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Health professionals and students encounter multi-level barriers to implementing high-value osteoarthritis care: a multi-national study

A.M. Briggs † *, E. Houlding † ‡, R.S. Hinman §, L.A. Desmond ‖, K.L. Bennell §, B. Darlow ¶, T. Pizzari #, M. Leech ††, C. MacKay ‡‡, P.J. Larmer §§, A. Bendrups ‖‖, A.M. Greig ¶¶, A. Francis-Cracknell ##, J.E. Jordan †††, H. Slater †

† *School of Physiotherapy and Exercise Science, Curtin University, Australia*
‡ *Faculty of Science, University of Ottawa, Ontario, Canada*
§ *Centre for Health, Exercise and Sports Medicine; Department of Physiotherapy, University of Melbourne, Australia*
‖ *Department of Medicine, Western Health, Victoria, Australia*
¶ *Department of Primary Health Care and General Practice, University of Otago, New Zealand*
# *La Trobe Sport and Exercise Medicine Research Centre, La Trobe University, Australia*
†† *Faculty of Medicine Nursing and Health Sciences, Monash University, Australia*
‡‡ *Toronto Rehabilitation Institute, University Health Network, Canada*
§§ *School of Clinical Sciences, Auckland University of Technology, New Zealand*
‖‖ *Department of Medicine (Royal Melbourne Hospital), University of Melbourne, Australia*
¶¶ *Department of Physical Therapy, University of British Columbia, Canada*
Department of Physiotherapy, Monash University, Australia
††† *HealthSense (Aust) Pty, Ltd, Victoria, Australia*

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SUMMARY

Objective: Consistent evidence-practice gaps in osteoarthritis (OA) care are observed in primary care settings globally. Building workforce capacity to deliver high-value care requires a contemporary understanding of barriers to care delivery. We aimed to explore barriers to OA care delivery among clinicians and students.

Design: A cross-sectional, multinational study sampling clinicians (physiotherapists, primary care nurses, general practitioners (GPs), GP registrars; total possible denominator: $n = 119{,}735$) and final-year physiotherapy and medical students (denominator: $n = 2{,}215$) across Australia, New Zealand and Canada. Respondents answered a survey, aligned to contemporary implementation science domains, which measured barriers to OA care using categorical and free-text responses.

Results: 1886 clinicians and 1611 students responded. Items within the domains 'health system' and 'patient-related factors' represented the most applicable barriers experienced by clinicians (25–42% and 20–36%, respectively), whereas for students, 'knowledge and skills' and 'patient-related factors' (16–24% and 19–28%, respectively) were the most applicable domains. Meta-synthesis of qualitative data highlighted skills gaps in specific components of OA care (tailoring exercise, nutritional/overweight management and supporting positive behaviour change); assessment, measurement and monitoring; tailoring care; managing case complexity; and translating knowledge to practice (especially among students). Other barriers included general infrastructure limitations (particularly related to community facilities); patient-related factors (e.g., beliefs and compliance); workforce-related factors such as inconsistent care and a general knowledge gap in high-value care; and system and service-level factors relating to financing and time pressures, respectively.

* Address correspondence and reprint requests to: A.M. Briggs, School of Physiotherapy and Exercise Science, Curtin University, GPO Box U1987, Perth, WA 6845, Australia. Tel.: 61-8 9266-4644; Fax: 61-8 9-266-3699.

E-mail addresses: A.Briggs@curtin.edu.au (A.M. Briggs), ehoul060@uottawa.ca (E. Houlding), ranash@unimelb.edu.au (R.S. Hinman), lucyannedesmond@gmail.com (L.A. Desmond), k.bennell@unimelb.edu.au (K.L. Bennell), ben.darlow@otago.ac.nz (B. Darlow), t.pizzari@latrobe.edu.au (T. Pizzari), michelle.leech@monash.edu (M. Leech), crystal.mackay@utoronto.ca (C. MacKay), peter.larmer@aut.ac.nz (P.J. Larmer), andrea.bendrups@unimelb.edu.au (A. Bendrups), alison.greig@ubc.ca (A.M. Greig), alison.francis-cracknell@monash.edu (A. Francis-Cracknell), healthsense_aust@bigpond.com (J.E. Jordan), H.Slater@curtin.edu.au (H. Slater).

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Conclusions: Clinicians and students encounter barriers to delivery of high-value OA care in clinical practice/training (micro-level); within service environments (meso-level); and within the health system (macro-level).

