Outcomes of a conservative care program for knee osteoarthritis through translation of research into practice

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Abstract

Introduction: Evidence-based guidelines suggest a conservative, nonsurgical approach as first-line treatment for knee osteoarthritis. However, previous literature has documented underutilization of the fundamental components of condition management emphasized in the guidelines. The intervention aim is to apply organized conservative components of care for knee osteoarthritis in an evidence-based management program through the translation of research into practice with a target to observe meaningful functional improvement in a distinct population.

Methods: The program, modeled after the nonsurgical arm of a randomized, controlled trial, was designed as a single-arm observational cohort study with a pre- and post-program comparison for participants reporting presence of knee osteoarthritis who were attributed to a specific employer’s health plan in the United States. The 12-week intervention consisted of condition education, group exercise, and a dietary intervention.

Results: Ninety-six participants enrolled in the program, of which 72% completed the protocol. The median change in pre- to post-program Knee Injury and Osteoarthritis Outcome Score values was 10.4 ± 0.8 (Z = 210.5, p < 0.001)—a clinically important change. Secondary outcomes were complementary to the primary outcome.

Conclusions: Results of the program indicate that the clinically significant 3-month findings in the report by Skou et al. (2015) regarding functional improvement can be replicated in an alternate setting. Organizing and offering fundamental components of condition management in a group format with provider oversight could be a feasible and logical component in the continuum of care for knee osteoarthritis, while complementing other secondary management strategies following diagnosis.

KEYWORDS
employer-based health plans, knee osteoarthritis, population health, quality improvement

1 | INTRODUCTION

Osteoarthritis (OA) is the most common form of arthritis (Lawrence et al., 2008), and the knee is the most frequently affected joint (Oliveria, Felson, Reed, Cirillo, & Walker, 1995). While it affects people of every age across racial and ethnic groups, its prevalence is higher among women than men and increases with age (Barbour, Helmick, Boring, & Brady, 2017; Litwic, Edwards, Cooper, & Dennison, 2013; Zhang & Jordan, 2010). A population-based study in the United Kingdom identified that one of three individuals age 45 or older had sought treatment for OA (Arthritis Research UK, 2013). The extent of the population impacted by knee OA is expected to
continue to escalate due to an aging population and the obesity epidemic, among other factors (National Institute for Health and Care Excellence, 2014; Zhang & Jordan, 2010). Beyond the pain, stiffness, and mobility limitations associated with knee OA, the presence of knee OA increases the risk of and impacts the ability to manage (Osteoarthritis Research Society International, 2016) other chronic conditions—notably cardiovascular disease (Williams et al., 2018). Likewise, the presence and severity of knee OA is specifically associated with the prevalence of frailty with suggested mechanisms including both a decline in physical activity and a state of systemic inflammation (Misra et al., 2015).

Available evidence-based guidelines including the American College of Rheumatology (ACR), American Academy of Orthopedic Surgeons (AAOS), National Institute for Health and Care Excellence (NICE), and Osteoarthritis Research Society International (OARSI) suggest that patients begin management of knee OA using core conservative options and applied nonsurgical options before progressing to surgical intervention in cases where nonsurgical treatment fails to relieve the underlying symptoms (Hochberg et al., 2012; Jevsevar et al., 2013; McAlindon et al., 2014; National Institute for Health and Care Excellence, 2014). Conservative options include adequate physical exercise, weight management, and self-management education. Applied nonsurgical options include physical therapy and specific intra-articular injections. The widely accepted surgical treatment option for knee OA is knee arthroplasty.

