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The structure, process and outcomes of interprofessional care among knee osteoarthritis patients: a scoping review

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Abstract

- Knee osteoarthritis (OA) is a common chronic condition that leads to joint pain and disability among older adults. An interprofessional collaborative approach has nowadays been widely advocated in knee OA management although little is known about the characteristics of care, roles and responsibilities of healthcare providers and how they collaborate as a team to optimise treatment outcomes.
- The Donabedian structure–process–outcome framework was used in the review. Six databases were searched from February 2013 to March 2023.
- A total of 26 articles that met our inclusion criteria were reported. All studies ($n = 26$) identified the physiotherapist as a critical member of the interprofessional team. Several studies ($n = 5$) have offered training to healthcare providers in the management of knee OA. The intervention components in most studies included disease-based education ($n = 21$) and exercise therapy ($n = 16$).
- A comprehensive understanding of the existing interprofessional knee OA care in this review could potentially assist the government and healthcare organisations in developing interprofessional practice guidelines and designing intervention programmes that maximise their benefits.

Introduction

Osteoarthritis (OA) is a common degenerative joint disease caused by articular cartilage loss and degradation (1). It is a leading cause of joint pain and disability among older adults and exerts a substantial financial and societal burden on the global healthcare system (2). Of all site-specific forms of OA, the knee is the most frequently affected joint, contributing to nearly four-fifths of the OA load worldwide (3). In 2020, about 654.1 million people aged over 40 suffered from knee OA. The global prevalence of knee OA is 16%, and the incidence is 203 per 10,000 person-years (4). Aggravated by an ageing

population and a growing obesity rate, the prevalence of knee OA is anticipated to double over the next 10–20 years (5, 6). Numerous studies have pointed out that the functional impairments induced by knee OA, such as joint stiffness, muscle weakness, and swelling, would significantly alter an individual's daily physical capabilities, including sitting, rising from chairs and negotiating stairs, subsequently contributing to a higher risk of depression, social impairment, diminished independence and decreased quality of life (7, 8). It is evident that the major structural changes in the knee

joint could have a detrimental effect on the physical, mental and social well-being of those with knee OA.

Interprofessional collaborative practice is widely advocated nowadays in the care of knee OA. Interprofessional care is defined as ‘multiple health workers from different professional backgrounds working together with patients, families, carers and communities to deliver the highest quality of care’ (9). It is proposed as one of the six key components of OA management in the National Institute for Health and Care Excellence (NICE) guidelines of the United Kingdom (10). The evidence has shown that employing interprofessional care is effective in reducing a knee OA patient’s chance of undergoing total knee arthroplasty, which is the last resort for such patients (11). A vast majority of studies have acknowledged interprofessional care to be indispensable to improving patient outcomes, boosting the satisfaction levels of both patients and practitioners and ultimately establishing cost-effective healthcare (12, 13).

While interprofessional care has been extensively incorporated into the existing healthcare practice and pedagogy, as evidenced by a growing body of literature demonstrating its advantages, a clear understanding of the roles and responsibilities of each provider in the team, the interactions between patients and interprofessional team members and the communication and interactions among the team members during the care of knee OA patients have gained inadequate academic attention. Previous studies focused on the effects of interprofessional care on either the general healthcare system or on patients with other chronic diseases, rather than specifically targeting knee OA patients, despite the alarming epidemic of knee OA (14). In addition, although some studies have highlighted the positive outcomes of interprofessional knee OA care, such as improvements in function and mobility (15), there is a lack of systematic protocols and guidelines that drive best-evidence practice. The understanding of the characteristics of interprofessional knee OA care practices and their associated outcomes is currently fragmented. Developing a complete overview of interprofessional knee OA care has the potential to provide valuable insights for government entities and policymakers and to support the development of interprofessional practice guidelines and the establishment of intervention programmes for knee OA patients. With this goal in mind, the objective of this review was to identify the key domains of structure, process and outcome involved in interprofessional knee OA care.

Conceptual framework

The Donabedian structure–process–outcome framework was used to systematically analyse and describe the existing evidence on the care provided to knee OA patients within an interprofessional collaborative

approach (16). The structure domain denotes the settings and characteristics in which interprofessional care is delivered, such as human resources (e.g. the composition of the interprofessional team and the training, education and qualifications of providers) and support systems (e.g. protocols and referral systems). The process domain refers to the activities of delivering and receiving interprofessional care, underscoring the involvement of both patient–provider interactions (e.g. intervention components and pharmacological management) and interactions among the members of the interprofessional team (e.g. interprofessional communication). The outcome domain comprises the results of delivering interprofessional care in terms of patient-level (e.g. clinical outcomes, functional outcomes, psychological and behavioural outcomes and quality of life), provider-level (e.g. staff workloads) and organisation-level (e.g. quality of care, healthcare utilisation and costs) aspects. The Donabedian framework is well established for assessing the quality of care, yet it has rarely been applied in an interprofessional context.

Materials and methods

The scoping review was conducted using the methodological framework of Arksey & O’Malley (17), with modifications recommended by Levac *et al.* (18). It is reported based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist. It has been registered in OSF Registries, with the number Y7DB9 (<https://osf.io/y7db9>).

Identifying the research question

The scoping review aims to answer the following question: what is known in the existing literature regarding the structure, process and outcome domains involved in interprofessional knee OA care?

Identifying the relevant studies

A structured literature search was conducted using the following six databases: CINAHL, Medline, Ovid Journals, PubMed, Web of Science and Embase. A combination of search strings related to ‘knee osteoarthritis’, ‘interprofessional’ and ‘care’ was used. The details of the search strategy are provided in Appendix 1 (see section on [Supplementary materials](#) given at the end of the article). These databases were searched for articles published between February 2013 and March 2023. The grey literature was searched on search engines using Google Scholar. When further clarifications were needed, the corresponding author was contacted.

Selecting the studies

The selection of articles was based on the following inclusion criteria: empirical studies published in Chinese and/or English and studies that outlined an interprofessional approach to managing knee OA patients by at least two healthcare providers. There were no restrictions on care settings. Articles were excluded if they focused on inflammatory knee pathology; were protocols, theoretical papers or review papers; or studied healthcare students rather than healthcare providers.

