



OPEN ACCESS

# Patient and physician perspectives guiding intra-articular treatment choice in knee osteoarthritis: stakeholders are aligned on treatment priorities but have different assessments of treatment effect

Vandana Menon,<sup>1</sup> Caroline Huber,<sup>2</sup> Alexandria Portelli,<sup>2</sup> Marissa Baker-Wagner,<sup>2</sup> Scott Kelley,<sup>1</sup> Kathy Lang<sup>2</sup>

► Additional material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/jisakos-2020-000578>).

<sup>1</sup>Flexion Therapeutics Inc, Burlington, Massachusetts, USA  
<sup>2</sup>Precision Medicine Group Inc, Bethesda, Maryland, USA

## Correspondence to

Dr Kathy Lang, Precision Medicine Group Inc, Bethesda, Maryland 20810, USA; [kathy.lang@precisionvh.com](mailto:kathy.lang@precisionvh.com)

Accepted 15 March 2021  
Published Online First 8 April 2021

## ABSTRACT

**Objectives** Knee osteoarthritis (OA) is a leading cause of health-related disability. In the absence of curative non-operative therapies, treatment goals are limited to symptom relief. Data are limited on how patients and physicians prioritise available treatment options. We assessed patients' preferences for and physicians' attitudes towards intra-articular treatments including corticosteroids (IACS), an extended-release corticosteroid (TA-ER) and hyaluronic acids (IAHA).

**Methods** We conducted a prospective, IRB-exempt, double-blind survey of patients with and providers who treat knee OA. Respondents were required to have received or prescribed TA-ER in a non-trial setting. We evaluated patients' OA history, impact of knee OA and treatment preferences, and physicians' decision-making and prescribing experiences.

**Results** Of the 97 patient participants, mean age was 56 years, 70.0% were women, 75.0% had bilateral knee OA and 46.4% were diagnosed over 5 years ago. Of the 50 physician participants, 42.0% were orthopaedic surgeons, 34.0% were rheumatologists and 60.0%, on average, treat 50+ patients with knee OA per month. Treatment selection factors considered 'very important' to patients and physicians included disease severity (88.7%, 82.0%), impact on quality of life (88.7%, 72.0%), disease extent (84.5%, 54.0%) and activity level (80.4%, 64.0%). A majority (93.8%) of patients indicated moderate to severe difficulty with their knees. Fewer patients (76.3%) reported shared decision making compared with physicians (92.0%). Half (50.5%) of the patients reported that they experienced months of pain relief with TA-ER, 27.7% with IACS and 18.8% with IAHA. Physician assessments were consistent but estimated a greater duration of treatment effects than that reported by patients across all therapies.

**Conclusion** While knee OA has a tremendous impact on patients, there are significant unmet treatment needs. The increasing use of patient-reported outcomes will allow patients and physicians to track pain and functional status over time and across therapies, improving shared decision-making.

## INTRODUCTION

Osteoarthritis (OA) of the knee, a highly prevalent degenerative joint disease, is a leading global cause of disability.<sup>1</sup> An estimated one in two Americans will develop knee OA over their lifetime.<sup>2</sup> This chronic progressive disease is characterised

## What are the new findings

- For both patients and physicians surveyed, disease severity (88.7% of patients; 82% of physicians) and impact on quality of life (88.7% of patients; 72.0% of physicians) were assessed as the most important factors in making knee osteoarthritis (OA) treatment decisions.
- While both patients and physicians reported discussing different treatment options for their knee OA (86% of both groups reported thoroughly weighing treatment options), fewer patients than physicians reported that the decision to choose an intra-articular treatment therapy was a shared one (76.3% of patients vs 92% of physicians).
- Patients reported longer-lasting pain relief and functional improvement with triamcinolone acetonide extended-release compared with intra-articular injections of corticosteroids and intra-articular hyaluronic acid. Overall, physicians reported a greater duration of effect than patients across all treatments, however.

predominantly by pain leading to substantial reductions in functional status, mobility and quality of life.<sup>3,4</sup>

Currently, there are limited therapeutic options and no non-operative curative treatments for knee OA. The primary goals of non-surgical management are to reduce pain and maintain or improve function and health-related quality of life (HRQoL).<sup>5</sup> Available therapeutic modalities include non-pharmacological options, such as lifestyle modification, physical therapy and assistive devices, and pharmacological options, such as acetaminophen, oral and topical non-steroidal anti-inflammatory drugs (NSAIDs), opioids and intra-articular injections.<sup>6,7</sup> Intra-articular injections of corticosteroids (IACS) and hyaluronic acid (IAHA) are commonly used, especially in patients with more advanced knee OA.<sup>8,9</sup> For example, a large commercial claims analysis found that over 50% of patients with OA received IACS or IAHA.<sup>10</sup> Another study found that IACS was the most frequently selected OA treatment among hip and knee surgeons.<sup>11</sup> Recent clinical guidelines, however, recommend IACS over other forms of IA therapies based on the benefit-risk profiles.<sup>6,12</sup>



© International Society of Arthroscopy, Knee Surgery and Orthopaedic Sports Medicine 2021. Re-use permitted under CC BY-NC. No commercial re-use. Published by BMJ.