Despite the strong, unequivocal recommendation of the previously stated conservative care options as initial and fundamental components to manage knee OA, published reports indicate that each component is underutilized. Wallis, Webster, Levinger, and Taylor (2013) reported that a minority of individuals with knee OA meet physical activity guidelines and participate in less physical activity than age-matched healthy controls without OA. Fear of activity and movement has been shown to be common in those diagnosed with knee OA (Gunn et al., 2017), which impacts willingness to participate in physical exercise without prescriptive guidance, or at all, as reports have demonstrated distrust in the safety and potential benefit of exercise (Holden, Nicholls, Young, Hay, & Foster, 2012). This hesitancy is illustrated through findings by Healey et al. (2018) in which as few as 4% and 13% of individuals who sought medical care for joint pain in the last 12 months have attempted aerobic exercise or muscle-strengthening activity, respectively, to counteract the issue. Similarly, in the previous 12 months, less than one of four had consulted written information for self-management tips and less than 10% attempted weight management through dieting. In contrast, those with joint pain were more willing to turn to forms of pharmacologic management such as paracetamol (31.3%), oral anti-inflammatory (31.4%), or stronger painkillers (40.4%) (Healey et al., 2018). It is conceivable that individuals affected with knee OA do not have a full understanding of treatment options available, highlighting the importance of fully educating the affected population on the various options encouraging patient-centric decisions. This need is also reflected in the medical economics literature on information asymmetry and agency in the physician–patient relationship, where patients rely upon providers to inform them on treatment options that are appropriate for their condition (Getzen, 1997). Thus, patients are more likely to participate in specific treatments to the extent that their health care provider advocates for conservative care and their family and friends support the decision (Hofstede et al., 2016).

Beyond the aforementioned underutilized conservative options, research has documented fragmentation and gaps between current practice patterns and clinical practice guidelines regarding the utilization of applied nonsurgical treatments. The ACR, AAOS, NICE, and OARSI guidelines broadly recommend managing knee OA with components that can be applied through formal physical therapy (Hochberg et al., 2012; Jevsevar et al., 2013; McAlindon et al., 2014; National Institute for Health and Care Excellence, 2014). All four stated guidelines include the appropriate use of oral or topical anti-inflammatories, paracetamol, and intra-articular corticosteroid injections, though both paracetamol and intra-articular corticosteroid injections are graded “inconclusive” by the AAOS in the management of knee OA. The NICE and OARSI guidelines provide additional support for the judicious use of bracing. To explore the concordance of treatment recommendations with application, Dhawan et al. (2014) utilized a commercial payer database in the United States to demonstrate that only 10% of patients experienced physical therapy for diagnosed knee OA in the 5 years preceding knee arthroplasty. In addition, during the same time period, less than 3% of patients were treated with a varus or valgus directing unloader brace, and only 44% and 15% of patients were treated with either an intra-articular corticosteroid injection or a hyaluronic acid intra-articular injection, respectively. However, nearly 20% of the population underwent knee arthroscopy in the 5 years preceding knee arthroplasty, with the majority of the procedures occurring within 1 year of eventual knee arthroplasty. Contrary to recommendations, more than one third of the knee arthroscopy procedures took place without coded diagnosis of a meniscal tear or loose body (Dhawan et al., 2014). Explanations have been suggested to account for the gap between evidence-based recommendations and their adoption, including a lack of trust in nonsurgical treatments among providers, practitioner preference for surgery (Hofstede et al., 2016), and lack of organization and clarity about the roles and responsibilities of providers towards patient care for the condition (Selten et al., 2017).