Introduction

Transformative changes to the way health systems provide care, including clinical practice behaviours and clinical education, are needed to support population ageing and address the increasing disability burden of non-communicable diseases (NCDs)[1–3]. Consideration of osteoarthritis (OA) care is essential, since it is frequently present as a primary condition or as part of a multimorbidity presentation[4]. Transformation requires an assessment of the capacity of the workforce to provide high-value care; that is, care for which evidence supports its effectiveness and the probability of benefit exceeds that of harm[5]. Specifically, addressing barriers to care delivery through targeted upskilling of the workforce and trainees, optimising workforce configurations and cadres and implementing novel models of service delivery[1,2,6–8].

Clinical guidelines and models of care for OA consistently recommend effective, first-line therapies such as exercise/physical activity, education and support for self-management, and where appropriate, weight loss and management of psychological factors[9–13]. However, appraisals of OA guidelines consistently identify limited guidance in how best to practically implement these recommendations[11,14–16]. Substantial evidence-practice gaps understandably persist in OA care[17–23], across countries and particularly in primary care settings. Evidence-practice gaps extend across the primary care workforce, although discipline-specific contextual factors are also likely to be important[24]. Many contemporary models of OA care for high-income economies involve general practitioners (GPs), primary care nurses and physiotherapists as central care providers[9], so understanding drivers of evidence-practice gaps is particularly relevant for these practitioners. As a corollary, consideration of the barriers to the delivery of high-value OA care that are encountered by the emerging health workforce in these disciplines, is also highly relevant[25].

Lau *et al.*[24] in a systematic review of reviews, identified multiple and diverse barriers to delivery of evidence-based care for diverse complex interventions in primary care settings. They organised barriers into external contextual factors (macro-level), organisation-level factors (meso-level), professional/personal factors (micro-level), and specific factors related to the nature of the care intervention. These domains align with those of other implementation and/or behaviour change frameworks[26–28]. Evaluating barriers to high-value care delivery according to empirically-derived implementation/behaviour change frameworks is important, since the breadth of issues and their interdependencies are more likely to be identified from such an approach, increasing the chances for successful interventions and/or system reform initiatives.

A recent systematic review and meta-synthesis of qualitative studies published between 2006 and 2015 cited a range of barriers to implementation of evidence-based OA care[29]. Only one of the eight primary studies reported the use of any theoretical framework to guide the study. Subsequent qualitative studies have been limited to single nations or disciplines and have not considered barriers encountered by students[30–32], while other reviews have considered barriers to implementation of a single-class of interventions such as exercise[33]. The aim of this study was to undertake a large, multi-national, mixed-methods evaluation of barriers to implementing high-value OA care as identified by primary care providers and students and to report these against common domains of implementation science frameworks.

Methods

Design

A multi-national, cross-sectional survey across Australia, New Zealand and Canada conducted from April–December 2017. Here, we report on the perceived barriers to implementation of high-value OA care, while confidence and attitudes related to components of OA care delivery will be reported separately (under review). Human Research Ethics Committees at all participating institutions granted approval to undertake the study. Reporting is consistent with the STROBE statement for cross-sectional studies (Supplementary file 1).

Participants and settings

Practicing and pre-licensure clinicians (students) were recruited. Practicing clinicians included physiotherapists, primary care nurses, GPs and GP registrars. For pragmatic reasons, GPs were recruited in Australia and New Zealand only and GP registrars were recruited in Australia only. Inclusion criteria for clinicians were: 1) current registration to practice in one of the three nations; and 2) enrolled in the Australian GP Training Program (GP registrars only). Pre-licensure clinicians included students enrolled in their final year of physiotherapy or medical training in 2017 at one of eight University programs in Australia, New Zealand or Canada. Given the custom outcomes used, we did not define a sample size *a priori*.

Recruitment

Recruitment of clinicians was undertaken through advertisements disseminated by national professional bodies (see Acknowledgements) and University Alumni offices and/or academic departments. Students were invited to participate through academic staff at their University.

Protocol

Recruitment was undertaken in phases over 2017, according to the availability of professional bodies to disseminate invitations, and appropriate timing in academic curriculum calendars. Clinicians were directed to a secure data collection portal powered by Qualtrics™ (Sydney, Australia). Students completed the survey during a lecture or tutorial or at home, either online using Qualtrics™, or on a paper survey developed for Optical Mark Read scanning to digitally identify responses.

Outcomes

The survey (Supplementary file 2) collected data on demographic, employment and educational history characteristics.