**To cite:** Menon V, Huber C, Portelli A, et al. *J ISAKOS* 2021;**6**:271–276.

**Table 1** Patient demographic characteristics

Patient demographic characteristics	Patients n=97 n (%)
Age	
Mean±SD	55.8±13.0
Gender	
Female	70 (72.2)
Race	
Black or African American	8 (8.3)
White or Caucasian	80 (82.5)
Other	9 (9.3)
Type of health insurance	
Medicare/Medicaid	31 (32)
Private	41 (42.3)
Multiple	19 (19.6)
Other	6 (6.2)

Given the progressive nature of knee OA, patients may try several different therapies over the course of their lifetime. Treatment choice for knee OA is highly patient-specific and depends on disease characteristics, expectations, preferences and clinician recommendations.<sup>13</sup> These patient-level factors also create heterogeneity in treatment response.<sup>14,15</sup> In 2017, the FDA approved an extended-release IA corticosteroid (TA-ER) for OA knee pain.<sup>16</sup> While a number of studies have assessed preferences for and experiences with knee OA treatments, to our knowledge, none has specifically assessed these factors across IA treatments, including TA-ER.<sup>17–23</sup> This study aimed to describe treatment priorities, perceptions of shared decision-making and treatment experiences among patients and providers who have experience with IA therapies, including TA-ER.

## MATERIAL AND METHODS

### Study design and sample

We conducted a double-blind cross-sectional survey of patients with knee OA and physicians who treat such patients. Separate survey instruments were developed for patients and physicians based on a targeted review of the literature evaluating treatment satisfaction, treatment decision-making, including facilitators of and barriers to certain treatments, and the patient–physician relationship in knee OA (see online supplemental file). A convenience sampling approach was used to survey up to 100 patients and 50 physicians.

We recruited for the surveys using two separate panels of geographically diverse individuals who agree to participate in survey research: adults (aged 18+) in the general population in the USA and physicians licensed and practicing medicine in the USA. Email invitations containing links to the surveys were sent to the panel members. Interested patient respondents completed a screener to assess certain demographic and clinical characteristics. The screener also contained an information statement providing an overview of the study and indicating that participation in the study was voluntary. All participants were asked to review the information statement and provide consent. Patients who gave informed consent and met the following inclusion criteria based on their responses to the screener questions were invited to participate in the full survey: aged 18 years and older, told by a physician they have knee OA in one or both knees and received TA-ER as a treatment for their knee OA in a routine (non-trial) setting. Similarly, interested physician respondents were asked to complete a screener to assess consent and certain

demographic and clinical experience characteristics. Physicians who met the following criteria based on their responses to the screener were invited to participate in the full survey: actively licensed and practicing medical doctor (MD or DO), specialises in orthopaedics, rheumatology, rehabilitative medicine or sports medicine and has prescribed TA-ER as a treatment for knee OA in a routine (non-trial) setting.

The internet-based surveys were programmed, fielded and hosted electronically by Jibunu, a market research firm, between September and December 2019. No personally identifying information was collected, and the study was deemed to be exempt from IRB oversight by Advarra IRB (Study ID: Pro00037350). Both patients and physicians received compensation in the form of a nominal gift card for participation in the survey.

### Study measures

We collected data from patients on their knee OA history, HRQoL, treatment decision-making processes and preferences, treatment satisfaction and relationship with their knee OA care physician. We adapted the Knee Injury and Osteoarthritis Score (KOOS) to assess HRQoL. The KOOS assesses patients' opinions and problems with their knee OA and includes five subscales; we adapted the quality of life subscale.<sup>24</sup> To assess treatment satisfaction, we adapted the Treatment Satisfaction Questionnaire for Medication (TSQM). The TSQM was designed to assess patient satisfaction with specific medications and comprises effectiveness, side effects, convenience and global satisfaction.<sup>25</sup> Patients who indicated they had experience with intra-articular injections were asked about their experiences and satisfaction with the therapies, specifically IACS, IAHA and TA-ER. We adapted the Shared Decision Making Questionnaire (SDM-Q-9) to assess the patient–physician relationship in knee OA care and treatment decisions. The SDM-Q-9 is the patient version of an instrument that evaluates the extent to which patients are involved in the treatment decision-making process.<sup>26</sup>

