Characteristics of People with Hip or Knee Osteoarthritis Deemed Not Yet Ready for Total Joint Arthroplasty at Triage

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ABSTRACT

Purpose: To identify the characteristics of people with hip or knee osteoarthritis (OA) attending a regional triage centre for an initial consult who are deemed not yet ready for total joint arthroplasty (TJA). **Methods:** Initial consultation notes ($n = 482$) were reviewed retrospectively. Predictive variables were derived from the literature a priori, and 14 of these variables were suitable for inclusion in stepwise multiple logistic regression analyses. **Results:** Of the 222 eligible people, 131 (59%) were deemed not yet ready for TJA. Five variables entered into the model ($\chi^2_5 = 133.19$, $p < 0.001$) for an overall success rate of 81.1%. Those deemed not yet ready for TJA were more likely to have knee OA (vs. hip OA; odds ratio [OR] = 0.352, $p = 0.018$), to have less severe OA (OR = 0.246 for each category increase in severity, $p < 0.001$), to use no gait aid (vs. cane; OR = 0.390, $p = 0.033$), and to have a higher Lower Extremity Functional Scale score (OR = 1.050 for each 1-point increase, $p = 0.003$) and better joint status as measured by the Knee Society Scale or Hip Harris Scale (OR = 3.946 for each category increase, $p = 0.007$). **Conclusion:** Considering these characteristics will help clinicians to identify individuals likely to require interventions other than TJA.

Key Words: health services; hip; knee; mobility limitation; osteoarthritis.

RÉSUMÉ

Objectif : Identifier les caractéristiques des personnes souffrant d'arthrose du genou ou de la hanche qui se rendent à un centre de triage régional pour une première consultation et sont considérées comme n'étant pas prêtes pour une arthroplastie totale des articulations (ATA). **Méthodes :** Des notes de première consultation ($n = 482$) ont été examinées de manière rétrospective. Des variables prédictives ont d'abord été tirées de la recension des écrits à ce sujet, puis 14 de ces variables se sont avérées convenables pour une inclusion dans des analyses de régression logistique multiple par étapes. **Résultats :** Sur les 222 personnes admissibles, 131 (59 %) ont été considérées comme n'étant pas prêtes pour une ATA. Cinq variables ont été entrées dans le modèle ($\chi^2_5 = 133,19$, $p < 0,001$) pour un taux global de réussite de 81,1 %. Les personnes considérées comme n'étant pas prêtes pour une ATA étaient plus susceptibles de souffrir d'arthrose du genou (hanche et genou; rapport de cotes [RC] = 0,352, $p = 0,018$), de souffrir d'arthrose moins grave (RC = 0,246 pour chaque augmentation de catégorie de gravité, $p < 0,001$), de n'utiliser aucune aide à la marche (cane et aucune aide à la marche; RC = 0,390, $p = 0,033$) et d'avoir des résultats plus élevés à l'échelle fonctionnelle des membres inférieurs (RC = 1,050 pour chaque augmentation d'un point, $p = 0,003$) et des articulations en meilleur état selon le score des échelles de hanche Harris et de la Knee Society (RC = 3,946 pour chaque augmentation de catégorie, $p = 0,007$). **Conclusion :** Le fait de tenir compte des caractéristiques énumérées ci-dessus aidera les cliniciens à identifier les personnes qui pourraient avoir besoin d'une intervention autre que l'ATA.

Osteoarthritis (OA) is the most common type of arthritis, usually occurring with advancing age and most often affecting weight-bearing joints such as hips and knees.¹

Worldwide, OA is among the top 10 contributors to disability and results in functional loss and dependence for those affected.² By 2020, the worldwide prevalence

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of OA is expected to double from that in 2005.² In Canada, OA affects more than 30 million people,¹ and the Hamilton–Niagara–Haldimand–Brant region Local Health Integration Network (LHIN), where our study took place, has an arthritis prevalence of 20.1%, significantly higher than the provincial prevalence of 16.2% for Ontario.³ To date, no disease-modifying treatment for OA is available, and musculoskeletal disability may progress to the point at which conservative management fails and total joint arthroplasty (TJA) is required.⁴ During the 2012–2013 fiscal year, 104,855 Canadians opted to proceed with a hip or knee TJA—almost 17,000 more than in 2007–2008.⁵ As the population ages, the burden on Canadian health care systems to meet the increasing demand for TJA is driving innovation in health service delivery to identify those people with knee and hip OA who are most likely to benefit from TJA and treat them in a timely manner.