Regarding the screening process, relevant papers were retrieved and imported to EndNote X9 for screening, and duplicates were removed. This involved two stages: first, two reviewers (JL and MK) independently scanned the titles and abstracts according to the selection criteria. Second, full-text articles were identified and assessed for eligibility. When disagreements occurred and could not be resolved through discussion, a third reviewer (AW) was consulted to determine the final selection. A critical appraisal of the included articles was not performed in the review.

Charting the data

JL and MK independently extracted data for the included articles. Information including authors, year of publication, country, aim, care programme, duration of care, study design and healthcare providers involved was charted. The main results were also charted on a Microsoft Excel sheet.

Collating, summarizing and reporting the results

The results were further categorised and summarised into the respective subthemes of structure, process and outcome domains.

Results

Search flow

The literature search from six databases yielded 4953 articles. After 793 duplicate articles were removed, 4160 titles and abstracts were screened for inclusion. The full-text versions of 106 articles that potentially met our eligibility criteria were then evaluated. Finally, a total of 26 articles were selected for inclusion and reported in the current review. The complete search process is illustrated in Fig. 1.

Study characteristics

All the included articles were published between 2013 and 2023. Among all 26 studies, 21 were based on interprofessional knee OA care interventional programmes, while 5 focused on theoretical perspectives of delivering interprofessional knee OA care. Only the structure and process domains were examined in the latter articles. The selected articles were generally conducted in Western countries, namely, the Netherlands ($n = 6$), Australia ($n = 5$), the United States ($n = 3$), Norway ($n = 3$), Brazil ($n = 3$), Canada ($n = 2$) and the

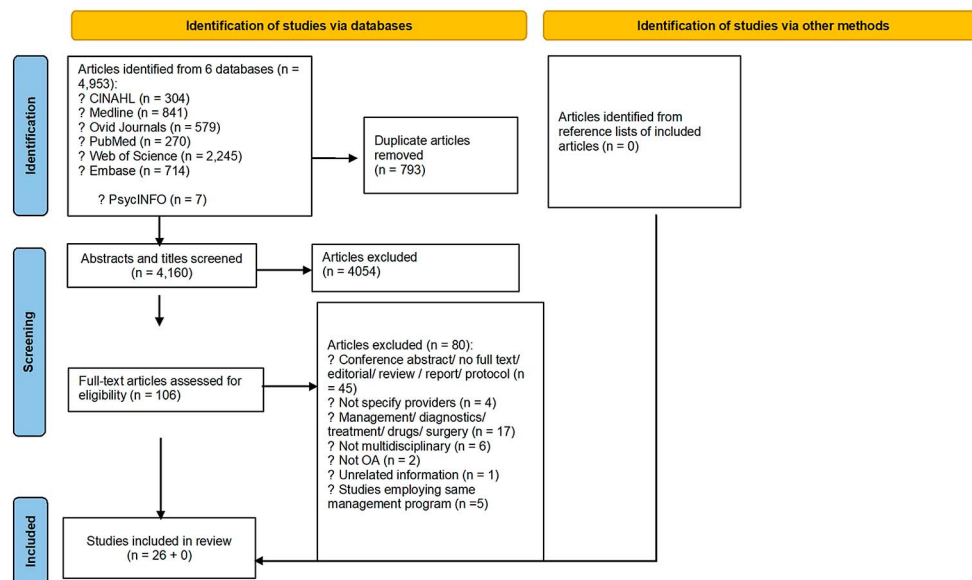


Figure 1
PRISMA flow diagram.

United Kingdom ($n = 2$). Two care programmes were located in Asia, namely, Singapore ($n = 1$) and Hong Kong ($n = 1$). The study designs included observational studies ($n = 11$), randomised controlled trials ($n = 5$), qualitative studies ($n = 4$), pilot studies ($n = 2$), case studies ($n = 2$), a mixed-methods study ($n = 1$) and a quasi-experimental study ($n = 1$). The duration of the interprofessional knee OA care programmes ranged from 3 hours to 2 years. A summary of the included studies is provided in Supplementary file 1.

Structure

Human resources

Interprofessional team composition

Supplementary file 1 reveals the number of different healthcare providers in the interprofessional team, which varied from two to seven in the selected articles. Specifically, one study utilised a physiotherapist-led approach (19) and one employed a pharmacist-initiated strategy (20) in delivering the knee OA care programme. Among the 21 programmes, physiotherapists were reported in all studies (100%), indicating their central role in managing knee OA. The involvement of physicians, including general practitioners, orthopaedic surgeons and rheumatologists, was reported in 17 studies (81.0%). Dietitians/nutritionists were part of the team in 11 studies (52.4%), followed by occupational therapists in 9 studies (42.9%). Nurse practitioners were mentioned in five studies (23.8%), along with health psychologists/psychotherapists, exercise/physical educators and social workers, who each appeared in five studies (23.8%). Pharmacists and orthotists/podiatrists were involved in three studies each (14.3%).

Training, education and qualification

Before implementing an interprofessional knee OA programme, healthcare providers in five studies were provided with training sessions (19, 21, 22, 23, 24). These were generally in the form of interactive workshops and seminars, accompanied by relevant educational materials (24), reminder materials (24), experiential training (19) and educational outreach visits (24). The primary objective of the training programme was to update healthcare providers on the logistics of the programme, the latest knee OA epidemiology, clinical features and evidence-based treatment recommendations (19, 21, 22, 24). The training was also aimed at facilitating collaboration at both the provider and organisational levels (23). In one study, intensive training was provided specifically in cognitive-behavioural theory-based pain-coping skills for physiotherapists and occupational therapists (19).

Two studies reported on the work experience of interprofessional team members, including physiotherapists, primary care nurses, general

practitioners and dietitians, which ranged from 2 to 13.7 years (25, 26). Only one study reported that a portion of the healthcare providers had completed OA-specific professional development in the past five years (an average of 23.5%) and held postgraduate qualifications in musculoskeletal health (an average of 17.2%) (25).