We collected data from physicians on their knee OA patient population, treatment decision-making, treatment prescribing experiences including specific patient characteristics that would make them more or less likely to prescribe TA-ER and the patient–physician relationship in knee OA. Physicians who indicated they had experience with IA injections were asked about their experiences and satisfaction with TA-ER, IACS and IAHA. The patient–physician relationship was assessed using an adaptation of the SDM-Q-Doc,<sup>26</sup> while the treatment decision-making and prescribing experience questions were developed based on the targeted literature review. The SDM-Q-Doc assesses the extent to which patients are involved in the treatment decision-making process from the physician perspective.

### Data analysis

Data from all eligible study participants were included in the descriptive analysis. Participants were excluded if they had incomplete survey responses (abandoned or terminated the survey) or if they completed the survey in under 5 min. Demographic, clinical characteristics and treatment patterns were summarised using counts and percentages for categorical variables. Measures of central tendency (mean/median/SD/IQR) were used for continuous variables. Since participants were recruited using convenience sampling techniques, study data were not analysed to make inferences about the broader population of patients with knee OA and physicians who treat patients with knee OA. All analyses were conducted using SAS V.9.3.

Table 2 Patient clinical characteristics

Patient clinical characteristics	Patients n=97 n (%)
Location of osteoarthritis	
One knee only	24 (24.7)
Both knees	73 (75.3)
Time since onset of noticeable symptoms	
Less than 3 years ago	16 (16.5)
Between 3 and 5 years ago	33 (34)
More than 5 years ago	48 (49.5)
Time since diagnosis	
Less than 3 years ago	23 (23.7)
Between 3 and 5 years ago	29 (29.9)
More than 5 years ago	45 (46.4)
Type of doctor seen for KOA	
Rheumatologist	11 (11.3)
Orthopaedist/orthopaedic surgeon	58 (59.8)
Primary care	18 (18.6)
Other	10 (10.3)
Prior treatments for knee OA	
Acetaminophen*	60 (61.9)
OTC NSAIDs†	56 (57.7)
Prescription-only NSAIDs	47 (48.5)
Prescription-only pain medications‡	53 (54.6)
Topical creams or patches	70 (72.2)
Magnetic pulse therapy	17 (17.5)
IACS§	65 (67)
Viscosupplement¶ (IAHA)	16 (16.5)
TA-ER	97 (100)
Knee surgery	35 (36.1)
How often are you aware of your KOA and symptoms?	
Weekly or longer	11 (11.4)
Daily	45 (46.4)
All the time or constantly	41 (42.3)
How have you modified your lifestyle to avoid potentially damaging activities to your knee(s)?	
Mildly or not at all	20 (20.6)
Moderately	38 (39.2)
Significantly	39 (40.2)
How much are you troubled by a lack of confidence in your knee(s)?	
Mildly or not at all	16 (16.5)
Moderately	39 (40.2)
Significantly	42 (43.3)
In general, how much difficulty do you have with your knee(s)?	
Mildly or none	6 (6.2)
Moderate	54 (55.7)
Severe	37 (38.1)

\*For example, Tylenol.

†For example, Advil/ibuprofen.

‡For example, Codeine, tramadol, hydrocodone, hydromorphone, morphine, methadone, oxycodone, fentanyl.

§Other than triamcinolone acetonide extended-release.

¶Hyaluronic acid injection.

IACS, intra-articular injections of corticosteroids; IAHA, intra-articular hyaluronic acid; KOA, knee osteoarthritis; NSAID, non-steroidal anti-inflammatory drug; OA, osteoarthritis; OTC, over the counter; TA-ER, triamcinolone acetonide extended-release.

## RESULTS

### Patient respondent characteristics

During the survey period, a total of 97 patients met the study inclusion criteria and completed the full survey, out of 4956 who responded to the survey invitation. Reasons for exclusion included ineligibility based on the screener and incomplete responses. The sample was predominantly women (72.2%) and Caucasian (82.5%) with a mean±SD age of 55.8±13 years (table 1). Three quarters of the sample reported bilateral knee OA and almost half reported