There is a universal interest in identifying the characteristics of people with hip and knee OA who do not respond to conservative treatment and whose symptoms progress to the point of requiring TJA. On the basis of cohort studies, the most common predictors of TJA include increased age,^{6,7} decreased physical function,^{6–12} increased pain,^{6,8,10–13} radiographic findings of severe OA,^{6,8,11–13} decreased range of motion (ROM),^{6,11} being female,¹⁴ and willingness to undergo TJA.¹⁴ Orthopaedic surgeons make decisions about a patient's suitability for TJA, and the complexity of this decision-making process is evident in disagreement both among orthopaedic surgeons^{15–17} and when clinical factors deemed important by these specialists were compared with those deemed important by family physicians or rheumatologists.^{15,17} To help clinicians, priority tools have been developed, providing algorithms that predict who is most likely to benefit from TJA. Predictors include pain severity and musculoskeletal disability,^{8,12,18,19} disease severity (judged on the basis of radiographic findings as well as impact on the patient),^{12,19} impairments identified on physical examination of the joint,^{12,19} and limitations in activities of daily living and role restrictions.¹⁹

Joint assessment programmes have been established in which health care providers such as advanced practice physiotherapists (APPs) work under medical directives from orthopaedic surgeons to triage people with hip and knee OA referred for surgical consult.^{5,20} In Ontario's Local Health Integrated Network 4 (LHIN-4), the Regional Joint Assessment Program (RJAP) assesses people with hip and knee pain to determine appropriate triage for surgical, joint replacement, or non-surgical options to manage pain and improve function.²⁰ A quarterly report for the RJAP indicated that only 37% of people referred to the RJAP were deemed ready for TJA on initial consult (unpublished data, July–September 2011). The efficiency of the triage process could be improved by better understanding the characteristics of the 63% who

do not require immediate TJA. The purpose of our study, therefore, was to identify the characteristics of people who attend the RJAP for an initial surgical consult and are deemed not yet ready for TJA.

METHODS

Study design

Our study was a retrospective chart review of consultation notes for people who attended the RJAP for an initial assessment with one of the eight attending surgeons and one of the four APPs affiliated with Hamilton Health Sciences during a 3-month period from January 1 to March 31, 2012. The study protocol was approved by the Hamilton Integrated Research Ethics Board.

Sample

We reviewed charts for 482 people with hip or knee pain who attended the LHIN-4 Hamilton Health Sciences RJAP during the study quarter. Charts were eligible for inclusion if the patient had a diagnosis of OA confirmed by an APP or an orthopaedic surgeon, attended an initial surgical consult, and was deemed either “not yet ready for TJA” or “ready for TJA.” We excluded charts if a consult was conducted on a previously replaced joint; if data for the variables of interest were missing; or if the patient was medically unfit for surgery, in need of less invasive hip or knee joint surgery, or required immediate treatment of another condition. To maintain confidentiality, we assigned each chart a unique study number, which was used to link data extraction information, and removed all patient identifiers.

Chart review and data extraction

We identified potential predictive variables using clinical rationale for selecting people not yet ready for TJA and the available literature, despite the focus on the common characteristics of people who proceed with TJA. The data extraction sheet was piloted on the same chart by all five chart reviewers (JJ, NM, LP, KR, GZ) and one APP (SSM). The five chart reviewers then completed replicate data extractions on five randomly selected charts and compared their results. The extraction form was modified to resolve discrepancies in coding and adapt to the chart information available.

A total of 24 independent variables selected a priori were available for extraction at varying levels of detail. Each chart reviewer was assigned 95–98 charts; all data were extracted between June 6 and June 21, 2012. We reviewed the extracted data to identify eligible charts and exclude those in which variables of interest were not specifically documented or were reported inconsistently. Eligibility was confirmed on the basis of documented assessment date, diagnosis of OA, and triage status (dependent variable: not yet ready for TJA vs. ready for TJA).

Triage status

Triage status is determined after the initial assessment and recorded in the patient's chart by the APP or attending orthopaedic surgeon. This clinical judgment is based on various factors (medical history, pain, physical function, age, radiographic findings, physical examination of the joint, use of conservative treatments) and is discussed with the patient on completion of the assessment. Triage assigns each patient to one of five categories: ready for TJA, other hip–knee surgery required, not yet ready for TJA, medically unstable for surgery, or other non-joint condition requires immediate treatment.