Despite the intensive training provided and the requirement for professionals to have extensive experience, healthcare providers in three studies reported lacking the expertise required to effectively support knee OA patients. This included deficiencies in skills related to assessment, measurement, monitoring, tailoring care and managing cases with complications (27, 28, 29).

Support system

Protocol

Protocols that covered different aspects of interprofessional knee OA care were identified. These aspects could be categorised into screening and triaging, assessment and diagnosis, intervention and treatment, and long-term management. Screening and triaging protocols involved outlining the procedures of the intake process to identify patients who required further assessment and treatment (20, 21, 29, 30, 31). Assessment and diagnosis protocols specified the evaluation methods to accurately diagnose and determine the severity of knee OA, including self-reported questionnaires, history taking, physical and clinical examinations, blood tests and imaging techniques (e.g. CT, MRI, X-rays, ultrasound and radiographs) (19, 20, 21, 24, 30, 32, 33, 34, 35, 36, 37). Intervention and treatment protocols (e.g. the prescription of exercise, medication and orthotics) mainly adhered to evidence-based knee OA clinical practice guidelines and existing comprehensive OA care models (19, 29, 30, 31, 32, 33, 36, 38, 39). Long-term management protocols outlined the follow-up procedures, monitoring of symptom progression, adjustment of the treatment plans and re-evaluation and reinforcement of patient knowledge (19, 21, 32, 33). To foster remote connectivity with the patients, tools such as telephone calls, emails and electronic health record portals were utilised (19, 21, 24, 33, 36). These protocols also employed online communication systems, such as electronic medical records, to document and report the patient's progress within the interprofessional teams (22, 31, 35, 40).

Referral system

Three studies provided clear and objective referral criteria (19, 31, 35). These studies outlined specific indications or parameters determining when a referral was considered necessary. While the information could be valuable in promoting consistent and well-informed decision-making on referrals among healthcare providers, one study reported that the referring clinicians differed in

their interpretation of the referral criteria and expressed varying levels of autonomy when making referrals (26). Healthcare providers in one study stated that the referral process was convoluted and, at times, irrelevant (41).

Process

The review classified the process of providing interprofessional knee OA care as involving both provider–patient interaction and interprofessional interaction. The details of the process domain are given in Table 1.

Provider–patient interaction

Intervention component

Patient education was one of the most commonly reported intervention components ($n = 21$) (19, 20, 21, 22, 23, 24, 26, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39,

42, 43, 44). Education was delivered through various formats, including lectures, workshops, OA guidebooks (24) and DVDs. The content covered a range of topics, including the causes and aetiology of knee OA, treatment options (24) and self-management strategies.

Education was provided by different healthcare professionals in the form of group sessions or individual consultation sessions. Written notes and online resources were given to enhance the effectiveness of the programme. Physicians generally provided education on the biomedical aspects of knee OA, such as joint anatomy, pathology and management. Nurses were also responsible for conducting education sessions on the disease and its management principles (42). Physiotherapists and physical educators encouraged patients to do more physical exercise and instructed them in ways to alleviate pain. Occupational therapists focused on joint protection strategies, such as optimizing ergonomics and alternating different levels of energy expenditure. Nutritionists provided education on the

Table 1 Process of interprofessional knee OA care ($n = 26$).

Included studies	Provider–patient interactions					Interprofessional interactions
	Intervention components					
	PE	NUT/ WM	ET	PS	PM	
Bouma <i>et al.</i> (40)						Y – communication (feedback of info about patient consultation, either face-to-face or digital contact)
Briggs <i>et al.</i> (25)					Y	
Briggs <i>et al.</i> (27)					Y	
Chan <i>et al.</i> (42)	Y		Y			
Claassen <i>et al.</i> (43)	Y					
Claes <i>et al.</i> (32)	Y	Y	Y			
De Rezende <i>et al.</i> (33)	Y					
Kawi <i>et al.</i> (29)	Y		Y			Y – regular meeting between physiotherapist and nurse to facilitate online SM program
Koh <i>et al.</i> (38)	Y	Y	Y			
Law <i>et al.</i> (26)	Y	Y	Y			Y – discussion (content: whether listed for replacement surgery)
Malay <i>et al.</i> (19)	Y	Y	Y			Y – open communication channels available
Marra <i>et al.</i> (20)	Y		Y		Y	Y – communication between pharmacist and primary care physician
Miller <i>et al.</i> (39)	Y		Y	Y	Y	
Moe <i>et al.</i> (21)	Y					
Moore <i>et al.</i> (34)	Y		Y			
Okwera <i>et al.</i> (41)						Loss of communication with interprofessional team
Østerås <i>et al.</i> (22)	Y	Y	Y			Y – interactive multidisciplinary workshop; discussion
Østerås <i>et al.</i> (23)	Y		Y			
Rezende <i>et al.</i> (44)	Y	Y	Y			
Rodrigues da Silva <i>et al.</i> (30)	Y					
Selten <i>et al.</i> (28)						Mistrust; hampered dialogue (lack of clarity about roles and responsibilities)
Smink <i>et al.</i> (24)	Y				Y	
Suter <i>et al.</i> (35)	Y		Y		Y	
Tan <i>et al.</i> (31)	Y	Y	Y	Y		
Voorn <i>et al.</i> (36)	Y	Y	Y	Y		Y – multidisciplinary team conference
Yu <i>et al.</i> (37)	Y	Y	Y			

ET, exercise therapy; NUT, nutrition; PE, patient education; PM, pharmacological management; PS, psychological support; WM, weight management; Y indicates the presence of the component.

importance of a well-balanced diet. Social workers reiterated the importance of developing habits of regular leisure, sports and social gatherings (30, 33). Psychologists highlighted the development of personality traits from childhood to adulthood and focused on building coping skills to manage conditions and emotions (33).