Table 3 Physician characteristics

Physician characteristics	Physicians n=50 n (%)
Age	
Mean±SD	56.5 (±15.5)
Gender	
Male	45 (90)
Race	
White or Caucasian	34 (68)
Asian	8 (16)
Other	8 (16)
Average number of patients treated for knee OA each month	
1–25 patients	5 (10)
26–50 patients	15 (30)
More than 50 patients	30 (60)
Proportion of patients currently seeking care for knee OA	
≤25%	15 (30)
26%–50%	22 (44)
51%–100%	13 (26)
Number of patients treated with TA-ER in the past 6 months	
≤5	9 (18)
6–12	18 (36)
13–20	12 (24)
≥21	11 (22)
Type of physician	
Rheumatologist	17 (34)
Orthopaedist/orthopaedic surgeon	21 (42)
Sports medicine physician	7 (14)
Physical medicine and rehabilitation physician	5 (10)
Treatments that have been prescribed or recommended	
Acetaminophen*	44 (88)
OTC NSAIDs†	48 (96)
Prescription-only NSAIDs	47 (94)
Topical creams or patches	47 (94)
Magnetic pulse therapy	6 (12)
Corticoid steroid injection‡ (IACS)	50 (100)
Viscosupplement§ (IAHA)	49 (98)
TA-ER	50 (100)
Prescription-only pain medications¶	41 (82)
Knee surgery	48 (96)

\*For example, Tylenol.

†For example, Advil/ibuprofen.

‡Other than triamcinolone acetonide extended-release.

§Hyaluronic acid injection.

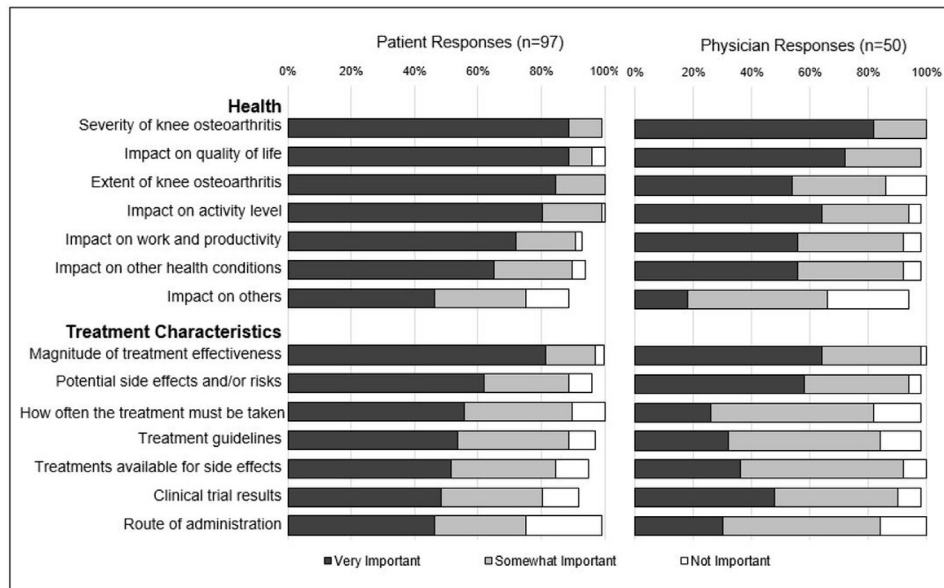
¶For example, codeine, tramadol, hydrocodone, hydromorphone, morphine, methadone, oxycodone, fentanyl.

IACS, intra-articular injections of corticosteroids; IAHA, intra-articular hyaluronic acid; NSAID, non-steroidal anti-inflammatory drug; OA, osteoarthritis; TA-ER, triamcinolone acetonide extended-release.

long-standing symptoms (more than 5 years) (table 2). Nearly 60% of patients reporting seeing an orthopaedist or orthopaedic surgeon for their knee OA care, while 18.6% of patients see their primary care physician and 11.3% see a rheumatologist. The majority of patients reported having used topical creams or patches (72.2%), IACS (67.0%), acetaminophen (61.9%) and over-the-counter NSAIDs (57.7%), while only 16.5% reported IAHA use. Most patients indicated their knee OA significantly impacts their life. Nearly all patients (88.7%) reported being aware of their condition daily or constantly and indicated that they have moderate or severe difficulty with their knee(s) (93.8%), while 79.4% reported that they modified their lifestyle moderately or significantly because of their OA.

### Physician respondent characteristics

Of 297 physicians who responded to the initial invitation, 50 physicians met the inclusion criteria and completed the survey.



**Figure 1** OA health and treatment-related factors perceived most important by patient and physician respondents. Reported in proportion of responses. Participants could choose more than one option. OA, osteoarthritis.