As noted earlier, we included in our study only charts of those deemed ready for TJA and not yet ready for TJA. Those ready for TJA have been judged suitable for the surgical wait-list but do not necessarily decide to proceed to surgery; for those deemed not yet ready, immediate conservative management strategies such as intra-articular injections are offered, specific community-based services are recommended, and follow-up assessments are scheduled as required.

Measures

The joint assessed during the initial consult was coded as 1 (knee) or 2 (hip); a person presenting with both hip and knee pain was assigned to one of the two categories on the basis of the joint assessment's focus. Variables describing symptoms due to OA of the consulting joint were of primary interest.

Pain intensity was assessed using an 11-point numeric rating scale (NRS), or self-reported pain was documented as mild, moderate, or severe; for our purposes, pain was coded as 1 (mild, or NRS 0–3), 2 (moderate, or NRS 4–6), or 3 (severe, or NRS 7–10).

Physical function was assessed using the Lower Extremity Functional Scale (LEFS), a region-specific self-report measure of lower-extremity function for people with musculoskeletal ailments²¹ whose scores range from 0 to 80 points (a higher score indicates better function).²¹ The LEFS has sound psychometric properties and is a valid and reliable measure for people with hip and knee OA.²¹ For the study, we extracted the total LEFS score from each chart.

Pain and physical function were also assessed using the Knee Society Score (KSS) and Harris Hip Score (HHS) for people with knee OA and hip OA, respectively. These outcome measures are administered by the clinician, and a small portion of the score is also allotted to ROM and joint deformity.^{22,23} For both measures, higher scores indicate better outcomes.^{22,23} To enable inclusion of either KSS or HHS scores, depending on consulting joint, we converted both scores to an interval scale on the basis of clinical interpretation of these outcome measures: 1 (poor), 2 (fair), 3 (good), or 4 (excellent).²²

We extracted categorical data describing use of a gait aid and coded these data using three dummy variables to

compare use of a cane, walker, or wheelchair with the reference category, no gait aid. Radiologic findings of the consulting joint OA were coded as “yes” or “no.” Measures of lower extremity ROM were extracted and coded as within functional limits or restricted, based on a published cutoff value indicating lower-extremity functional limitations.²⁴ Regardless of the number or type of conservative interventions trialed for the consulting joint, we coded this variable as “yes” or “no.” Severity of OA was determined by the assessing clinician on the basis of radiological findings and clinical presentation and was coded according to the reported category as 1 (mild), 2 (mild to moderate), 3 (moderate), 4 (moderate to severe), or 5 (severe).

Other health conditions may account for the relationship between readiness for TJA and OA symptomatology. We therefore coded and summed data from participants' past medical history, including documentation of primary diagnosis (OA or other), anaesthetic risk (“yes” or “no”), cancer (“no” or “yes”), osteoporosis (“no” or “yes”), and number of system-specific comorbidities (musculoskeletal, cardiovascular, pulmonary, neurological, gastrointestinal, metabolic, integumentary, mental health) to arrive at the total number of comorbid conditions. Any past surgery to the spine or any lower-extremity joint was coded as “no” or “yes” and summed to give a total count of past axial and lower-extremity surgeries.

We considered several demographic variables in addition to age (in years) and gender (female or male) as covariates. To account for the possibility that region of residence may affect triage status, we used partial postal codes to classify each patient as living in either a rural or an urban community. Additional targeted predictors describing quadriceps lag, lifestyle, occupation, and social support were not included in the analysis because of missing data.

Statistical analysis

We conducted all statistical analyses using IBM SPSS Statistics, version 22.0.0 (IBM Corporation, Armonk, NY), with the threshold for statistical significance set at $p < 0.05$. We used descriptive statistics to analyze the characteristics of the sample and compared distributions in groups using two-sample Mann–Whitney U and χ^2 tests (or t -tests, in the case of normally distributed continuous variables).