Although the utilization of nonsurgical management of knee OA is largely underwhelming, surgical rates have climbed considerably. The increasing incidence and prevalence of knee arthroplasty in the United States has been widely reported (Maradit et al., 2015). Whereas the utilization per capita of knee arthroplasty is greatest in the United States, similar concurrent growth has been observed in the United Kingdom (Culliford et al., 2010) and other developed countries without signs of slowing (Pabinger, Lothaller, & Geissler, 2015; Singh, Yu, Chen, & Cleveland, 2019). Though the most common age for those undergoing primary knee arthroplasty in the United States is 66 years (American Joint Replacement Registry, 2017), the growth rate of knee replacement worldwide in those less than 65 years of age is twice that of those who are 65 years or older (Papinger et al., 2015). This trend should be of notable importance to employer-based
health plans (EHPs) in the United States (Singh et al., 2019), which are private health insurance plans offered as a benefit of employment insuring nearly 50% of Americans (eHealth Insurance, 2019). An increasing incidence of knee arthroplasty per capita had been observed locally within the EHP to be described in this report over the 3 years leading up to the intervention. Overall, consideration of the increasing incidence and the cost of the procedure highlights the growing need to organize evidence-based alternatives to maintain function and knee-related quality of life (QOL) for patients inherently at risk of requiring future surgical intervention. Providing patient choice for low-cost and low-risk alternatives is a logical step and a demonstrated opportunity based on previously cited reports. Though clinical practice guidelines alone serve as tool to bridge the gap from evidence to implementation through provider adoption and clinical practice, the inefficiencies and challenges of translating research into practice have been well documented (Frantsve-Hawley & Rindal, 2019; Rapport et al., 2018). However, evidence exists to build upon the clinical guidelines to inform a method of organizing and delivering a subset of conservative interventions to a population with knee OA as an alternative to surgical intervention.

### 1.1 Rationale for program intervention

Skou et al. (2015) published the results of a randomized controlled trial in which patients with radiographically confirmed knee OA deemed eligible for total knee arthroplasty (TKA) were randomized to two groups: surgical intervention followed by a 12-week multimodal rehabilitation program or only a 12-week multimodal rehabilitation program. The 12-week program consisted of a group-based neuromuscular exercise training program (NEMEX-TJR) previously developed and shown to be safe in those with severe hip or knee OA (Ageberg, Link, & Roos, 2010), dietary advice, two education sessions, prescription pain medications as needed, and foot orthotics.

Skou et al. (2015) reported greater overall symptomatic and functional improvements in the group undergoing surgical intervention followed by the 12-week program; however, the group participating in only the 12-week program also achieved clinically significant improvements in knee pain, function, and knee-related QOL. Among the patients participating in only the 12-week program, 74% had elected not to undergo a TKA in the following year (Skou et al., 2015).

Though Skou et al. (2015) provides evidence directly comparing the alternative of conservative management to surgical intervention, other evidence exists to support the programmatic management of knee OA. For example, Hurley et al. (2007) have demonstrated that focusing on self-management techniques, coping, education, and either group or individual physical exercise over a 6-week period can lead to improved physical function. In addition, the participants demonstrated improved levels of self-efficacy, perception of control over symptoms, and better understanding of their condition and treatment choices (Hurley, Walsh, Bhavnani, Britten, & Stevenson, 2010). Minor differences between the two programs do exist, such as a distinct weight management program, two separate education sessions, and a 12-week exercise program in Skou et al. (2015) compared with education, self-management, and coping strategies built into each session of the 6-week exercise program in Hurley et al. (2007). However, the concepts are similar in applying guideline-adherent, conservative management for knee OA.

Inherently, different paths are available for an individual to elect when addressing deficits due to knee OA. As with any treatment choice, advantages and disadvantages exist, which are dependent on the risks and potential benefits of each treatment. Opting for surgical intervention carries risk of adverse events (Culler, Jevsevar, Shea, Wright, & Simon, 2015) or dissatisfaction with functional or pain outcomes following the surgical intervention (Bourne, Chesworth, Davis, Mahomed, & Charron, 2010). However, the surgery is considered highly effective, and positive clinical outcomes are well documented (Price et al., 2018). Evidence-based nonsurgical care innately carries less risk. Because knee arthroplasty is widely accepted as the final option when other alternatives fail, benefiting from or failing and exhausting all reasonable nonsurgical options may become a natural process of assigning level of necessity for surgical intervention. Gademan, Hofstede, Vlieland, Nelissen, and Marang-van (2016) determined that failure of conservative care options is a standard criterion to indicate appropriateness for surgery. Thus, an opportunity exists to serve patients clinically in a cost-effective manner (Pinto, Robertson, Hansen, & Abbott, 2012) by improving the organization of, and encouraging adherence to conservative, lower cost treatment options.