The sample was predominantly men (90.0%) and Caucasian (68.0%) with a mean±SD age of 57±15 years (table 3). More than half of physicians (60.0%) reported treating more than 50 patients with knee OA each month and nearly half (46%) reported treating more than 13 patients with TA-ER in the 6 months prior to the survey. The most commonly reported specialties were orthopaedic surgery (42.0%) and rheumatology (34.0%). All physician participants reported experience prescribing or recommending IACS (100.0%), while almost all reported experience with IAHA (98.0%), OTC NSAIDs (96.0%), prescription-only NSAIDs (94.0%) and topical creams or patches (94.0%).

### Factors considered in knee OA treatment selection

Patients and physicians reported similar attributes as highly important when making decisions about knee OA treatments (figure 1). For both groups, disease severity (mild vs debilitating) was assessed as the most significant factor when selecting a knee OA treatment, with 88.7% of patients and 82.0% of physicians classifying severity as ‘very important’. The impact of a treatment on a patient’s quality of life also was considered ‘very important’ for 88.7% of patients and 72.0% of physicians when making treatment-related decisions. The magnitude of a treatment’s effectiveness (81.4% of patients; 64.0% of physicians), patient activity level (80.4% of patients; 64.0% of physicians) and extent of knee OA (both vs one knee) (84.5% of patients; 54.0% of physicians) were also considered ‘very important’ factors in treatment determinations.

Fewer patients and physicians reported route of administration (46.4% of patients; 30.0% of physicians), availability of other treatments to manage side effects (51.5% of patients; 36.0% of physicians) and frequency of treatment administration (55.7% of patients; 26.0% of physicians) as important factors. More patients assessed treatment guidelines (53.6% of patients; 32.0% of physicians) and a treatment’s impact on productivity (72.2% of patients; 56.0% of physicians) as well as other individuals such as spouse or family (46.4% of patients; 18.0% of physicians) as ‘very important’ factors compared with physicians.

### Shared treatment decision-making

Almost all patients (86.6%) and physicians (92.0%) concurred that they discussed different treatment options for knee OA. Patients (86.6%) and physicians (86.0%) reported discussing the disadvantages and advantages of the knee OA treatment options. Fewer patients (76.2%), compared with physicians (90.0%), reported that treatment options were thoroughly weighed and that the decision to choose an IA therapy was a shared one (76.3% patients, 92.0% of physicians).

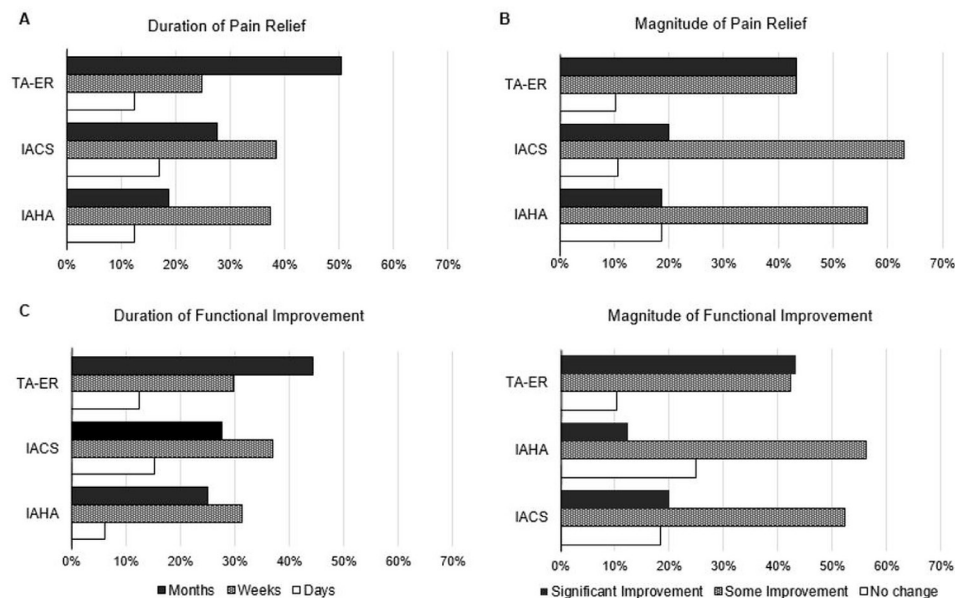
### Experience with and perspectives on intra-articular injections

Across the three evaluated intra-articular knee OA treatment options, 50.5% of patients reported that they experienced pain relief lasting months with TA-ER, 27.7% reported the same with IACS and 18.8% with IAHA; 43.3% reported ‘significant’ improvement in pain with TA-ER, 20.0% with IACS and 18.8% with IAHA (figure 2). For functional improvement, 44.3% of patients reported months of improvement with TA-ER, 27.7% with IACS and 25.0% with IAHA and 43.3% patients report ‘significant’ functional improvement with TA-ER, 20.0% with IACS and 12.5% with IAHA.

