenci L. Using surgical appropriateness criteria to examine outcomes of total knee arthroplasty in a United States sample. *Arthritis Care Res (Hoboken)*. 2015; 67:349–357. [PubMed: 25132662]
11. Singh JA, Lu X, Rosenthal GE, Ibrahim S, Cram P. Racial disparities in knee and hip total joint arthroplasty: an 18-year analysis of national Medicare data. *Ann Rheum Dis*. 2014; 73:2107–2115. [PubMed: 24047869]
12. Ballantyne PJ, Gignac MA, Hawker GA. A patient-centered perspective on surgery avoidance for hip or knee arthritis: lessons for the future. *Arthritis Rheum*. 2007; 57:27–34. [PubMed: 17266081]
13. Allen KD, Golightly YM, Callahan LF, Helmick CG, Ibrahim SA, Kwoh CK, Renner JB, Jordan JM. Race and sex differences in willingness to undergo total joint replacement: the Johnston County Osteoarthritis Project. *Arthritis Care Res (Hoboken)*. 2014; 66:1193–1202. [PubMed: 24470235]
14. Hawker GA, Guan J, Croxford R, Coyte PC, Glazier RH, Harvey BJ, Wright JG, Williams JJ, Badley EM. A prospective population-based study of the predictors of undergoing total joint arthroplasty. *Arthritis Rheum*. 2006; 54:3212–3220. [PubMed: 17009255]
15. Frankel L, Sanmartin C, Conner-Spady B, Marshall DA, Freeman-Collins L, Wall A, Hawker GA. Osteoarthritis patients' perceptions of "appropriateness" for total joint replacement surgery. *Osteoarthritis Cartilage*. 2012; 20:967–973. [PubMed: 22659599]
16. Kellgren JH, Lawrence JS. Radiological assessment of osteo-arthritis. *Ann Rheum Dis*. 1957; 16:494–502. [PubMed: 13498604]
17. Ibrahim SA, Hanusa BH, Hannon MJ, Kresevic D, Long J, Kent KC. Willingness and access to joint replacement among African American patients with knee osteoarthritis: a randomized, controlled intervention. *Arthritis Rheum*. 2013; 65:1253–1261. [PubMed: 23613362]
18. Lester G. Clinical research in OA--the NIH Osteoarthritis Initiative. *J Musculoskelet Neuronal Interact*. 2008; 8:313–314. [PubMed: 19147953]
19. Scott CE, Bugler KE, Clement ND, MacDonald D, Howie CR, Biant LC. Patient expectations of arthroplasty of the hip and knee. *J Bone Joint Surg Br*. 2012; 94:974–981. [PubMed: 22733956]
20. Bourne RB, Chesworth BM, Davis AM, Mahomed NN, Charron KD. Patient satisfaction after total knee arthroplasty: who is satisfied and who is not? *Clin Orthop Relat Res*. 2010; 468:57–63. [PubMed: 19844772]
21. Riddle DL, Kong X, Jiranek WA. Two-year incidence and predictors of future knee arthroplasty in persons with symptomatic knee osteoarthritis: Preliminary analysis of longitudinal data from the osteoarthritis initiative. *Knee*. 2009; 16:494–500. [PubMed: 19419874]
22. Riddle DL, Jiranek WA. Knee osteoarthritis radiographic progression and associations with pain and function prior to knee arthroplasty: a multicenter comparative cohort study. *Osteoarthritis Cartilage*. 2015; 23:391–396. [PubMed: 25535863]
23. Kwoh CK, Vina ER, Cloonan YK, Hannon MJ, Boudreau RM, Ibrahim SA. Determinants of patient preferences for total knee replacement: African-Americans and whites. *Arthritis Res Ther*. 2015; 17:348. [PubMed: 26635132]
24. Judge A, Arden NK, Kiran A, Price A, Javaid MK, Beard D, Murray D, Field RE. Interpretation of patient-reported outcomes for hip and knee replacement surgery: identification of thresholds associated with satisfaction with surgery. *J Bone Joint Surg Br*. 2012; 94:412–418. [PubMed: 22371552]
25. Lingard EA, Katz JN, Wright EA, Sledge CB. Predicting the outcome of total knee arthroplasty. *J Bone Joint Surg Am*. 2004; 86-A:2179–2186. [PubMed: 15466726]
26. Riddle DL, Perera RA, Stratford PW, Jiranek WA, Dumenci L. Progressing toward, and recovering from, knee replacement surgery: a five-year cohort study. *Arthritis Rheum*. 2013; 65:3304–3313. [PubMed: 23983118]
27. Escobar A, Quintana JM, Bilbao A, Azkarate J, Guenaga JJ, Arenaza JC, Gutierrez LF. Effect of patient characteristics on reported outcomes after total knee replacement. *Rheumatology (Oxford)*. 2007; 46:112–119. [PubMed: 16735451]