### 1.2 Specific aims

The participant outcomes realized through the nonsurgical program within the randomized, controlled trial by Skou et al. (2015) provide the rationale and a method to translate research into application, while aligning a collection of guideline-recommended aspects of care through a voluntary, patient-centric program. The aim of the project was to recreate the observed functional outcomes within a defined population, in this instance, the beneficiaries of an EHP in which recent increases in the incidence of knee arthroplasty had been observed. The primary goal was to achieve clinically meaningful improvements in pain and function as measured by a standardized assessment.

### 2 METHODS

Application of the evidenced-based program was designed as a single-arm observational cohort study with a pre-program and post-program comparison. The program was offered at two fitness center sites affiliated with and located near or on hospital campuses within a large healthcare system. Potential participants were covered beneficiaries of an EHP in the United States, which included nearly 12,000 beneficiaries who were 35 years of age or older at the time of the initial program implementation. Sixty-one percent of the population age 35 or older were female, and the median age of the cohort was 51 years
(range 35–83 years). As the program was designed and intended to benefit the population by organizing and delivering conservative management components of knee OA, inclusion criteria were broad and not intended to limit participation. Participants were eligible to enroll if reporting presence of knee OA previously confirmed to them through a provider interaction with or without radiographic results. Thus, structural severity of knee OA was unknown. Participants completed a preparticipation screening assessment in order to determine their relative fitness for the exercise portion of the program. Pass/fail criteria were approved by the program physician. Reasons for exclusion were reporting of symptoms indicating that group-based fitness setting may be unsafe, such as chest discomfort with or without exertion or experiencing unreasonable breathlessness. Individuals seeking enrollment due to a new onset, acute injury and individuals under an active rehabilitation plan of care were excluded. As it was known, the Knee Wellness Program (KWP) began enrolling participants as a pilot program in the EHP from October 2016 to May 2018. The voluntary pilot program was offered free of charge to participants.

2.1 Intervention

The KWP consisted of three components modeled after the non-surgical program arm of Skou et al. (2015) and completed concurrently for a total of 12 weeks. In contrast to Skou et al. (2015), participants in the KWP were not provided with orthotics nor offered prescription pain medication as part of the program. The three components of the KWP were the following:

1. Self-management education available online in video format, separated into three modules for a total of 1 h. The modules included physician-led understanding of the disease, self-management strategies, and treatment options; physical therapist-led orientation to safe exercise techniques with OA and joint preservation advice; and dietitian-led nutrition tips specific to arthritis. A difference between this education offering and the education in Skou et al. (2015) is that the KWP included three sessions over a 1-h time period instead of two sessions totaling 2 h.

2. Group exercise was offered at a fitness facility two times per week for 12 weeks for a total of 24 sessions. These sessions lasting approximately 1 h were supervised by exercise physiologists or athletic trainers and consisted of low-impact aerobic exercise, lower extremity resistance exercise, and stretching exercises based upon the NEMEX-TJR program (Ageberg et al., 2010) and individualized as needed (e.g., exercise specificity, intensity, and rate of progression) between the participant and supervising exercise specialist. The NEMEX-TJR program's aims, principles, and details have been thoroughly defined elsewhere (Ageberg et al., 2010), but the structured program focuses primarily on closed kinetic chain exercises in broad categories including postural stability, postural orientation, lower extremity strength, and functional movements with the ability to progress exercises within each category based on ability and quality of performance;

3. A dietary intervention available to participants with body mass index (BMI) of 25 or greater through a combination of in-person and telephonic meetings.

