Novel Patient Intake Survey for the Diagnosis and Management of Hip Osteoarthritis

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ABSTRACT

INTRODUCTION: Hip osteoarthritis (OA) is a common cause of hip pain in adults and a frequent presentation in primary care, emergency departments, and orthopedic clinics. To improve patient triage and optimize clinical efficiency, we developed a nine-item intake survey designed to assess patient symptoms and prior treatments. This study aimed to evaluate the survey's ability to differentiate hip OA from other hip pathologies and assess its correlation with treatment recommendations.

METHODS: New patients presenting with hip pain were administered a nine-item multiple choice survey. Each response was assigned a score, and the total cumulative score was recorded. Diagnoses and treatment recommendations, including total hip arthroplasty (THA), were documented. Logistic regression was used to assess associations between the survey scores and both diagnosis and treatment recommendations. Receiver operating characteristic (ROC) analysis and Youden's J statistics were applied to determine the optimal survey score threshold for diagnosing hip OA.

RESULTS: The survey effectively distinguished hip osteoarthritis from other hip pathologies based upon cumulative score. ROC analysis identified a total score of ≥9 as the optimal threshold, maximizing sensitivity (83.3%) and specificity (55.9%) for diagnosing hip OA. The positive predictive value for this threshold was 78.6%. Additionally, higher total survey scores were significantly associated with the recommendation for THA.

CONCLUSION: This study demonstrates that a simple nine-item, patient-reported survey can reliably differentiate hip OA from other hip conditions and may assist in guiding treatment decisions. Implementing such tools in primary care, emergency medicine, and orthopedic settings could enhance early diagnosis and streamline referrals.

LEVEL OF EVIDENCE: III

INTRODUCTION

Hip osteoarthritis (OA) is a progressive degenerative joint disease and a leading cause of pain, disability, and rising healthcare costs in the United States.[1] Its incidence is projected to increase significantly through 2050, largely due to the aging population and growing prevalence of obesity.[2] Age is one of the strongest predictors of OA, with prevalence rising sharply in individuals aged 65 years or older.[3] Additionally, females are at a greater risk of developing OA compared to males, with studies suggesting differences in disease progression and severity.[4] Other risk factors include genetic predisposition, occupations requiring prolonged standing and heavy lifting, prior trauma, obesity, and dietary factors.[5–7]

First line of treatment options for OA includes lifestyle modification, physical therapy (PT), analgesic medications, and intra-articular injections. While these options may provide symptomatic relief, none have been proven to halt disease progression.[8] For patients with end- stage hip OA, elective primary total hip arthroplasty (THA) remains the gold standard of treatment, offering substantial pain relief and improved function.[9,10] Patient selection for THA is multifactorial, requiring the orthopedic surgeon to consider age, comorbidities, body mass index (BMI), radiographic severity, pain levels, functional limitations, and physical deformity.[11]

The demand for THA is expected to rise substantially in the coming decades, with utilization in the United States projected to increase by 284% by 2040.[2] Meeting this demand requires not only a need for more fellowship-trained adult reconstruction surgeons, but also the implementation of efficient systems to optimize clinical workflows and resource allocation. The emergence of artificial intelligence (AI) in healthcare presents opportunities to reduce administrative burdens, improve patient satisfaction, and enhance diagnostic and treatment planning.[12] As AI becomes increasingly integrated into clinical workflows, validated standardized surveys may serve as valuable tools for streamlining diagnosis and treatment recommendations.

This study aims to evaluate the effectiveness of a short-form, nine-item survey as a diagnostic tool for hip OA and as a potential aid in surgical decision-making. As part of a quality improvement initiative, our adult reconstruction practice implemented this survey for all new patients presenting with hip pain at their initial visit. The survey was designed to supplement the diagnostic process, providing structured

clinical data to assist the surgeon in making accurate diagnoses and recommending appropriate treatment plans. We hypothesized that the survey would effectively differentiate patients with hip OA from those with other causes of hip pain and that total survey scores would correlate with the surgeon's recommendation for THA.

METHODS

This study received IRB approval by the Lifespan health system. Between October 2021 and April 2023, a total of 100 patient-completed intake surveys were collected and reviewed from an Adult Reconstruction Clinic within a large orthopedic practice. The survey consisted of nine multiple choice questions assessing patient demographics (age, gender, occupation), pain characteristics (location, duration, functional limitations) and previous treatments for hip pain [**Table 1**]. These nine questions were developed based on physician experience and another similar questionnaire used to diagnose knee OA.[13] Answer choices were designed to differentiate patients at higher risk for severe hip OA from those with mild OA or alternative hip pathologies. The surveys were administered during the intake process of the patient visit in a blinded fashion. They were then seen immediately after by the surgeon, who did not look at the survey answers.