28. Hawker GA, Badley EM, Borkhoff CM, Croxford R, Davis AM, Dunn S, Gignac MA, Jaglal SB, Kreder HJ, Sale JE. Which patients are most likely to benefit from total joint arthroplasty? *Arthritis Rheum.* 2013; 65:1243–1252. [PubMed: 23459843]
29. Holla JF, Steultjens MP, Roorda LD, Heymans MW, Ten WS, Dekker J. Prognostic factors for the two-year course of activity limitations in early osteoarthritis of the hip and/or knee: Results from the CHECK cohort. *Arthritis Care Res (Hoboken)*. 2010
30. Holla JF, van der Leeden M, Knol DL, Roorda LD, Hilberdink WK, Lems WF, Steultjens MP, Dekker J. Predictors and outcome of pain-related avoidance of activities in persons with early symptomatic knee osteoarthritis: A 5-year follow-up study. *Arthritis Care Res (Hoboken)*. 2014
31. Judge A, Arden NK, Cooper C, Kassim JM, Carr AJ, Field RE, Dieppe PA. Predictors of outcomes of total knee replacement surgery. *Rheumatology (Oxford)*. 2012; 51:1804–1813. [PubMed: 22532699]
32. Katz JN, Chang LC, Sangha O, Fossel AH, Bates DW. Can comorbidity be measured by questionnaire rather than medical record review? *Med Care.* 1996; 34:73–84. [PubMed: 8551813]
33. Radloff LS. The CES-D scale: a self report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 1:385–401.
34. Jensen MP, Keefe FJ, Lefebvre JC, Romano JM, Turner JA. One- and two-item measures of pain beliefs and coping strategies. *Pain.* 2003; 104:453–469. [PubMed: 12927618]
35. Riddle DL, Wade JB, Jiranek WA, Kong X. Preoperative Pain Catastrophizing Predicts Pain Outcome after Knee Arthroplasty. *Clin Orthop Relat Res.* 2009; 468:798–806. [PubMed: 19585177]
36. Vissers MM, Bussmann JB, Verhaar JA, Busschbach JJ, Bierma-Zeinstra SM, Reijman M. Psychological factors affecting the outcome of total hip and knee arthroplasty: a systematic review. *Semin Arthritis Rheum.* 2012; 41:576–588. [PubMed: 22035624]
37. Ghomrawi HM, Mancuso CA, Westrich GH, Marx RG, Mushlin AI. Discordance in TKA expectations between patients and surgeons. *Clin Orthop Relat Res.* 2013; 471:175–180. [PubMed: 22821348]
38. Mancuso CA, Sculco TP, Wickiewicz TL, Jones EC, Robbins L, Warren RF, Williams-Russo P. Patients' expectations of knee surgery. *J Bone Joint Surg Am.* 2001; 83-A:1005–1012. [PubMed: 11451969]
39. Noble PC, Conditt MA, Cook KF, Mathis KB. The John Insall Award: Patient expectations affect satisfaction with total knee arthroplasty. *Clin Orthop Relat Res.* 2006; 452:35–43. [PubMed: 16967035]
40. Poultsides LA, Ghomrawi HM, Lyman S, Aharonoff GB, Mancuso CA, Sculco TP. Change in preoperative expectations in patients undergoing staged bilateral primary total knee or total hip arthroplasty. *J Arthroplasty.* 2012; 27:1609–1615. [PubMed: 22480523]
41. Ibrahim SA, Siminoff LA, Burant CJ, Kwok CK. Understanding ethnic differences in the utilization of joint replacement for osteoarthritis: the role of patient-level factors. *Med Care.* 2002; 40:144–151. [PubMed: 11789631]
42. Parks ML, Hebert-Beirne J, Rojas M, Tuzzio L, Nelson CL, Boutin-Foster C. A qualitative study of factors underlying decision making for joint replacement among African Americans and Latinos with osteoarthritis. *J Long Term Eff Med Implants.* 2014; 24:205–212. [PubMed: 25272219]
43. Brander V, Gondek S, Martin E, Stulberg SD. Pain and depression influence outcome 5 years after knee replacement surgery. *Clin Orthop Relat Res.* 2007; 464:21–26. [PubMed: 17603386]
44. Blackburn J, Qureshi A, Amirfeyz R, Bannister G. Does preoperative anxiety and depression predict satisfaction after total knee replacement? *Knee.* 2012; 19:522–524. [PubMed: 21846588]
45. Alschuler KN, Molton IR, Jensen MP, Riddle DL. Prognostic value of coping strategies in a community-based sample of persons with chronic symptomatic knee osteoarthritis. *Pain.* 2013; 154:2775–2781. [PubMed: 23969326]
46. Sullivan M, Tanzer M, Stanish W, Fallaha M, Keefe FJ, Simmonds M, Dunbar M. Psychological determinants of problematic outcomes following Total Knee Arthroplasty. *Pain.* 2009; 143:123–129. [PubMed: 19304392]