Overall, physicians reported a greater duration of effect than patients for all therapeutic modalities. Sixty-eight per cent of physicians reported that their patients experience months of pain relief with TA-ER, 46.0% with IACS and 53% with IAHA. Similarly, 70% of physicians responded their patients experience functional improvements lasting months with TA-ER, 40.0% for IACS and 59.0% for IAHA.

### DISCUSSION

Knee OA is a highly prevalent and debilitating disease with limited effective treatment options. Patients often cycle through various knee OA therapies in an attempt to achieve symptom relief and improve or maintain functional status. Given the widespread use of IA therapies in OA and lack of current evidence specifically focused on these therapeutic options, we sought to understand and describe patient and physician decision-making



**Figure 2** Patient assessment of intra-articular knee OA treatments. IACS, Intra-articular injections of corticosteroids (n=65); IAHA, intra-articular hyaluronic acid (n=16); OA, osteoarthritis; TA-ER, triamcinolone acetonide extended-release (n=97).

processes when choosing treatments for knee OA, as well as characterise their experiences with current IA therapies.

Our results indicate that patients and physicians are generally aligned on the factors that are considered important in knee OA treatment choice. In keeping with other studies, the respondents in our survey identified disease severity and extent, quality of life and activity level as very important attributes when selecting a treatment.<sup>5 13 23 27</sup> Productivity and a treatment's impact on other individuals including family members, however, were considered more important by patients than physicians. This finding represents an opportunity to better incorporate the non-medical consequences of knee OA such as work loss and caregiver burden in shared decision-making.<sup>28–30</sup> To our knowledge, there have been limited studies that have focused on experiences and preferences with IA therapy. One recent qualitative study among US patients who had received IA therapies, however, found that disease severity and activity limitations were important factors in treatment selection.<sup>31</sup> Further, participants in this study felt there was a lack of consensus among providers (especially across different specialties) around the effectiveness of different IA therapies. This finding aligns with our study results that found patients and providers perceive different magnitudes of effect among the IA therapies assessed.<sup>31</sup>

Patients and physicians largely agreed that the decision regarding choice of IA therapy was based on a collaborative process in which different treatment options were discussed and evaluated, including the associated advantages and disadvantages. A greater proportion of physicians reported agreement with the shared decision-making attributes than patients suggesting the need for further improvements in patient-centred knee OA care.<sup>23</sup> There were differences between patient reports and physicians' perceptions of the effectiveness of all IA therapies, however, in terms of duration of pain relief and functional improvements. Compared with patients, however, physicians reported a greater magnitude of effect across all IA treatments assessed in this study. Our results are in line with research that suggests patient-reported outcomes (PROs) are useful markers of disease activity and should be more comprehensively included in knee OA care.<sup>32 33</sup> The use of PROs in clinical practice allows patients and physicians to track pain, functional status and

HRQoL over time and across therapies and thus refine the shared decision-making process for the management of knee OA.<sup>32</sup>

Future research is needed to explore differences in patient perspectives and experiences with IA treatments according to clinical and demographic characteristics (eg, race, geographical location). For example, this study did not assess patients' underlying causes of OA (ie, post-traumatic vs degenerative), their experiences based on their severity or their lifestyle including work and other activities, which may impact treatment preferences. It also did not examine how geographic location or race may influence treatment decision-making. Further, given the numerous treatment options for patients, additional studies are needed to explore patients' experiences with concomitant IA therapy and non-pharmacological interventions, such as lifestyle modifications and physical therapy. This evidence can further support optimal treatment decision-making in OA.

As with any convenience survey, the respondents may not be representative of the broader population of patients with knee OA and physicians who care for them. While web-based surveys have the advantages of reducing data entry errors and facilitating timely completion, results reflect the responses of patients and physicians with access and comfort using the technology. Given that OA commonly occurs among older adults, the use of a web-based survey may have resulted in a younger sample population (mean 56.5) than is typical of the general OA population. Our findings are in line with previous research, however, that found the mean age of symptomatic OA diagnosis in the USA was 53.5 years.<sup>34</sup>

Respondents may have inaccurately remembered past events, including treatment decisions and clinical outcomes and responses to treatment. Further, in order to ensure that we would gather data on patient and physician experiences with TA-ER specifically—which is not as commonly used as IACS—we required survey respondents to have either received or administered TA-ER. This may have introduced further bias around perceptions of treatment effectiveness and benefit, in that patients and providers who have used TA-ER may not be representative of patients with typical knee OA and provider populations. Given the study's focus on understanding perspectives on IA treatments, this study also did not capture all possible OA treatments,

including non-pharmacological options. As such, perceived treatment experiences may have been biased if patients were using concomitant medications. Last, this study was descriptive in nature, so no statistical tests were used to assess differences across the included treatments.