Other commonly reported intervention components involving the interaction between providers and patients were exercise therapy ($n = 16$), nutrition and weight management ($n = 9$) and psychological support ($n = 3$). Exercise therapy was prescribed and delivered by physiotherapists (19, 20, 22, 23, 26, 29, 31, 32, 34, 35, 36, 37, 38, 39, 42, 44). The aim was to improve joint mobility, muscle strength and physical function. Nutrition and weight management interventions were delivered by nutritionists with the aim of helping obese patients achieve normal body weight and optimise their nutritional status (19, 22, 26, 31, 32, 36, 37, 38, 44). Psychological support was provided by psychologists, social workers and counsellors, with the aim of addressing psychosocial concerns and improving emotional well-being (31, 36, 39).

Pharmacological management

Four studies reported on the use of pharmacological interventions for knee OA care, including the prescription and management of pain medications such as acetaminophen and NSAIDs (20, 24, 35, 39), which were mainly delivered by physicians (24, 35, 39) and pharmacists (20).

Interprofessional interaction

Communication

Interprofessional communication channels such as team conferences, joint consultations, discussions and meetings conducted face-to-face or remotely were identified in seven studies (19, 20, 22, 26, 29, 36, 40). The primary objectives were to confirm the diagnosis (36), set treatment goals and develop individualised management plans and advice (36). However, issues of ineffective communication, discontinuous care and mistrust between those in different disciplines were identified in two studies. General practitioners in one study expressed a lack of contact and coordination with the team of physiotherapists, leading to frustration in working relationships, given that different physiotherapists were involved on consecutive days, leading to an absence of continuity and collaboration (41). Another study reported mistrust among healthcare providers towards the management approaches of dietitians for weight reduction, which stemmed from the perception that dietitians were solely responsible for monitoring daily food intake and providing basic nutritional advice. There was also mistrust in supervised exercise modalities (28), which could be attributed to

differences in their perceived benefits, a lack of clarity on the mechanism of action and disagreements over non-evidence-based practices such as massage and heat therapy.

Outcome

Outcomes were categorised into three levels, namely, patient-level, provider-level, and organisation-level. A classification of the outcomes and their associated indicators is shown in Table 2. The details of the outcome domain are given in Supplementary file 2.

Patient-level

Clinical outcomes

Three main clinical outcomes, including pain, symptom and weight management related, were identified in the interprofessional care programmes. Statistically

Table 2 Classification of outcome and its associated indicators.

Outcome	Indicator
Patient-level	
Clinical outcome	
Pain	WOMAC, KOOS, ICOAP, patient-reported pain
Symptom	WOMAC, KOOS
Weight management related	BMI, waist circumference, weight loss
Functional outcome	
Functional mobility and capacity	TUGT, FTSST, timed up and downstairs, 6MWT, PSFS, WOMAC, KOOS, quadriceps strength, one-minute chair-stand test
Physical activity level	IPAQ
Activities of daily living	ADL, KOOS
Psychological and behavioural outcome	
Psychological distress	Patient-reported outcome
Self-efficacy	Self-efficacy
Adherence	IPAQ interview
Health literacy	HLS-Q12
Quality of life	KOOS (knee-related QoL), EQ-5D (HRQoL), EQ-VAS, SF-36 (HRQoL)
Organization-level	
Quality of care	
Patient satisfaction	5-Point Likert satisfaction scale
Healthcare utilization	Survey
Costing	QALY

6MWT, six-minute walk test; ADL, activities of daily living; BMI, body mass index; EQ-5D, EuroQoL 5 dimension scale; EQ-VAS, EQ visual analogue scale; FTSST, five times sit to stand test; HLS-Q12, European Health Literacy Survey Questionnaire short version; HRQoL, health-related quality of life; ICOAP, Intermittent and Constant Pain Score; IPAQ, International Physical Activity Questionnaire; KOOS, Knee Injury and Osteoarthritis Outcome Score; PSFS, patient-specific functional scale; QALY, quality-adjusted life year; SF-36, 36-item short form health survey; TUGT, timed up and go test; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

significant improvements in clinical outcomes, as evidenced by P values < 0.05 , were reported in 11 selected articles (19, 20, 22, 30, 31, 32, 33, 36, 37, 38, 44). Of these, nine studies reported a statistically significant improvement in pain, as indicated by the Western Ontario and McMaster Universities Osteoarthritis (WOMAC) Index, the Knee Injury and Osteoarthritis Outcome Score (KOOS) and the Intermittent and Constant Pain Score (ICOAP) or by patient-reported pain (19, 20, 21, 32, 33, 36, 37, 38, 44). Four studies reported a statistically significant improvement in symptoms, including stiffness and swelling (33, 36, 37, 38). Five studies showed a statistically significant improvement related to weight management, including weight loss, a decrease in the body mass index (BMI) and waist circumference (30, 31, 32, 33, 44). Despite the promising clinical outcomes, one study reported no changes in pain and BMI (43), no clinically significant improvement in KOOS (39) and no clinically relevant health outcomes (21).

Functional outcomes

Three main functional outcomes were identified in the review, including functional mobility and capacity, physical activity level and activities of daily living (ADL). Sixteen studies reported positive functional outcomes after the participants received interprofessional knee OA care (19, 20, 22, 23, 30, 31, 32, 33, 34, 36, 37, 38, 39, 42, 43, 44). Improvements in functional mobility and capacity, as indicated by the timed up and go test, five times sit to stand test, timed up and down stairs test, six-minute walk test (6MWT), patient-specific functional scale, WOMAC, KOOS, quadriceps strength and the one-minute chair-stand test, were reported in 13 studies (19, 20, 22, 30, 31, 32, 33, 34, 37, 38, 39, 42, 44). Increased physical activity levels and reduced sedentary lifestyles were reported in five studies (23, 30, 42, 43, 44). Three studies reported improved ADL (34, 36, 38). However, one study reported no clinically significant changes in ADL (39).

Psychological and behavioural outcomes

The psychological and behavioural outcomes were indicated in eight studies (19, 21, 29, 31, 38, 42, 43, 44). They comprised reduced psychological distress (19), increased self-efficacy (21, 42), increased adherence to the management programme (29, 44) and increased health literacy, including positive changes in illness perceptions and knowledge on knee OA and treatment options (38, 43). However, one study reported no significant changes in patient activation and self-efficacy (43).