To ensure a successful implementation process, key tactics were utilized, which align with previously published concepts (Rapport et al., 2018). Exercise specialists were actively oriented to the program ahead of session supervision and were paired with colleagues who had experience working with the program. Active translation of program knowledge allowed for fidelity to program implementation and execution (Rapport et al., 2018). Continuous improvement and learnings were facilitated through intermittent sharing of aggregated program results. The leaders of the facilities in which the program was implemented, the physician overseeing the program, and the program coordinator served as stewards of the implementation process, ensuring that the program was administered within the framework of the initial proposed plan. Individuals enrolling to participate were actively oriented to the objective of the program through the first self-management education session, which was reinforced prior to the first exercise session. The individual participant's primary objective was gauged in order to understand what success would feel like to him/her.

2.2 Measures

Two primary outcomes of interest and a collection of secondary measures were tracked in the program:

1. The number of patients who enrolled as a proportion of the estimated incidence of knee OA in the EHP; and

2. The change in the overall and subscale scores of the Knee injury and Osteoarthritis Outcome Score (KOOS) assessment;

The KOOS provides an objective measure of short- and long-term pain, symptoms, and functioning of individuals with knee injury or OA. It consists of five separately scored subscales: pain, other symptoms, function in daily living (activities of daily living [ADL]), function in sport and recreation, and knee-related QOL (Roos & Lohmander, 2003). The subscales can be aggregated and averaged for an overall score. A systematic review and meta-analysis found the KOOS to have adequate internal consistency, test–retest reliability, and construct validity (Collins et al., 2016).

Associated secondary measures included the Timed Up and Go (TUG) test, self-reported level of weekly physical activity, self-reported utilization of analgesics for the knee, and weight change.

The TUG test (Podsiadlo & Richardson, 1991), used to assess a patient’s functional mobility and balance, determines the amount of time it takes for an individual to rise from a chair, walk forward 10 feet, turn around, and return to sitting on the chair. The test has demonstrated excellent correlation to other functional tasks and tests, such as the time it takes for an individual with knee OA to ascend and then descend five steps (Maly, Costigan, & Olney, 2005). The TUG test is...
moderately correlated with each of the KOOS subscales (Sabirli, Paker, & Bugdayci, 2013).

Both the primary and secondary measures were assessed prior to the start of the program and following the program approximately 12 weeks after initiation.

2.3 | Statistical analysis

Analysis of each measure was determined through parametric and non-parametric descriptive statistics and the use of paired t-tests for inferential statistics.

2.4 | Ethical approval

The quality improvement project was deemed as exempt by the organization’s Institutional Review Board following a review by the organization’s Institutional Review Board versus QI Sub-Committee.

3 | RESULTS

Ninety-six EHP beneficiaries enrolled in the program; 69 (72%) completed the protocol and are included in the subsequent analyses. Characteristics of the 69 participants completing the protocol are provided in Table 1.

Experiences with knee pain and previous treatments varied across participants. In regard to pain, 56.7% had used over-the-counter or prescription pain medication specifically for knee pain in the week prior to program participation. In regard to previous treatments, 34.8% of participants had undergone physical therapy for their knee; 47.8% had elected injections, which could include hyaluronic acid, corticosteroids, platelet-rich plasma, or prolotherapy; and 31.9% had undergone a prior surgical procedure.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Description of program participants (n = 69)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years, mean (SD)</td>
<td>57.2 (7.3)</td>
</tr>
<tr>
<td>Gender, percent female</td>
<td>85.5%</td>
</tr>
<tr>
<td>Body mass index, mean (SD)</td>
<td>33.6 (7.3)</td>
</tr>
<tr>
<td>Analgesic utilization (specific to the knee)</td>
<td>56.5%</td>
</tr>
<tr>
<td>Previous series of physical therapy related to the condition</td>
<td>34.8%</td>
</tr>
<tr>
<td>Previous intra-articular injection(s)</td>
<td>47.8%</td>
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<tr>
<td>Previous knee surgery (ies)</td>
<td>31.9%</td>
</tr>
<tr>
<td>Pre-program KOOS, mean (SD)</td>
<td>56.5 (14.5)</td>
</tr>
</tbody>
</table>

Note. 0–100 scale indicating patient-reported level of knee pain, symptoms, function in activities of daily living, function in sport and recreational activity, and knee-related quality of life (0 represents maximum disability, 100 represents maximum level of function). Abbreviations: KOOS, Knee Injury and Osteoarthritis Outcome Score; SD, standard deviation of the mean.