## CONCLUSION

Knee OA has a tremendous impact on quality of life, and patients have significant unmet treatment needs. Patients and physicians in this survey identified similar clinical attributes (eg, disease severity) as very important in making knee OA treatment decisions. Differences among the patients and providers in this study around the value of non-medical consequences in treatment decision-making as well as perceived duration of effect among IA therapies, highlight the need for greater use of PROs in clinical practice. Findings from this study, especially around the differences in perceived duration of effect of IA therapies, may directly support clinical practice through a greater awareness of the value of shared decision-making. Future studies are needed, however, to better characterise the patient populations, including demographic and clinical characteristics and prior treatment patterns, who benefit most from different IA therapies, especially as new treatment innovations emerge.

**Correction notice** Since Online publication, the authors have noticed that the numbers and percentages for the reported specialities of physician participants were reversed in Table 3. This has now been corrected accordingly to 'orthopaedic surgery (42.0%) and rheumatology (34.0%)'.

**Contributors** CH, KL, MB-W and AP contributed to the conceptualisation and design of the study. CH, KL, MB-W, AP, VM and SK contributed to the analysis and interpretation of results. CH, KL, MB-W, AP, VM and SK also supported in the drafting of this manuscript, provided final approval for publication and agree to be accountable for all aspects of the work.

**Funding** This study was funded by Flexion Therapeutics.

**Competing interests** CH, AP, MB-W and KL are employees of PRECISIONheor, which received financial support from Flexion to conduct the study described in this manuscript. VM is a former employee of and held stock in Flexion Therapeutics. SK is a current employee of and holds stock in Flexion Therapeutics.

**Patient consent for publication** Not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** All data relevant to the study are included in the article or uploaded as supplementary information. Data were reported in aggregate and deidentified.

**Supplemental material** This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, an indication of whether changes were made, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