Quality of life

Eight studies reported improved quality of life, including knee or health-related quality of life, as indicated by the KOOS, the EuroQol 5 dimension scale, the EQ visual analogue scale or the 36-item short form health survey

(SF-36) (20, 22, 31, 33, 36, 37, 38, 42). However, one study reported no clinically significant improvement in quality of life among knee OA patients (39).

Provider-level

The provider-level outcomes were inadequately evaluated in the selected articles. Only one study reported on the potential to reduce staff workloads after delivering interprofessional knee OA care (35).

Organisation-level

Three organisation-level outcomes were identified in the review, namely, quality of care, healthcare utilisation and cost. The most commonly reported outcome was higher quality of care, as reflected by patient satisfaction (21, 23, 26, 36, 38, 39, 43). One study reported decreased healthcare utilisation, including a reduction in visits to primary care providers such as general practitioners and physiotherapists (43). One study reported higher costs in providing interprofessional interventions compared to providing the usual care (20).

Discussion

The adoption of an interprofessional approach in the care of knee OA patients is gaining recognition and emphasis, as evidenced by the increasing number of related literature reviews published in recent years (45, 46). In this review, the aim was to survey the existing literature to identify the structure, process and outcome domains involved in interprofessional knee OA care. The interprofessional teams were diverse in terms of size and access to human resources and support systems. Although interprofessional interactions have been described, there was a lack of clarity on the ways and dynamics in which the team members collaborated. Nevertheless, the positive outcomes observed in the majority of studies suggest that an interprofessional collaborative approach, with a focus on non-pharmacological management, has the potential to benefit both patients and the healthcare system as a whole.

It is evident that the availability of information on both structure and process domains in the existing literature is inadequate. Most of the included studies tended to evaluate the effectiveness of interprofessional knee OA care on improving health status by adopting randomized controlled trials (RCT), observational or pilot studies, yet it is equally important to examine the features and factors contributing to the success of interprofessional knee OA care, particularly at the organisation level.

While the guidelines of the Osteoarthritis Research Society International (OARSI) and the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis, and

Musculoskeletal Diseases propose non-pharmacological approaches such as education, weight management and structured exercise as core treatments for all knee OA patients (47, 48), these approaches undoubtedly require seamless coordination and communication among healthcare providers from different disciplines to deliver comprehensive care. Although the present studies mentioned certain aspects of interprofessional interactions, such as meetings and discussions to provide updates on the patient's progress, there remains a significant knowledge gap regarding the specific details of those interactions, including the timing, frequency, methods and content according to which collaboration and coordination are to take place. How professionals collaborate to optimise treatment outcomes is an important future research area, considering that merely having a team of diverse healthcare providers working together is inadequate. Instead, effective interprofessional collaboration requires flexible sharing of responsibilities, knowledge, authority and a shared belief in the value of coordination among team members.

In addition, evaluating the performance of interprofessional care could be challenging due to the absence of standardised tools and instruments to accurately measure interprofessional collaboration in the healthcare system. To overcome this challenge, it is crucial for future studies to prioritise the development and implementation of such tools. These tools should be designed to assess and evaluate various aspects of interprofessional collaboration, including communication, teamwork, shared decision-making and coordinated care. Standardised measurement instruments could provide a common framework for evaluating interprofessional collaboration, enabling researchers and healthcare organisations to gather consistent and comparable data on collaborative practices.

While a direct correlation between the structure and process and their impacts on outcomes is not well established, exploring the barriers to interprofessional knee OA practice and understanding the underlying reasons provides valuable insights into the existing limitations. Challenges that hamper interprofessional knee OA collaboration encompass provider factors (e.g. a perceived lack of expertise and training), interprofessional factors (e.g. ineffective communication and mistrust issues) and organisational factors (e.g. inconsistent referral criteria and fragmented care). Apart from the necessity to explore the interventions and strategies to overcome these barriers, most of these obstacles were found to arise from a fundamental problem within the structure of interprofessional knee OA care. Take the lack of standardised referral criteria as an illustration. Although several international guidelines, such as those of NICE and OARSI, have been established to provide healthcare professionals with recommendations on when to refer patients for further assessment or specialised care, there does not seem to be a comprehensive picture of the referral pathway. The

review supports Ettlin & Niedermann's (49) idea that a standardised treatment pathway is lacking in the existing knee OA care. Developing a clear and standardised referral pathway and guidelines to streamline the referral process is of the utmost importance. As suggested by Brand & Cox (50), it is necessary to improve the local system in aspects such as interprofessional communication, triage, the referral system and processes to support continuity of care. In addition, Handler *et al.* (51) expanded on the concept by integrating the macro-context and the mission of a public health system with the Donabedian framework to measure public health performance, highlighting the need to consider the broader context in which interprofessional care pathways are implemented.

Moreover, the prevention of knee OA is often overlooked. It is crucial to address preventive measures alongside treatment strategies to provide comprehensive care. The role of authorities in initiating and supporting the development of interprofessional care pathways is essential for ensuring their success. For example, while NICE provides well-defined referral pathways, significant issues remain, such as patients experiencing delays in receiving necessary interventions, with some even dying before undergoing arthroplasty. This underscores the importance of developing robust and efficient referral systems to improve patient outcomes in knee OA care.

Positive changes in patient outcomes are generally noted in the review although a few studies show clinically insignificant results after the implementation of interprofessional knee OA care. Yet, outcomes on both the provider level (e.g. practitioner satisfaction and team efficiency) and organisation level (e.g. cost-effectiveness, morbidity and mortality and healthcare utilisation) were seldom evaluated in the existing literature. While higher costs were identified in one study (20), it is essential to evaluate organisational outcomes since this would help to determine the cost-effectiveness and sustainability of such an approach in the long run. Indeed, in their review, Carron *et al.* (52) determined that the available data are insufficient to come to conclusions on the cost-effectiveness of interprofessional care. More endeavours are thus needed to understand the long-term outcomes for the healthcare system.