Of those that completed the protocol, mean (median) participation rates were 2.3 (3) of 3 education sessions and 15.3 (16) of 24 exercise sessions. Forty-eight percent of participants, both completing the protocol and with a BMI ≥ 25, met with the dietitian on a minimum of one occasion for dietary advice. The mean (median) number of visits completed for those who met with the dietitian was 2.4 (2.0).

The median change in pre- to post-program KOOS values was 10.4 ± 0.8. A 10-point increase is considered clinically important (Roos & Lohmander, 2003). A paired t test demonstrated that participants experienced a statistically significant increase in the KOOS assessment following the intervention (Z = 210.5, p < 0.001). The median changes in the subscale scores from pre- to post-program, which contributed to the overall median change of 10.4, were as follows: change in pain, +11.0; change in symptoms, +4.0; change in ADL, +12.0; change in sport and recreational activity, +20.0; and change in and knee-related QOL, +6.0. See Figure 1 for pre- and post-program mean scores for the overall KOOS assessment and the KOOS subscales.

The time to complete the TUG test decreased by 19% over the course of the intervention for those completing the test pre-and post-program (See Figure 2, n = 48). Following the intervention, there was an increase in 12.3% of participants who reported at least 30 min of physical activity, a minimum of 3 days per week following the program compared with prior to the program (n = 65, four participants did not complete this question either on the pre- or post-program evaluation). In addition, 11.9% fewer participants reported utilization of pain medication for their knee following the program compared with pre-program (n = 67, two participants did not complete this question either on the pre- or post-program evaluation). More specifically, the rate of participants reporting use of an over-the-counter analgesic, prescription nonsteroidal anti-inflammatory medication, or a narcotic specifically for knee pain within 1 week prior to participation was 44.8%, 25.4%, and 4.5%, respectively. In comparison, the same utilization rates following program participation decreased to 34.3%, 11.9%, and 3.0%, respectively. The mean (median) weight reduction for those participants who met with the dietitian and completed the post-program measures was 1.3% ± 3.0 (0.6%).

4 | DISCUSSION

The KWP led to significant improvements in pain, function, and knee-related QOL as measured by the KOOS for participants with presence of knee OA who completed the program. Secondary outcomes such as the TUG test, self-reported levels of physical activity, self-reported utilization of analgesics, and weight change for those participating in the dietary intervention were favorable and supportive of the primary outcome. The primary results further support the program outcomes and demonstrated impact by Skou et al. (2015) and indicate that the program is replicable in an alternate setting. The results of this program are also congruent with outcomes demonstrated by other
conservative condition management programs (Hurley et al., 2007) offered in a group format in the community (ESCAPE Pain, 2019). In this case, 96 participants enrolled in the program, whereas 69 (72%) completed the protocol. Enrollees represented approximately 27% of the estimated annual incidence of newly diagnosed knee OA patients in the EHP population, though the program welcomed all participants with reported presence of knee OA regardless of when they were first diagnosed. Participants in the KWP were younger (mean 57.2 ± 7.5 years), more likely to be female (85.5%), have a higher BMI (33.6 ± 7.3), and have a higher baseline aggregate KOOS (56.5 of 100) than the participants in the nonsurgical arm of the study by Skou et al. (2015) (age: 67 ± 8.7 years; female: 60%; BMI 32 ± 5.8; KOOS: 42.1 of 100). Though the severity of OA based on radiographic findings in the group completing the nonsurgical program arm of the study by Skou et al. (2015) was known, understanding the

**FIGURE 1** Comparison of pre- and post-program mean Knee Injury and Osteoarthritis Outcome Scores (KOOS). (a) Mean pre- and post-program (approximately 12 weeks) KOOS for participants completing the pre- and post-program evaluation (n = 69, 72% of all participants). (b) Mean pre- and post-program KOOS assessment by subscale for participants completing the pre- and post-program evaluation (n = 69, 72% of all participants) [Colour figure can be viewed at wileyonlinelibrary.com]

**FIGURE 2** Comparison of pre- and post-program mean time to completion in the Timed Up and Go (TUG) test (n = 48) [Colour figure can be viewed at wileyonlinelibrary.com]
radiographic severity of OA in the population completing the KWP was not within scope of this project in order to avoid unintended barriers or costs.