Predictors of the probability that a patient with hip or knee OA would be deemed not yet ready for TJA were determined using univariate and multivariate logistic regression analyses. The data were checked to confirm that assumptions were met. Specifically, we checked for empty or small cells (very few cases) that would make the model unstable or unable to run at all by doing a cross-tabulation between each potential predictor and the triage status outcome variable. We evaluated the

linearity assumption for continuous data using the Box-Tidwell test and transposed age into interval data (10-yr groups) to achieve a stable model. We used the forward stepwise selection method (where variables with score statistic $p < 0.05$ are entered) with removal testing based on the probability of the likelihood ratio statistic (using maximum partial likelihood estimates, $p < 0.10$). The significance of the model was assessed using the Omnibus tests of model coefficients; the pseudo- R^2 statistic, Nagelkerke's R^2 , was calculated; and the model's goodness of fit was evaluated using the Hosmer–Lemeshow test. We also calculated sensitivity, specificity, overall percentage correct, and negative and positive predictive values. Finally, the prediction model was confirmed via backward stepwise (likelihood ratio) regression analyses using the same criteria. Significance was set at $p < 0.05$.

RESULTS

Figure 1 shows the flow of participants through the study. For this sample of people with a confirmed diagnosis of OA attending the RJAP for an initial surgical consultation, the probability of being deemed not yet ready for TJA was 59%. Table 1 summarizes the sample characteristics. Regardless of triage status, most participants were women, sought surgical consultation for knee pain, and had a primary diagnosis of OA. Only 14 people had a primary diagnosis other than OA. A total of 89 people (40%) had previously undergone surgery to the spine, hip, knee, or foot and ankle; of the 76 people with a history of surgery at a single joint site, 60 had undergone knee surgery. Overall, 48% of the sample had two or three comorbid conditions. Those deemed not yet ready for TJA were younger, on average, by approximately 3 years, fewer had severe pain (41% vs. 76%), and fewer had tried conservative interventions for OA (90.1% vs. 97.8%) than those deemed ready for TJA (see Table 1). Of the 60 people presenting with hip OA, 38 (63%) were deemed ready for TJA. As expected, those not yet ready for TJA had better ROM and higher self-reported lower-extremity physical function, and fewer used gait aids (Table 1).

Because all charts included radiologic evidence of OA and all six people with anaesthetic risk were deemed not yet ready for TJA, we did not include these 2 variables in the regression analyses. The only person who used a wheelchair was deemed ready for TJA, but we retained this dummy variable as a component of the use of gait aids variable. A total of 14 variables were suitable for analyses; the correlation matrix indicated that the highest correlation ($r = 0.307$) was between LEFS score and pain. Univariate analyses revealed significant associations between triage status and 9 independent variables: consulting joint ($p < 0.001$), conservative management trialed ($p = 0.024$), pain ($p < 0.001$), primary diagnosis ($p = 0.008$), severity ($p < 0.001$), use of a cane ($p < 0.001$), ROM ($p < 0.001$), KSS–HSS ($p < 0.001$), and LEFS

Figure 1 Study flow of chart review and participant eligibility.

($p < 0.001$). No significant associations were observed between triage status and age, gender, region of residency, history of orthopaedic surgeries, and number of comorbid conditions.

Because all 14 variables were identified as important clinically and we had an adequate sample size, all were included as potential predictors in the multivariate stepwise logistic regression analyses. Five explanatory variables were included in the final model ($\chi^2_5 = 133.19$, $p < 0.001$; Nagelkerke $R^2 = 0.61$). The likelihood of being deemed not yet ready for TJA was greater for people consulting on the knee joint ($p < 0.05$), categorized as having mild to moderate OA severity ($p < 0.001$), using no gait aid ($p < 0.05$), scoring better on the LEFS ($p < 0.01$), and categorized as having fair to excellent joint function on the basis of the KSS or HHS. The prediction model correctly classified 81.7% of those not yet ready for TJA and 80.2% of those ready for TJA, for an overall success rate of 81.1%; the false positive and false negative rates were 14.4% and 24.7%, respectively. The Hosmer–Lemeshow test ($\chi^2_8 = 8.65$, $p = 0.372$) suggests that the model was correctly specified.