Identifying potential interprofessional team members and intervention components that could maximise treatment outcomes may also require further exploration. Although in the existing studies, different healthcare providers were employed within the team, it is worth noting that the OARSI guideline has incorporated traditional Chinese medicine (TCM) practices (e.g. acupuncture) and mind-body exercises (e.g. Tai Chi and yoga), which are recommended for pain relief and improving physical function in knee OA patients. The guidelines emphasise evidence-based approaches, and TCM practices such as acupuncture have been supported by systematic reviews and meta-analyses for their efficacy in managing

osteoarthritis symptoms (53, 54). According to Yang *et al.* (55), TCM been accepted as a complementary therapy not only in Asian countries but also in the West due to its demonstrated effectiveness. For example, acupuncture needle stimulation may help to relieve pain through promoting the excitation of qi and blood circulation. The combination of acupuncture with the usual medical care has demonstrated greater effectiveness compared to the usual care alone in managing knee OA (56, 57). In view of this, more endeavours are required in the future, conducting studies beyond the scope of Western countries and the possibility of including complementary and alternative therapies as part of the intervention, so that comprehensive interprofessional knee OA care can be delivered.

This scoping review has several limitations. First, a few potentially relevant articles in Chinese could not be accessed despite attempts made by the authors. Second, the findings on the outcome domain might be subject to publication bias, given that studies with non-significant or negative outcomes may be less likely to be published. Third, there might be methodological limitations as a critical appraisal of the included studies is not the primary focus of a scoping review.

Conclusion

Ascertaining the structure, process and outcome domains of interprofessional knee OA care is crucial to establishing a complete overview of the management of knee OA. This scoping review identified twenty-six studies on interprofessional knee OA care published between 2013 and 2023. Given the varied contexts of present interprofessional knee OA care, ranging from the healthcare providers involved, the duration of care and the availability of human resources and support systems to the process of interprofessional interaction, the review could only find a limited number of relationships between changes in outcomes and structures and processes. One possible explanation for this is that there is no well-established framework for interprofessional knee OA so that the existing care process is fragmented. This review provides further insights into the existing limitations in the provision of interprofessional knee OA care and offers a deeper understanding of how to further improve interprofessional knee OA care models in the future.

Supplementary materials

This is linked to the online version of the paper at <https://doi.org/10.1530/EOR-2023-0209>.

ICMJE Statement of Interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the work.

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Author contribution statement

All authors contributed to the conception and design of the study, acquisition of data, analysis and interpretation of data, drafting the article or revising it critically for important intellectual content, final approval of the version to be submitted and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

References

- 1 Martel-Pelletier J, Boileau C, Pelletier JP, *et al.* Cartilage in normal and osteoarthritis conditions. *Best Pract Res Clin Rheumatol* 2008 **22** 351–384. (<https://doi.org/10.1016/j.berh.2008.02.001>)
- 2 Liu M, Jin F, Yao X, *et al.* Disease burden of osteoarthritis of the knee and hip due to a high body mass index in China and the USA: 1990–2019 findings from the global burden of disease study 2019. *BMC Musculoskelet Disord* 2022 **23** 63. (<https://doi.org/10.1186/s12891-022-05027-z>)
- 3 Long H, Liu Q, Yin H, *et al.* Prevalence trends of site-specific osteoarthritis from 1990 to 2019: findings from the global burden of disease study 2019. *Arthritis Rheumatol* 2022 **74** 1172–1183. (<https://doi.org/10.1002/art.42089>)
- 4 Cui A, Li H, Wang D, *et al.* Global, regional prevalence, incidence and risk factors of knee osteoarthritis in population-based studies. *EClinicalMedicine* 2020 **29–30** 100587. (<https://doi.org/10.1016/j.eclinm.2020.100587>)
- 5 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** 9332–9336. (<https://doi.org/10.1073/pnas.1703856114>)
- 6 Ferreira RM, Torres RT, Duarte JA, *et al.* Non-pharmacological and non-surgical interventions for knee osteoarthritis: a systematic review and meta-analysis. *Acta Reumatol Port* 2019 **44** 173–217
- 7 Raposo F, Ramos M & Lúcia Cruz A. Effects of exercise on knee osteoarthritis: a systematic review. *Musculoskeletal Care* 2021 **19** 399–435. (<https://doi.org/10.1002/msc.1538>)
- 8 Odole AC, Ogunlana MO, Adegoke BOA, *et al.* Depression, pain and physical function in patients with osteoarthritis of the knee: implications for interprofessional care. *Niger J Med Rehabil* 2015 **18**. (<https://doi.org/10.34058/njmr.v18i1.120>)
- 9 Gilbert JHV, Yan J & Hoffman SJ. A WHO report: framework for action on interprofessional education and collaborative practice. *J Allied Health* 2010 **39** 196.
- 10 Metcalfe L, O'Brien DW & Ellis R. Mapping the current landscape of osteoarthritis patient educational resources: a scoping review of osteoarthritis guidebooks. *NZ J Physiother* 2022 **50** 64–71. (<https://doi.org/10.15619/NZJP/50.2.03>)
- 11 Hsu H & Siwec RM. *Knee Osteoarthritis*. Treasure Island, FL, USA: StatPearls Publishing.
- 12 Peltonen J, Leino-Kilpi H, Heikkilä H, *et al.* Instruments measuring interprofessional collaboration in healthcare - a scoping review.