Following survey completion, each question was scored individually, and a cumulative score was calculated. Responses were assigned point values of 0, 1, or 2, where 0 indicating the lowest likelihood of severe hip OA and 2 indicating the highest likelihood. After survey collection, patient charts were retrospectively reviewed to document the attending surgeon's initial diagnosis and treatment recommendations. Diagnoses included hip OA, greater trochanteric bursitis (GTB), lower back pain, or other hip-related conditions. Treatment recommendations were recorded and included physical therapy (PT), non-steroidal anti-inflammatory drugs (NSAIDs), intra-articular hip injections, or total hip arthroplasty (THA).

Statistical Analysis

Descriptive statistics were used to summarize study variables. Continuous variables were reported as means with standard deviations, while categorical variables were presented as frequencies and percentages. Logistic regression was employed to assess the association between total survey score, individual survey responses, and treatment recommendations (i.e., clinical diagnosis and intervention recommendation). Odds ratios (ORs) with 95% confidence intervals (CIs), and model c statistics were reported. Classical sandwich estimation was utilized to protect against model misspecification, while a p-value of <0.05 was used to determine statistical significance. A separate model was run for each treatment recommendation and pain score combination. In the modeling, total survey score was treated as a continuous variable while the individual survey responses were treated as categorical variables. The resulting ORs should be interpreted as the likelihood of having the diagnosis or intervention recommendation of interest compared to all others, with ORs >1 (ORs <1) indicating that increases in the pain score are associated with a greater (lower) likelihood of having outcome of interest. Receiver operating characteristic (ROC) analysis and Youden's J statistics were used to determine the optimal survey score threshold for diagnosing hip OA. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and corresponding 95% confidence intervals (CI) were calculated to assess the diagnostic performance of the survey.

Table 1. Descriptive statistics

Variable	Mean (SD) or n (%)
Q1. What age range do you fall in?	
+0 Under 55 years of age	13 (13.0%)
+1 55 to 65 years of age	32 (32.0%)
+2 Over 65 years of age	55 (55.0%)
Q2. What gender do you identify with?	
+0 Female	61 (61.0%)
+1 Male	39 (39.0%)
+0 Self describe as _____	0 (0.0%)
Q3. How would you classify your current occupation?	
+0 Mainly desk work or retired	74 (74.0%)
+1 On my feet all day	21 (21.0%)
+2 Heavy lifting work	5 (5.0%)
Q4. Where is your pain concentrated?	
+0 Lower back/buttocks	7 (7.0%)
+1 Lateral side of the hip	54 (54.0%)
+2 Groin	39 (39.0%)
Q5. How long has your pain been going on?	
+0 Less than a month	5 (5.0%)
+1 1–6 months	35 (35.0%)
+2 6+ months	60 (60.0%)
Q6. When did the pain start?	
+0 During activity	15 (15.0%)
+1 No specific incident/woke up with pain	69 (69.0%)
+2 Fall or trauma	16 (16.0%)
Q7. What have you currently done about your pain?	
+0 Nothing	9 (9.0%)
+1 Took medications or completed exercises+PT	91 (91.0%)
+2 Exercises/Stretching/	0 (0.0%)
Q8. How limited are you due to your joint pain?	
+0 Not Limited	11 (11.0%)
+1 Limiting my prior baseline activities	71 (71.0%)
+2 Fully limited	18 (18.0%)
Q9. Have you been previously told you have OA?	
+0 No	29 (20.0%)
+1 Yes, my primary care provider told me	26 (26.0%)
+2 Yes, an orthopedic specialist told me	54 (54.0%)

SD: Standard deviation; BMI: Body mass index; PT: Physical therapy; NSAID: Non-steroidal anti-inflammatory drugs

RESULTS

Patient Characteristics

Of the 100 completed surveys, the mean BMI of participants was 28.76 (SD: 6.07). At the time of survey completion, 55% of patients were over 65 years of age, 32% were between 55 and 65 years of age, while 13% were below the age of 55. The majority of the respondents were female (61%), and 74% reported being retired or working a sedentary desk job. Only 5% of patients worked in occupations requiring regular heavy lifting.