Table 2 shows the logistic regression coefficient, Wald test statistic, and odds ratio (OR) for each predictor that had a significant partial effect. Holding all variables constant, a person with knee OA was 44.8 times as likely to be deemed not yet ready for TJA if he or she had mild OA (i.e., severity = mild), did not use a gait aid, and had excellent lower extremity physical function. Inverting the 0.352 OR for consulting joint for ease of interpretation, a person with hip OA was 2.8 times as likely to be ready for TJA as a person with knee OA. Inverted OR for the effect of OA severity indicated that the odds of being ready for TJA increased by 4.1 for each increase in category of OA severity. The inverted OR of the dummy-coded variable use of a gait aid indicated that the odds of being ready for TJA were 2.6 times higher for a person who used a cane. Better physical function, however, increased the

Table 1 Characteristics of Participants Not Ready for TJA or Triaged to the Wait-List for TJA at the Time of Initial Orthopaedic Consult for Hip and Knee Osteoarthritis ($n = 222$)

Variables	No. (%) of charts*	
	Not ready for TJA ($n = 131$)	TJA wait-list ($n = 91$)
Age, y, mean (SD) [†]	62.81 (10.3)	66.05 (10.5)
Gender		
Male	54 (41.2)	34 (37.4)
Female	77 (58.8)	57 (62.6)
Consulting joint [‡]		
Knee	109 (83.2)	53 (58.2)
Hip	22 (16.8)	38 (41.8)
Postal code		
Urban	113 (86.3)	76 (83.5)
Rural	18 (13.7)	15 (16.5)
Conservative management [§]		
Yes	118 (90.1)	89 (97.8)
No	18 (13.7)	2 (2.2)
Pain [‡]		
Mild	3 (19.1)	3 (3.3)
Moderate	52 (39.7)	19 (20.9)
Severe	54 (41.2)	69 (75.8)
Severity [‡]		
Mild	22 (16.8)	0 (0)
Mild to moderate	12 (9.2)	0 (0)
Moderate	38 (29.0)	5 (5.5)
Moderate to severe	16 (12.2)	6 (6.6)
Severe	43 (32.8)	80 (87.9)
Primary diagnosis of osteoarthritis		
Yes	118 (90.1)	90 (98.9)
No	13 (9.9)	1 (1.1)
History of spine, hip, knee, or foot–ankle surgery		
Yes	49 (37.4)	40 (44.0)
No	82 (62.6)	51 (56.0)
Osteoporosis		
Yes	11 (8.4)	11 (12.1)
No	120 (91.6)	80 (87.9)
Cancer		
Yes	7 (5.3)	5 (5.5)
No	124 (94.7)	86 (94.5)
Musculoskeletal comorbidities		
None	96 (73.3)	57 (62.6)
1	24 (18.3)	22 (24.2)
>1	11 (8.4)	12 (13.2)
Cardiovascular comorbidities		
None	48 (36.6)	21 (23.1)
1	48 (36.6)	43 (47.3)
>1	35 (26.8)	27 (29.7)
Pulmonary comorbidities		
None	114 (87.0)	80 (87.9)
1	16 (12.2)	11 (12.1)
>1	1 (0.8)	0 (0.0)
Neurological comorbidities		
None	119 (90.8)	82 (90.1)
1	9 (6.9)	7 (7.7)
>1	3 (2.3)	2 (2.2)
Gastrointestinal comorbidities		
None	100 (76.3)	79 (86.8)
1	29 (22.2)	10 (11.0)
>1	2 (1.5)	2 (2.2)
Metabolic comorbidities		
None	92 (70.2)	63 (69.2)
1	46 (28.3)	26 (28.6)
>1	2 (1.5)	2 (2.2)

Table 1 (Continued)

Variables	No. (%) of charts*	
	Not ready for TJA (<i>n</i> = 131)	TJA wait-list (<i>n</i> = 91)
Integumentary comorbidities		
None	129 (98.5)	88 (96.7)
1	2 (1.5)	3 (3.3)
>1	0 (0.0)	0 (0.0)
Mental health comorbidities		
None	113 (86.3)	82 (90.1)
1	15 (11.5)	9 (9.9)
>1	3 (2.3)	0 (0.0)
Gait aid		
None	102 (77.9)	46 (50.5)
Cane‡	22 (16.8)	37 (40.7)
Walker	7 (5.3)	7 (7.7)
Wheelchair	0 (0.0)	1 (1.1)
Lower-extremity range of motion‡		
Within functional limits	54 (41.2)	10 (11.0)
Restricted	77 (58.8)	81 (89.0)
Knee Society–Hip Harris score‡		
Poor	71 (54.2)	86 (94.5)
Fair	37 (28.2)	5 (5.5)
Good	13 (9.9)	0 (0.0)
Excellent	10 (7.6)	0 (0.0)
Lower Extremity Functional Scale¶ (range = 0–80 points), mean (SD)	32.30 (15.0)	20.97 (10.6)

*Unless otherwise noted.

†Independent-samples *t*-test, *p* < 0.05.