- J Interprof Care* 2020 **34** 147–161.
<https://doi.org/10.1080/13561820.2019.1637336>
- 13 Wagner EH, Flinter M, Hsu C, *et al.* Effective team-based primary care: observations from innovative practices. *BMC Fam Pract* 2017 **18** 13.
<https://doi.org/10.1186/s12875-017-0590-8>
 - 14 De La Rosa M, Pitts S & Chen P-H. An interprofessional collaboration of care to improve clinical outcomes for patients with diabetes. *J Interprof Care* 2020 **34** 269–271.
<https://doi.org/10.1080/13561820.2019.1643297>
 - 15 Shea L, Calderon B, Stratton J, *et al.* Interprofessional osteoarthritis care: a pilot for interprofessional care and education. *Med Res Arch* 2022 **10**. <https://doi.org/10.18103/mra.v10i9.2894>
 - 16 Donabedian A. In *Explorations in Quality Assessment and Monitoring: The Definition of Quality and Approaches to its Assessment*, vol 1. Ann Arbor, Michigan: Health Administration Press, 1980.
 - 17 Arksey H & O'Malley L. Scoping studies: towards a methodological framework. *Int J Social Res Methodol* 2005 **8** 19–32.
<https://doi.org/10.1080/1364557032000119616>
 - 18 Levac D, Colquhoun H & O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010 **5** 69.
<https://doi.org/10.1186/1748-5908-5-69>
 - 19 Malay MR, Lentz TA, O'Donnell J, *et al.* Development of a comprehensive, nonsurgical joint health program for people with osteoarthritis: a case report. *Phys Ther* 2020 **100** 127–135.
<https://doi.org/10.1093/ptj/pzz150>
 - 20 Marra CA, Grubisic M, Cibere J, *et al.* Cost-utility analysis of a multidisciplinary strategy to manage osteoarthritis of the knee: economic evaluation of a cluster randomized controlled trial study. *Arthritis Care Res* 2014 **66** 810–816. <https://doi.org/10.1002/acr.22232>
 - 21 Moe RH, Grotle M, Kjekken I, *et al.* Effectiveness of an integrated multidisciplinary osteoarthritis outpatient program versus outpatient clinic as usual: a randomized controlled trial. *J Rheumatol* 2016 **43** 411–418. <https://doi.org/10.3899/jrheum.150157>
 - 22 Østerås N, Blaker IB, Hjortland T, *et al.* Improving osteoarthritis management in primary healthcare: results from a quasi-experimental study. *BMC Musculoskelet Disord* 2021 **22** 79.
<https://doi.org/10.1186/s12891-021-03959-6>
 - 23 Østerås N, Moseng T, van Bodegom-Vos L, *et al.* Implementing international osteoarthritis guidelines in an integrated care model – results from a cluster randomized controlled trial. *Osteoarthr Cartil* 2018 **26** S34–S35. <https://doi.org/10.1016/j.joca.2018.02.085>
 - 24 Smink A, Dekker J, Vliet Vlieland TPM, *et al.* Health care use of patients with osteoarthritis of the hip or knee after implementation of a stepped-care strategy: an observational study. *Arthritis Care Res* 2014 **66** 817–827. <https://doi.org/10.1002/acr.22222>
 - 25 Briggs AM, Hinman RS, Darlow B, *et al.* Confidence and attitudes toward osteoarthritis care among the current and emerging health workforce: a multinational interprofessional study. *ACR Open Rheumatol* 2019 **1** 219–235. <https://doi.org/10.1002/acr2.1032>
 - 26 Law R, Nafees S, Hiscock J, *et al.* A lifestyle management programme focused on exercise, diet and physiotherapy support for patients with hip or knee osteoarthritis and a body mass index over 35: a qualitative study. *Musculoskeletal Care* 2019 **17** 145–151.
<https://doi.org/10.1002/msc.1382>
 - 27 Briggs AM, Houlding E, Hinman RS, *et al.* Health professionals and students encounter multi-level barriers to implementing high-value osteoarthritis care: a multi-national study. *Osteoarthr Cartil* 2019 **27** 788–804. <https://doi.org/10.1016/j.joca.2018.12.024>
 - 28 Selten EM, Vriezekolk J, Nijhof M, *et al.* Barriers impeding the use of non-pharmacological, non-surgical care in hip and knee osteoarthritis: the views of general practitioners, physical therapists, and medical specialists. *J Clin Rheumatol* 2017 **23** 405–410.
<https://doi.org/10.1097/RHU.0000000000000562>
 - 29 Kawi J, Schuerman S, Alpert PT, *et al.* Activation to self-management and exercise in overweight and obese older women with knee osteoarthritis. *Clin Nurs Res* 2015 **24** 644–660.
<https://doi.org/10.1177/1054773814544167>
 - 30 Rodrigues da Silva JM, de Rezende MU, Spada TC, *et al.* Educational program promoting regular physical exercise improves functional capacity and daily living physical activity in subjects with knee osteoarthritis. *BMC Musculoskelet Disord* 2017 **18** 546.
<https://doi.org/10.1186/s12891-017-1912-7>
 - 31 Tan BY, Ding BTK, Pereira MJ, *et al.* Collaborative model of care between Orthopaedics and allied healthcare professionals trial (CONNACT) – a feasibility study in patients with knee osteoarthritis using a mixed method approach. *BMC Musculoskelet Disord* 2020 **21** 592. <https://doi.org/10.1186/s12891-020-03611-9>
 - 32 Claes BA, Leung HWC, Matters K, *et al.* Interim analysis: an interdisciplinary team approach in facilitating weight reduction and improving function for people with knee or hip osteoarthritis. The Osteoarthritis Chronic Care Program at Royal North Shore Hospital. *Nutr Diet* 2015 **72** 232–239.
<https://doi.org/10.1111/1747-0080.12166>
 - 33 de Rezende MU, Hissadomi MI, de Campos GC, *et al.* One-year results of an educational program on osteoarthritis: a prospective randomized controlled trial in Brazil. *Geriatr Orthop Surg Rehabil* 2016 **7** 86–94. <https://doi.org/10.1177/2151458516645634>
 - 34 Moore HE, Corning WL, van der Esch M, *et al.* Evaluation of treatment outcome using the Patient Specific Functional Scale in knee osteoarthritis patients undergoing multidisciplinary rehabilitation. *Osteoarthr Cartil* 2020 **28** S396–S397.
<https://doi.org/10.1016/j.joca.2020.02.618>
 - 35 Suter E, Birney A, Charland P, *et al.* Optimizing the interprofessional workforce for centralized intake of patients with osteoarthritis and rheumatoid disease: case study. *Hum Resour Health* 2015 **13** 41.
<https://doi.org/10.1186/s12960-015-0033-3>
 - 36 Voorn VMA, Vermeulen HM, Nelissen RGH, *et al.* An innovative care model coordinated by a physical therapist and nurse practitioner for osteoarthritis of the hip and knee in specialist care: a prospective study. *Rheumatol Int* 2013 **33** 1821–1828.
<https://doi.org/10.1007/s00296-012-2662-3>
 - 37 Yu SP, Williams M, Eyles JP, *et al.* Effectiveness of knee bracing in osteoarthritis: pragmatic trial in a multidisciplinary clinic. *Int J Rheum Dis* 2016 **19** 279–286. <https://doi.org/10.1111/1756-185X.12796>
 - 38 Koh KW & Stillman M. Knee osteoarthritis group program improves access to services and self-management. *Physiotherapy* 2015 **101** e776–e777. <https://doi.org/10.1016/j.physio.2015.03.3652>
 - 39 Miller KA, Baier Manwell LM & Rabago D. Multimodal care for knee and hip osteoarthritis: a pilot feasibility study of a novel approach to a common problem. *Wis Med J* 2020 **119** 44–47.
 - 40 Bouma SE, van Beek JFE, Alma MA, *et al.* What affects the implementation of lifestyle interventions in patients with osteoarthritis? A multidisciplinary focus group study among healthcare professionals. *Disabil Rehabil* 2022 **44** 8283–8293.
<https://doi.org/10.1080/09638288.2021.2011438>
 - 41 Okwera A & May S. Views of general practitioners toward physiotherapy management of osteoarthritis-a qualitative study.