## REFERENCES

- Wallace IJ, Worthington S, Felson DT, *et al*. Knee osteoarthritis has doubled in prevalence since the mid-20th century. *Proc Natl Acad Sci U S A* 2017;114:9332–6.
- Murphy L, Helmick CG. The impact of osteoarthritis in the United States: a population-health perspective. *Am J Nurs* 2012;112:S13–19.
- Farr IJ, Miller LE, Block JE. Quality of life in patients with knee osteoarthritis: a commentary on nonsurgical and surgical treatments. *Open Orthop J* 2013;7:619–23.
- Hoogbeem TJ, den Broeder AA, de Bie RA, *et al*. Longitudinal impact of joint pain comorbidity on quality of life and activity levels in knee osteoarthritis: data from the osteoarthritis initiative. *Rheumatology* 2013;52:543–6.
- Newberry S, FitzGerald J, SooHoo N. *Treatment of osteoarthritis of the knee: an update review [Internet]*. Rockville (MD): agency for healthcare research and quality (US), 2017.
- Kolasinski SL, Neogi T, Hochberg MC, *et al*. 2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis Rheumatol* 2020;72:220–33.
- Jevsevar DS. Treatment of osteoarthritis of the knee: evidence-based guideline, 2nd edition. *J Am Acad Orthop Surg* 2013;21:571–6.
- Koenig KM, Ong KL, Lau EC, *et al*. The use of hyaluronic acid and corticosteroid injections among Medicare patients with knee osteoarthritis. *J Arthroplasty* 2016;31:351–5.
- Lapane KL, Liu S-H, Dubé CE, *et al*. Factors associated with the use of hyaluronic acid and corticosteroid injections among patients with radiographically confirmed knee osteoarthritis: a retrospective data analysis. *Clin Ther* 2017;39:347–58.
- Bedard NA, DeMik DE, Glass NA, *et al*. Impact of clinical practice guidelines on use of intra-articular hyaluronic acid and corticosteroid injections for knee osteoarthritis. *J Bone Joint Surg Am* 2018;100:827–34.
- Carlson VR, Ong AC, Orozco FR, *et al*. Compliance with the AAOS guidelines for treatment of osteoarthritis of the knee: a survey of the American association of hip and knee surgeons. *J Am Acad Orthop Surg* 2018;26:103–7.
- Bannuru RR, Osani MC, Vaysbrot EE, *et al*. OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. *Osteoarthritis Cartilage* 2019;27:1578–89.
- McAlindon TE, Bannuru RR, Sullivan MC, *et al*. OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis Cartilage* 2014;22:363–88.
- Kittelson AJ, George SZ, Maluf KS, *et al*. Future directions in painful knee osteoarthritis: harnessing complexity in a heterogeneous population. *Phys Ther* 2014;94:422–32.
- Deveza LA, Melo L, Yamato TP, *et al*. Knee osteoarthritis phenotypes and their relevance for outcomes: a systematic review. *Osteoarthritis Cartilage* 2017;25:1926–41.
- Paik J, Duggan ST, Keam SJ. Triamcinolone acetonide extended-release: a review in osteoarthritis pain of the knee. *Drugs* 2019;79:455–62.
- Hilgsmann M, Pinto D, Dennison E, *et al*. Patients' preferences for osteoarthritis treatment: the value of stated-preference studies. *Aging Clin Exp Res* 2019;31:1–3.
- Laba T-L, Brien J-anne, Fransen M, *et al*. Patient preferences for adherence to treatment for osteoarthritis: the MEDication Decisions in Osteoarthritis Study (MEDOS). *BMC Musculoskelet Disord* 2013;14:160.
- Posnett J, Dixit S, Oppenheimer B, *et al*. Patient preference and willingness to pay for knee osteoarthritis treatments. *Patient Prefer Adherence* 2015;9:733–44.
- Ratcliffe J, Buxton M, McGarry T, *et al*. Patients' preferences for characteristics associated with treatments for osteoarthritis. *Rheumatology* 2004;43:337–45.
- Selten EM, Vriezckolk JE, Geenen R, *et al*. Reasons for treatment choices in knee and hip osteoarthritis: a qualitative study. *Arthritis Care Res* 2016;68:1260–7.
- Taylor SD, Everett SV, Taylor TN, *et al*. A measure of treatment response: patient and physician satisfaction with traditional NSAIDs for osteoarthritis control. *Open Access Rheumatol* 2013;5:69–76.
- Papandony MC, Chou L, Senevickrama M, *et al*. Patients' perceived health service needs for osteoarthritis (OA) care: a scoping systematic review. *Osteoarthritis Cartilage* 2017;25:1010–25.
- Roos EM, Lohmander LS. The knee injury and osteoarthritis outcome score (KOOS): from joint injury to osteoarthritis. *Health Qual Life Outcomes* 2003;1:64.
- Atkinson MJ, Sinha A, Hass SL, *et al*. Validation of a general measure of treatment satisfaction, the Treatment Satisfaction Questionnaire for Medication (TSQM), using a national panel study of chronic disease. *Health Qual Life Outcomes* 2004;2:12.
- Patient as Partner. SDM-Q-9 / SDM-Q-Doc, 2019. Available: [http://www.patient-als-partner.de/index.php?article\\_id=20&clang=2/](http://www.patient-als-partner.de/index.php?article_id=20&clang=2/) [Accessed 24 Jul 2019].
- Hauk L. Treatment of knee osteoarthritis: a clinical practice guideline from the AAOS. *Am Fam Physician* 2014;89:918–20.
- Murphy LB, Cisternas MG, Pasta DJ, *et al*. Medical expenditures and earnings losses among US adults with arthritis in 2013. *Arthritis Care Res* 2018;70:869–76.
- Kotlarz H, Gunnarsson CL, Fang H, *et al*. Osteoarthritis and absenteeism costs: evidence from US national survey data. *J Occup Environ Med* 2010;52:263–8.
- Palazzo C, Nguyen C, Lefevre-Colau M-M, *et al*. Risk factors and burden of osteoarthritis. *Ann Phys Rehabil Med* 2016;59:134–8.
- MacFarlane LA, Williams EE, Lenhard NK, *et al*. Factors influencing physician recommendation for intra-articular therapies in osteoarthritis: a qualitative study. *Arthritis Care Res* 2020.
- Sørensen NL, Hammeken LH, Thomsen JL, *et al*. Implementing patient-reported outcomes in clinical decision-making within knee and hip osteoarthritis: an explorative review. *BMC Musculoskelet Disord* 2019;20:230.
- Golightly YM, Allen KD, Nyrop KA, *et al*. Patient-reported outcomes to initiate a provider-patient dialog for the management of hip and knee osteoarthritis. *Semin Arthritis Rheum* 2015;45:123–31.
- Losina E, Weinstein AM, Reichmann WM, *et al*. Lifetime risk and age at diagnosis of symptomatic knee osteoarthritis in the US. *Arthritis Care Res* 2013;65:703–11.