‡ χ^2 distribution, *p* < 0.001.

§ χ^2 distribution, *p* < 0.05.

¶Independent-samples *t*-test, *p* < 0.001.

TJA = total joint arthroplasty.

Table 2 Logistic Regression Predicting Who Is Not Yet Ready for Total Joint Replacement Among People with Hip and Knee Osteoarthritis

Predictor	β	Wald χ^2	<i>p</i> -value	OR (95% CI)
Consulting joint (hip vs. knee)	−1.044	5.621	0.018	0.352 (0.149–0.835)
Severity*	−1.401	28.593	<0.001	0.246 (0.147–0.412)
Gait aid (cane vs. no aid)	−0.942	4.560	0.033	0.390 (0.164–0.926)
LEFS score (1-point increment)†	0.048	8.843	0.003	1.050 (1.017–1.084)
Knee Society/Harris Hip score category†	1.373	7.381	0.007	3.946 (1.466–10.621)
Constant	4.045	9.081	0.003	57.105

*Higher category = worse.

†Higher score = better.

LEFS = Lower Extremity Functional Scale.

odds of being not yet ready for TJA: Each 1-point increase in LEFS score increased the odds by a factor of 1.05. For each increase in category (poor, fair, good, excellent) qualifying joint status based on KSS–HSS score, the odds of not yet being ready for TJA increased by 3.9.

DISCUSSION

The aim of our retrospective chart review was to determine the characteristics of people considered not

yet ready for TJA on initial assessment at the LHIN-4 Hamilton Health Sciences RJAP. In our sample, the prevalence of this triage status was 59%. Our analysis identified five significant explanatory variables: consulting joint, OA severity, use of a gait aid, LEFS score, and KSS- or HHS-based classification of joint status. Identifying characteristics that predict which people seeking an initial surgical consultation for hip and knee pain are not yet ready for TJA is important to enhance triaging

services. A person with knee OA, moderate or lower OA severity, no use of cane, and higher levels of lower extremity functioning and joint status is likely to be deemed not yet ready for TJA. The likelihood of this triage status decreases in an additive way for a person with any combination of alternative characteristics (hip OA, higher OA severity category, use of a cane, or poorer lower extremity functioning or joint status). Knowledge of these characteristics can assist health care professionals in deciding whether to refer a client to a triage centre for an initial surgical consultation.

Previous research has identified characteristics of people wait-listed for TJA, including older age, poor function, higher level of pain, severity of radiographic findings of OA, decreased ROM, being female, and being willing to undergo TJA.^{6–14} Despite variations in study design, including prospective clinical and community-based populations^{6–11,13} with OA,^{6–11,13} at risk for OA,⁶ or wait-listed for TJA;¹⁰ clinical vignettes reviewed by orthopaedic surgeons;¹² and a systematic review,¹⁴ the factors that predicted TJA were generally consistent.

In contrast to these previous studies, ours aimed to identify the characteristics of people deemed not yet ready for TJA. In our study, people deemed ready for TJA were similar to TJA candidates described in previous reports with respect to gender and age; however, these characteristics were not significant predictors. Consistent with the Canadian Institute for Health Information 2014 Canadian Joint Replacement Registry annual report,⁵ more women than men were wait-listed for TJA. In our study, women made up the majority of our sample irrespective of triage status. We should note that some predictors of TJA candidacy reported in the literature, such as willingness to undergo TJA, were not documented consistently in the charts we reviewed, and other potential explanatory variables, such as ROM, were coded categorically (“restricted,” “within functional limits”). Adequate management using conservative interventions, especially the use of pain medications, has been identified as an important predictor of the need for TJA.⁸

In our study, use of conservative management was scored as yes or no, rather than by type or duration of use, and was not a significant predictor. When pain was scored according to one of five categories, it was not a significant predictor. However, pain is also incorporated into the Hip Harris Scale and Knee Society Scale, and better scores on these outcome measures predicted the triage status “not yet ready for TJA.” All eligible charts included radiographic evidence of OA, but radiographic severity was not graded; however, both radiographic findings and findings on physical assessment were incorporated into the clinician’s rating of OA severity, which was a significant predictor. Physical functioning, though, as measured by two different outcome measures and use of a gait aid (cane vs. no aid), provided important infor-

mation in addition to the clinician’s global rating of OA severity regarding who was not yet ready for TJA. Taken together, our findings show an encouraging pattern: Among people with knee or hip OA attending the RJAP, those deemed not yet ready for TJA had the opposite characteristics of those identified as predictors of TJA candidacy in studies using a variety of study designs and sample populations.