47. Deshpande BR, Katz JN, Solomon DH, Yelin EH, Hunter DJ, Messier SP, Suter LG, Losina E. The number of persons with symptomatic knee osteoarthritis in the United States: Impact of race/ethnicity, age, sex, and obesity. *Arthritis Care Res (Hoboken)*. 2016
48. Buchbinder R, Jolley D, Wyatt M. 2001 Volvo Award Winner in Clinical Studies: Effects of a media campaign on back pain beliefs and its potential influence on management of low back pain in general practice. *Spine (Phila Pa 1976)*. 2001; 26:2535–2542. [PubMed: 11725233]
49. Buchbinder R, Jolley D. Effects of a media campaign on back beliefs is sustained 3 years after its cessation. *Spine (Phila Pa 1976)*. 2005; 30:1323–1330. [PubMed: 15928560]

Highlights

- A large population is impacted by unrealistically poor expectations.
- Psychological factors are associated with knee arthroplasty outcome expectations.
- Poor outcome expectations are not affected by the extent of knee OA.
- Poor expectations for some patients likely precede knee arthroplasty by many years.
- Mass media interventions may better align expectations with current evidence.

Table 1

Characteristics of the sample population.

Characteristic	Non-surgical sample (n = 3542) Mean (SD) or % and [missing n]
Demographic	
Age	66.4 (8.9) [0]
Sex (% female)	58.6 [0]
Race (% African American)	16.9 [3]
Socioeconomic	
Currently working (% no)	42.3 [249]
Highest education grade completed	[15]
% High school	14.1
% Some college	22.1
% College degree	63.4
Live alone (% yes)	25.2 [98]
Take part in organized social activities (% never or almost never)	78.7 [107]
Disease-related	
Worst K-L score (% Grade of 3 or 4)	27.4 [414]
Frequent knee pain (% yes)	41.3 [9]
Modified Charlson comorbidity score	0.62 (1.17) [50]
Joint replacement awareness	
Family ever had replacement surgery (% no)	76.1 [0]
Psychological	
Clinical depression symptoms (% yes)	12.3 [123]
Ignoring sensation	3.2 (1.7) [296]
Coping self-statements	3.7 (1.8) [300]
Praying or hoping (% score of 1)	37.6 [293]
Reinterpreting pain sensations (% score of 1)	44.0 [305]
Diverting attention (% score of 1)	42.2 [300]
Increased behavioral activities	2.6 (1.8) [302]
Catastrophizing (% score of 1)	28.1 [298]
Outcome expectation for pain (% moderate pain or greater)	26.0 [272]
Outcome expectation for walking difficulty (% moderate difficulty or greater)	21.8 [277]

Table 2

Associations between independent variables and pain expectations coded as none or mild pain versus moderate, severe, or extreme pain.

	Univariate analyses	Multivariable analyses
Covariates		
Demographic		
Age	1.02 (1.01, 1.03) *	1.02 (1.01, 1.04) +
Sex (women)	1.13 (0.96, 1.33)	
Race (African American)	2.24 (1.84, 2.71) *	2.11 (1.69, 2.64) +
Socioeconomic		
Currently working (no)	1.22 (1.04, 1.44) *	0.94 (0.78, 1.15)
Highest education grade completed		
At least a college degree	1.00 *	1.00
Some college	1.52 (1.25, 1.85)	1.19 (0.92, 1.54)
12 years	1.72 (1.37, 2.16)	1.23 (0.99, 1.52)
Live alone (yes)	1.26 (1.06, 1.52) *	0.96 (0.80, 1.15)
Organized social activities (never or almost never)	1.28 (1.06, 1.55) *	1.27 (1.03, 1.57) +
Osteoarthritis-related		
Radiographic knee osteoarthritis (yes)	1.02 (0.87, 1.21)	
Frequent knee pain (yes)	1.19 (1.01, 1.39) *	0.96 (0.81, 1.16)
Comorbidity score (1)	1.35 (1.14, 1.60) *	1.07 (0.89, 1.29)
Joint replacement awareness		
Family member had hip or knee replacement (no)	1.28 (1.06, 1.54) *	1.19 (0.97, 1.47)
Psychological		
Clinical depression symptoms (yes)	2.15 (1.72, 2.69) *	1.80 (1.40, 2.31) +
Ignoring pain sensations	1.0 (0.96, 1.05)	
Coping self-statements	1.06 (1.01, 1.11) *	1.05 (0.99, 1.11)
Praying and hoping (score of 1)	1.51 (1.28, 1.78) *	1.01 (0.83, 1.25)
Reinterpreting pain sensations (score of 1)	1.38 (1.17, 1.62) *	1.25 (1.03, 1.51) +
Diverting attention (score of 1)	1.20 (1.02, 1.41) *	0.92 (0.75, 1.14)
Increased behavioral activities	1.03 (0.99, 1.08) *	0.99 (0.93, 1.05)
Catastrophizing (score of 1)	1.83 (1.54, 2.18) *	1.45 (1.18, 1.79) +