- Physiother Theory Pract* 2019 **35** 940–946.
(<https://doi.org/10.1080/09593985.2018.1459987>)
- 42 Chan PK, Yeung SS, Siu KW, *et al.* Comprehensive osteoarthritis management programme: a multi-disciplinary non-surgical management programme for Chinese patient with osteoarthritis of knee. *Osteoarthr Cartil* 2019 **27** S445.
(<https://doi.org/10.1016/j.joca.2019.02.479>)
- 43 Claassen A, Schers H, Koeter S, *et al.* Preliminary effects of a regional approached multidisciplinary educational program on healthcare utilization in patients with hip or knee osteoarthritis: an observational study. *BMC Fam Pract* 2018 **19** 82.
(<https://doi.org/10.1186/s12875-018-0769-7>)
- 44 Rezende MU, Ocampos G, Brito NR, *et al.* During two years, what is the difference between an exclusive two-day educational program on OA and a program that adds multimodal attention for 6 months in the treatment of OA?. *Osteoarthr Cartil* 2020 **28** S371.
(<https://doi.org/10.1016/j.joca.2020.02.579>)
- 45 Finney A, Healey E, Jordan JL, *et al.* Multidisciplinary approaches to managing osteoarthritis in multiple joint sites: a systematic review. *BMC Musculoskelet Disord* 2016 **17** 266.
(<https://doi.org/10.1186/s12891-016-1125-5>)
- 46 Jayakumar P, Moore MLG & Bozic KJ. Team approach: a multidisciplinary approach to the management of hip and knee osteoarthritis. *JBJS Rev* 2019 **7** e10. (<https://doi.org/10.2106/JBJS.RVW.18.00133>)
- 47 Arden NK, Perry TA, Bannuru RR, *et al.* Non-surgical management of knee osteoarthritis: comparison of ESCEO and OARSI 2019 guidelines. *Nat Rev Rheumatol* 2021 **17** 59–66.
(<https://doi.org/10.1038/s41584-020-00523-9>)
- 48 Lim WB & Al-Dadah O. Conservative treatment of knee osteoarthritis: a review of the literature. *World J Orthop* 2022 **13** 212–229.
(<https://doi.org/10.5312/wjo.v13.i3.212>)
- 49 Ettlin L & Niedermann K. How can the international clinical guidelines for knee osteoarthritis management be implemented systematically in Switzerland? *Zenodo* 2020.
(<https://doi.org/10.5281/zenodo.5109786>)
- 50 Brand C & Cox S. Systems for implementing best practice for a chronic disease: management of osteoarthritis of the hip and knee. *Intern Med J* 2006 **36** 170–179.
(<https://doi.org/10.1111/j.1445-5994.2006.01018.x>)
- 51 Handler A, Issel M & Turnock B. A conceptual framework to measure performance of the public health system. *Am J Public Health* 2001 **91** 1235–1239. (<https://doi.org/10.2105/ajph.91.8.1235>)
- 52 Carron T, Rawlinson C, Arditi C, *et al.* An overview of reviews on interprofessional collaboration in primary care: effectiveness. *Int J Integr Care* 2021 **21** 31. (<https://doi.org/10.5334/ijic.5588>)
- 53 Bannuru RR, Osani MC, Vaysbrot EE, *et al.* OARSI guidelines for the non-surgical management of knee, hip, and polyarticular osteoarthritis. *Osteoarthr Cartil* 2019 **27** 1578–1589.
(<https://doi.org/10.1016/j.joca.2019.06.011>)
- 54 McAlindon T, Bannuru R, Sullivan M, *et al.* OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthr Cartil* 2014 **22** 363–388. (<https://doi.org/10.1016/j.joca.2014.01.003>)
- 55 Yang M, Jiang L, Wang Q, *et al.* Traditional Chinese medicine for knee osteoarthritis: an overview of systematic review. *PLoS One* 2017 **12** e0189884. (<https://doi.org/10.1371/journal.pone.0189884>)
- 56 Zhang L, Yuan H, Zhang L, *et al.* Effect of acupuncture therapies combined with usual medical care on knee osteoarthritis. *J Tradit Chin Med* 2019 **39** 103–110.
- 57 Zhou W & Benharash P. Significance of “deqi” response in acupuncture treatment: myth or reality. *J Acupunct Meridian Stud* 2014 **7** 186–189. (<https://doi.org/10.1016/j.jams.2014.02.008>)