The component-specific participation rates of enrollees in the self-management and group exercise components were similar to the rates reported in the nonsurgical arm of the study published by Skou et al. (2015). However, 95% of the participants in Skou et al. (2015) who were eligible for the dietary intervention completed at least one session with the dietitian, which is much higher than the approximate 50% participation rate of those eligible to meet with the dietitian in this program within the EHP. The KWP included dietary education and strategies as one of the three self-management education modules available to participants. A hypothesis is that including this education in the self-management modules may have lessened the perceived need by participants to follow through with the dietary intervention. Inclusion of the dietary education in the self-management education was a difference between this program and the program described by Skou et al. (2015). Despite lower than expected participation in the dietary intervention by those eligible, overall participation and completion rates demonstrate the feasibility in offering this program within similar populations.

The median change in pre- to post-program KOOS values of 10.4 ± 0.8 (Z = 210.5, p < 0.001) is clinically significant (Roos & Lohmander, 2003). In addition, the magnitude of the positive change in the KOOS subscale scores in this program approximates the baseline to 3-month changes illustrated in the supplementary material of the study published by Skou et al. (2015) further supporting program feasibility. In comparison, we would logically expect to see no change over the same time period from a population perspective without intervention, a concept supported by Øiestad et al. (2016) showing stable or slight declines in physical function year to year in two large observational cohorts of individuals with incident knee OA.

The time to complete the TUG test decreased by 19% over the course of the intervention. This result is similar to the 14% reduction reported at the 12-month follow-up for participants in the nonsurgical arm of the study by Skou et al. (2015). In addition to this physical performance measure, an increase was noted following the intervention in the proportion of participants reporting a minimum of 30 min of physical activity at least 3 days per week. The increase was relatively small. However, the positive change is supportive of the primary outcome based on a previously published systematic review and meta-analysis demonstrating that exercising 3 or more days per week led to greater pain reduction and improvements in disability compared with fewer days (Juhl, Christensen, Roos, Zhang, & Lund, 2014). The increase is also encouraging based on previously cited evidence that those with diagnosed knee OA partake in less physical activity than age-matched healthy controls (Wallis et al., 2013) and that a decline in physical activity is one suggested mechanism contributing to the association of knee OA and the prevalence of frailty (Misra et al., 2015). We believe that a subset of participants developed greater confidence in increasing their exercise or physical activity habits through participation in a guided exercise program—a concept supported through a previous evaluation of barriers and facilitators to exercise (Dobson et al., 2016).

Following the intervention, 11.9% fewer participants reported using pain medication for their knee in the week prior to the post-program evaluation. Because this program was an offering intended to benefit participants within an EHP and was purely observational, no restriction or control was placed on pain medication usage. The finding indicates that improvements in the KOOS assessment do not appear to be confounded by participants simply increasing their use of pain medication. Participants reported reduced utilization rates of medication specifically for knee pain, while still reporting decreased levels of pain, improved daily functional activity, and improved knee-related QOL.