* significant associations in the univariate analyses at $P < 0.10$ and included in the multivariable analyses. Bivariate analyses examine only the association between the variable of interest and pain expectation, while the multivariable analysis examines the simultaneous association between all variables marked with an asterisk and pain expectation.

+statistically significant associations in the multivariable analyses at $P < 0.05$

Table 3

Odds ratios for the interaction between dichotomized major depressive symptoms and pain catastrophizing for associations with at least moderate pain expectations.[#]

Major depressive symptoms		
	No - OR (95% CI)	Yes - OR (95% CI)
Pain catastrophizing		
No	1.0 ⁺	1.36 (0.95, 1.96)
Yes	1.33 (1.06, 1.66)	3.17 (2.26, 4.44)

[#] Adjusted for age, race, working status, education, living alone, social activity, frequent knee pain status, family history of joint replacement, coping self-statements, praying and hoping, reinterpreting pain sensations, diverting attention, and increased behavioral activities.

⁺ Reference category

Table 4

Associations between independent variables and walking difficulty expectations, coded as either none or mild difficulty versus moderate, severe, or extreme difficulty.

	Univariate analyses	Multivariable analyses
Covariates		
Demographic		
Age	1.02 (1.01, 1.03) [*]	1.02 (1.01, 1.04) ⁺
Sex (women)	1.0 (0.84, 1.12)	
Race (African American)	2.65 (2.17, 3.24) [*]	2.09 (1.65, 2.63) ⁺
Socioeconomic		
Currently working (no)	1.17 (0.99, 1.39) [*]	0.84 (0.68, 1.05)
Highest education grade completed		
At least a college degree	1.00	1.00 ⁺
Some college	1.70 (1.38, 2.09) [*]	1.36 (1.08, 1.70)
12 years	2.51 (1.99, 3.16) [*]	1.72 (1.32, 2.23)
Live alone (yes)	1.35 (1.12, 1.63) [*]	1.00 (0.81, 1.24)
Organized social activities (never or almost never)	1.11 (0.90, 1.36)	
Osteoarthritis-related		
Radiographic knee osteoarthritis (yes)	0.97 (0.81, 1.16)	
Frequent knee pain (yes)	1.25 (1.05, 1.48) [*]	1.00 (0.82, 1.20)
Comorbidity score (1)	1.56 (1.30, 1.86) [*]	1.18 (0.97, 1.44)
Joint replacement awareness		
Family member had hip or knee replacement (no)	1.36 (1.10, 1.68) [*]	1.29 (1.02, 1.62) ⁺
Psychological		
Clinical depressive symptoms (yes)	2.26 (1.79, 2.85) [*]	1.83 (1.41, 2.37) ⁺
Ignoring pain sensations	0.96 (0.92, 1.01)	
Coping self-statements	1.06 (1.01, 1.11) [*]	1.06 (0.99, 1.23)
Praying and hoping (score of 1)	1.79 (1.51, 2.13) [*]	1.06 (0.85, 1.33)
Reinterpreting pain sensations (score of 1)	1.40 (1.17, 1.66) [*]	1.17 (0.96, 1.44)

	Univariate analyses	Multivariable analyses
Diverting attention (score of 1)	1.48 (1.24, 1.76) [*]	1.10 (0.89, 1.36)
Increased behavioral activities	1.02 (0.97, 1.07)	
Catastrophizing (score of 1)	2.05 (1.71, 2.46) [*]	1.50 (1.20, 1.86) ⁺

^{*} significant associations in the bivariate analyses at $P<0.10$ and included in the multivariable analyses. Univariate analyses examine only the association between the variable of interest and walking difficulty expectation, while the multivariable analysis examines the simultaneous association between all variables marked with an asterisk and walking difficulty expectation.

⁺ statistically significant associations in the multivariable analyses at $P<0.05$