Regarding self-reported pain characteristics, most patients described lateral hip pain (54%) while 39% reported groin pain. The majority (69%) could not attribute their pain to a specific injury, and 60% had been experiencing symptoms for more than six months at the time of survey completion. Nearly all patients (91%) had previously attempted medications or PT for hip pain, and 54% had been told from an orthopedic specialist that they had hip OA.

Following chart review, 66% patients were diagnosed with hip OA at their first initial visit, while 16% were diagnosed with greater trochanteric bursitis. Physical therapy was the most frequently recommended treatment (45%), while surgery was recommended for 38% of patients [**Table 1**].

Diagnosis

Analysis of the association between the survey and clinical diagnosis showed that the total score was significantly related to the diagnoses of hip osteoarthritis (p=0.001), greater trochanteric bursitis (p=0.007), and low back pain (p=0.01). Odds ratios analysis demonstrated that higher total scores were associated with an increased likelihood of a hip OA diagnosis (OR=1.72), and a decreased likelihood of both GTB (OR=0.61) and low back pain (OR=0.72). The discriminative ability of the survey was strong, with associated c-statistics exceeding 0.70 for these diagnoses [**Table 2**].

ROC analysis combined with Youden's J statistic identified a total score of ≥9 as the threshold that maximized both sensitivity (83.3%) and specificity (55.9%) for diagnosing hip OA. At this threshold, the PPV was 78.6% and the NPV was 63.3% [**Table 3**].

Management

Logistic regression analysis found that none of the individual survey questions were significantly associated with the likelihood of receiving specific treatment recommendations including PT, medications, or injections. However, the total survey score was significantly correlated with the recommendation for surgery (OR=1.62, p=0.0005). The model's c-statistic (0.66) indicated moderate discriminative ability in predicting which patients were recommended for total hip arthroplasty [**Table 4**].

Table 2. Results of logistic regression model examining the association between the intake form total score and initial diagnosis (**P<0.05 are bolded**)

Initial Diagnosis	Mean Score	95% CI	Odds-ratio (95% CI)	P-Value	c
Hip Osteoarthritis	9.76	7.96–8.98	1.72 (1.24–2.38)	**0.001**	0.72
Greater Trochanteric Bursitis	8.19	7.42–8.96	0.61 (0.43–0.87)	**0.007**	0.70
Lower Back Pain	8.50	7.58–9.42	0.72 (0.55–0.94)	**0.01**	0.71
Other	9.00	7.56–10.44	0.88 (0.41–1.89)	0.75	0.51

Table 3. ROC data for all the diagnoses.

Diagnosis	Sensitivity Value (95% CI)	Specificity Value (95% CI)	Positive predictive value Value (95% CI)	Negative predictive value Value (95% CI)	Accuracy
Hip OA	0.83 (0.74–0.92)	0.56 (0.39–0.73)	0.79 (0.69–0.88)	0.63 (0.46–0.81)	74%
Greater trochanter bursitis	0.75 (0.66–0.84)	0.56 (0.32–0.81)	0.90 (0.83–0.97)	0.30 (0.14–0.46)	72%
Back pain	0.75 (0.66–0.84)	0.67 (0.40–0.93)	0.94 (0.89–0.99)	0.27 (0.11–0.42)	73%
Other	0.71 (0.61–0.80)	0.40 (0–0.83)	0.96 (0.91–0.99)	0.07 (0–0.16)	69%

Table 4. Results of logistic regression model examining the association between the intake form total score and recommended intervention. (**P<0.05 are bolded**)

Intervention	Odds-ratio (95% CI)	P-Value	c
PT	0.78 (0.60–1.02)	0.07	0.60
NSAID	0.81 (0.62–1.06)	0.12	0.60
Intra-articular injection	0.91 (0.65–1.27)	0.57	0.53
Total hip arthroplasty	1.62 (1.24–2.11)	0.0005	0.66

DISCUSSION

Total joint replacement, including total hip arthroplasty (THA), is projected to remain one of the most prevalent elective surgical procedures in the coming decades.[14] Currently, over seven million Americans have undergone total joint arthroplasty, experiencing improved function and pain relief despite advanced osteoarthritis (OA).[15] The continued success of this procedure, coupled with an aging population and rising obesity rates, is expected to drive a substantial

increase in THA utilization. Meeting this growing demand will require not only healthcare policy adjustments to expand the workforce of fellowship-trained adult reconstruction surgeons but also strategies to improve clinical efficiency.[2] Standardized, reliable patient-reported surveys offer a promising tool to streamline patient assessment, enhance surgeon planning, and optimize resource allocation. To our knowledge, no prior studies have evaluated the accuracy of a patient-reported survey as a diagnostic tool for severe hip OA requiring THA.