The relationship between body mass and knee OA is well-supported in the literature. Those who are overweight or obese are at a heightened risk for OA, most notably of the knee. Specifically, Reyes et al. (2016) have demonstrated that the risk of OA increases in a dose–response gradient with BMI, and subsequently, increasing BMI is associated with a higher risk of TKA (Apold et al., 2014). The 2017 annual report from the American Joint Replacement Registry indicates that the average individual undergoing TKA is obese; the mean BMI for males and females is 30.6 and 31.0, respectively. Weight loss of greater than 10% of body weight has been linked to slowed cartilage degeneration compared with stable weight controls (Gersing et al., 2017). Despite the directional literature, gaps in care access exist as many health insurers in the United States, including Medicare, do not cover medical nutrition therapy for a degenerative knee condition without other comorbidities such as diabetes or chronic renal disease. In this program, the observed weight reduction of 1.3% in the participants who were eligible and agreed to meet with the dietitian is positive, though small in magnitude. Christensen, Bartels, Astrup, and Bliddal (2007) determined that physical disability could be reduced with weight reduction of approximately 5% over the course of 20 weeks (i.e., approximately 0.25% per week). By this recommendation, weight loss in the subset of the program population who participated in the dietary intervention fell short of the recommended pace.

The components of this program are designed to be able to be sustained independently following completion, which is necessary for individuals with a chronic, irreversible condition. Though post-program commitment to maintenance needs to occur for the 3-month improvement noted in this program to be sustained, the ability to do so was demonstrated at up to 12 months in Skou et al. (2015). A similar level of commitment is necessary to participate in the voluntary program and is likely one of the drivers of program success. Despite the application of the program on a population that is inherently at risk for a worsening physical condition over time, the voluntary nature of the program likely identified a population in which the baseline functional status had a greater degree of modifiability due to motivation alone. Success of the pilot program could also be contributed to organizing evidence-based and complementary components of care into one program and delivering concurrently for additive effect. Published considerations regarding knowledge dissemination and implementation tactics, which have been well studied and described...
specific to clinical application (Naylor et al., 2009; Rapport et al., 2018), were innately adopted. A rigorous focus was placed on maintaining fidelity of implementation regarding the translation of the evidence-based program into a nontraditional clinical setting as a conservative management program.

The extent to which organizing and offering evidence-based, non-surgical offerings can delay an event such as TKA in a population with knee OA is unknown and beyond the scope of this report. Future research should seek to understand whether stand-alone interventions or the additive effect of various evidence-based non-surgical interventions have the ability to prevent or delay the need for TKA in an at-risk population. The growing incidence and cost of TKA as a result of diagnosed knee OA highlights the urgency to organize and offer secondary management strategies in order to optimally address the prevalent condition and warrants continued investigation.

4.1 | Limitations

The evaluation of the program is limited by its implementation in a single EHP, which participated in a conservative condition management program without a matched comparison. Given the size of the target population within the EHP, the development of an untreated comparison group was determined to be unfeasible. However, the congruence of the functional results in this program with the functional improvements noted in the randomized, controlled trial by Skou et al. (2015) provides reassurance that the results are influenced directly by the intervention and the design of the randomized, controlled trial provides generalizability.

Though feasibility was demonstrated within an EHP by offering the program at two campuses within a large healthcare system, this inherently limits the reach of the program to associates at other campuses. Potential participants outside of the two primary campuses likely had increased challenges in accessing the program during this pilot, which limited overall participation. To maintain fidelity of implementation, the exercise program was only offered in a facility setting. Future iterations may benefit from the addition of technology to monitor exercise for those in which it is not feasible to attend in person.

5 | CONCLUSIONS

The results of the KWP for participants with presence of knee OA indicate that the findings in the report by Skou et al. (2015) regarding functional improvement can be replicated in an alternate setting. Positive, statistically significant outcomes regarding improvement in pain, function, and knee-related QOL as measured by the KOOS were demonstrated in the participating population. Other secondary outcomes were positive and supportive of the primary outcome. Operating the program within a defined population through a fitness facility setting with provider oversight could be considered as a viable component in the overall continuum of care for knee OA and could be used to inform future programming intended to span the continuum of care.

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CONFLICT OF INTEREST

None declared. Richard Snow, DO, MPH, was affiliated with OhioHealth during the conception and development of the program.

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