Our finding that physical functioning is a key component in identifying readiness for TJA has been reported in previous research.^{6–12} The challenge lies in identifying the most efficient way for a triage service to quantify the severity of musculoskeletal disability in people with hip and knee OA. Self-report measures do not require much assessment space, equipment, or clinician time, and our study found that the odds of being deemed not yet ready for TJA increased nearly 10-fold for each clinically important increase in LEFS score (i.e., 9 points²¹).

However, the physical function reported in response to questions asking about hypothetical activities is known to provide distinct information that complements the information gathered through observed performance;²⁵ moreover, self-reported functioning may overestimate capacity.²⁶ The fact that LEFS scores did not correlate with the global rating of severity and contributed independently to the prediction model calls into question whether the clinicians who completed the initial consultation had access to these scores and were able to interpret them. The KSS–HHS multicomponent assessment of joint status (primarily pain and function, but also ROM and deformity and instability) classifies joint status ranging from poor to excellent, and moving up one category increased the odds of not being ready for TJA threefold.

The use of a cane is an observable indication that physical performance is limited. A prospective cohort study by Birrell and colleagues (2003) previously reported that disability, defined by use of a cane, predicted the need for hip joint replacement.¹¹ Even after adjusting for consulting joint, we found that those who did not use a cane were more likely to be deemed not yet ready for TJA. Thus, we can confirm the importance of assessing physical functioning in people with knee OA, and we suggest that further study is needed to assist with clinical interpretation of outcome measures used to address this construct.

Our findings must be considered in the context of the study’s limitations. Individual variation in charting style and content was introduced by the fact that one of four APPs or one of eight orthopaedic surgeons recorded the assessment. As a result, some data were missing and charts had to be excluded from the final analysis. Other data, such as the severity of comorbid conditions or specific conservative treatments reported, could not be extracted in detail. Decisions about triage status were made by different APPs and orthopaedic surgeons, and

the level of agreement among the RJAP clinicians is not known. Furthermore, we were not able to obtain information on satisfaction with outcomes associated with triage status, which could have served as a criterion standard for classifying readiness for TJA. Finally, sample selection introduced certain limitations that should be considered when interpreting the results. First, only people with a diagnosis of OA were included. Second, only people who attended the LHIN-4 Hamilton Health Sciences RJAP were included. Third, only people assessed within the study quarter were eligible, and it is possible that weather or other confounding variables in this quarter may have heightened symptoms or discouraged people with more severe OA from attending the LHIN-4 Hamilton Health Sciences RJAP. Therefore, our findings should be confirmed with people assessed during a different quarter and in different triage services.

CONCLUSIONS

We anticipate that identifying the characteristics predicting readiness for TJA will facilitate the triage process at the LHIN-4 RJAP, where the majority of people referred for an initial surgical consult are not yet ready for TJA. Referral based on our model would successfully classify 81%, but the false positive and false negative rates for our model indicate that 14% of those who are ready for TJA would be missed and 25% of those who are not yet ready would be referred for an initial consult. Presumably those who do need TJA would pursue referral, and those not yet ready would be successfully triaged. The specialist's global rating of OA severity was a significant independent predictor of triage status, which confirms that clinical judgments of readiness for TJA involve synthesizing numerous factors, chief among which is the severity of musculoskeletal disability. It appears that multiple measures, both self-reported and performance based, are required to assess limitations in physical function that predict which people with primary OA of the hip or knee are not yet ready for TJA.

KEY MESSAGES

What is already known on this topic

As the population ages and the number of people with disability due to hip and knee osteoarthritis (OA) increases, wait times for total joint arthroplasty (TJA) may be unacceptably long. Resources have been devoted to improve efficacy and supply. It is now recognized that referral and triage services can be facilitated by prioritizing those most likely to benefit from TJA.

What this study adds

The characteristics of people considered not yet ready for TJA after an initial surgical consultation were determined. People referred with knee OA are more likely to be deemed not ready for TJA than those with hip OA. Apart from joint involvement, clinically meaningful measures of physical functioning and the clinician's global

rating of OA severity are the key factors for identifying readiness for TJA. Knowledge of these characteristics can assist health care professionals when deciding when to refer a client to a triage centre for an initial surgical consultation.

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