In this study, we examined the relationship between patient responses on a nine-item survey and an adult reconstruction surgeon's initial diagnosis and treatment recommendation. Our findings demonstrate that the cumulative score effectively differentiated patients diagnosed with hip OA from those with alternative conditions such as greater trochanteric bursitis or lower back pain. A cumulative score of ≥9 was identified as the optimal threshold, maximizing both sensitivity and specificity for hip OA diagnosis. Notably, the survey score was also significantly associated with the surgeon's recommendation for THA, suggesting its potential role in surgical decision-making.

Beyond its application in orthopedic specialty clinics, this survey may have significant value for primary care and emergency department (ED) physicians, who are often the first to evaluate patients with hip pain. Hip OA is a common complaint in both settings, yet differentiating OA from other causes of hip pain, such as bursitis, lumbar radiculopathy, or referred pain, can be challenging, particularly in time-limited encounters. A simple, intake survey could assist primary care providers in stratifying patients based on their likelihood of having hip OA, guiding earlier referrals to orthopedic specialists when surgical intervention may be needed. Similarly, in the ED setting, where musculoskeletal pain is a frequent complaint but advanced imaging and specialist consultation may not always be immediately available, this tool could provide a structured approach to risk-stratifying patients, ensuring that those with high scores receive appropriate follow-up while those with lower scores are directed toward nonoperative management.

This study represents the first of its kind to assess a novel nine-item patient-reported intake survey as a diagnostic aid for hip OA and a predictor of surgical intervention. As artificial intelligence (AI) continues to be integrated into healthcare, standardized questionnaires may serve as valuable screening tools to assist orthopedic clinical workflows and enhance AI-driven diagnostic models. By pre-screening patients before their initial consultation, such tools could improve efficiency, reduce wait times, and allow surgeons to focus on higher-risk patients requiring advanced interventions. In primary care and ED settings, incorporating this survey into initial patient evaluations could help expedite appropriate referrals, reduce unnecessary imaging, and improve overall patient care efficiency.

While our findings are promising, this study has several limitations. The short-form nature of the questionnaire restricts the breadth of patient demographic and clinical data captured. Factors such as family history, race/ethnicity, and dietary habits, which may influence hip OA risk and severity, were not accounted for.[16,17] Another inherent limitation is the potential for reporting bias, as patient-reported outcomes can be influenced by individual pain tolerance, recall accuracy, and emotional state at the time of survey completion. Additionally, this study was conducted within a single adult reconstruction clinic, which may limit the generalizability of findings to broader orthopedic and primary care populations. Further research is warranted to validate these findings in larger, more diverse cohorts and to assess the survey's performance in primary care and emergency medicine, where early identification of hip OA could facilitate timely referrals and interventions. Moreover, the generation and weighting of the survey questions was based on surgeon experience and prior studies which may be vulnerable to biases.[13] Future studies are needed to optimize the question selection and weighting to further improve the efficacy of our screening survey. Lastly, a senior arthroplasty attending selected patients for the osteoarthritis cohort based on the criteria of having a clinical exam and history as well as radiographic evidence consistent with osteoarthritis. We did not perform a formal evaluation of the radiographic presence or severity of osteoarthritis in this study. Future studies may investigate the relationship between clinical findings and radiographic osteoarthritis, as well as the correlation between survey scores and radiographic findings.

CONCLUSION

Patient-reported surveys may serve as valuable adjuncts in orthopedic clinical workflows by improving diagnostic efficiency and guiding treatment decisions. This study assessed a nine-item intake survey as a useful tool for distinguishing hip osteoarthritis from other causes of hip pain and demonstrated its correlation with total hip arthroplasty recommendations. Implementing structured intake surveys in orthopedic, primary care, and emergency medicine settings could facilitate earlier identification of hip OA, streamline referrals, and optimize patient management. Further research is needed to assess the survey's effectiveness in diverse clinical settings and its potential role in standardizing hip OA evaluation and treatment planning.

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