Barriers to the delivery of high-value care for people with OA were measured with custom-designed survey items ($n = 13$ for clinicians; $n = 12$ for students), informed by recent systematic reviews[24,29], an expert international panel and mapped to six domains aligned with implementation science frameworks.[24,26,28] Thirteen items spanned the domains of 'knowledge and skills in OA care'; 'evidence and intervention factors'; 'workplace/clinical placement factors'; 'health system factors'; 'patient factors'; and 'other factors' and were measured on a 4-point Likert scale (1 = not at all applicable to me; to 4 = highly applicable to me). Respondents who selected a score ≥2 for an item within the domains 'knowledge and skills'; 'workplace/clinical placement factors' (clinicians only); or 'other factors' were asked to provide a written response to explain the perceived barrier(s).

Survey items were subject to content validity testing using the method proposed by Polit *et al.*[34]. A multidisciplinary panel of 12 independent, international experts (Supplementary file 3) iteratively rated and commented on the relevance of the survey items over two rounds, from which a modified kappa (k^*) was calculated per item. At the completion of round 2, all items remained above the threshold for k^* being evaluated as 'excellent' (i.e., >0.74; range achieved with 95% CIs: 0.78 (0.71, 0.84) to 1.00 (1.00, 1.00)) for content validity.

Data analysis

Continuous data were summarized using mean and standard deviations by discipline. Categorical data were summarized using frequency distributions and compared with chi square statistics. Data were analysed with IBM SPSS Statistics Version 25, with clinician and student data analysed separately and level of statistical significance set at $P < 0.05$. Free-text data were analysed using a summative content analysis approach[35]. We adopted the analytic framework published by Cunningham *et al.*[36].

Free text data were content-analysed separately by discipline by primary analysts (AMB, EH, LD). First, primary analysts read all responses across the disciplines. Second, one analyst re-reviewed all physiotherapy clinicians' responses to inductively derive a 'base' coding framework of first-order (detailed) codes. Third, the base coding framework was verified by two researchers using a 20% sample of responses and changes were made according to feedback. Fourth, coding was undertaken against the revised base framework and another 20% sample of coded data was re-verified by up to two researchers. Fifth, the final base framework was deductively applied to other disciplines' responses for coding. Sixth, coding was performed for each remaining discipline and was again verified by up to two other researchers based on a 20% sample of responses per discipline. Discordance in coded data ranged from 1.9–6.7% for clinician data and 0.4–3.6% for student data. Seventh, researchers (AMB, EH and HS) then amalgamated first-order codes into second-order codes (sub-themes) and mapped these into overarching third-order codes (themes) to derive a meta-synthesis. Code frequencies were calculated for each first-order theme to give an indication of prominence.

The results reported are crude and descriptive estimates only, unadjusted for potentially relevant co-variables.

Results

Demographic characteristics

Table I provides a summary of the demographic characteristics of valid responses (i.e., where data were provided) by clinicians ($n = 1886$) and students ($n = 1161$) and the proportions of participants from the total possible populations sampled. 1127 (60%) clinician responses were provided from Australia, 366 (19%) from New Zealand and 393 (21%) from Canada. 683 (59%) student responses were provided from Australia, 270 (23%) from New Zealand and 208 (18%) from Canada.

Barriers to implementing OA care

Table II details the perceived applicability of barriers to OA care across five domains, by clinical discipline and student groups and by level of applicability. Figures. 1 and 2 illustrate barriers deemed most important ('applicable' or 'highly applicable'). 'Health system' and 'patient-related factors' were the most relevant to clinicians, whereas for students, 'personal knowledge and skills' and 'patient-related factors' were the most relevant (Fig. 1). A greater proportion of GPs and GP registrars cited 'health system' and 'patient related' factors as applicable or highly applicable barriers to OA care delivery, whereas nurses more frequently cited 'personal knowledge and skills' [Fig. 2(A)]. A greater proportion of medical students perceived barriers to OA care delivery compared to physiotherapy students across all domains, except for 'evidence and interventions' [Fig. 2(B)].

Personal knowledge and skills

Overall, 37–88% of clinicians and 68–85% of students perceived barriers to OA care in the domain of knowledge and skills, at any level of applicability. The results that follow all relate to any level of applicability ('somewhat applicable', 'applicable', or 'highly applicable') in order to reflect the maximum scope of relevant barriers. Nurses consistently cited these barriers as being more applicable to their context than other disciplines, particularly in relation to awareness of OA care guidelines (i.e., knowing *what* care to provide) (87%), and dealing with comorbidities (70%). Compared with physiotherapists (37%); a greater proportion of nurses (65%), GPs (59%) and GP registrars (69%) reported a larger skills deficit in OA care delivery (i.e., skills in *how* to deliver care). Both physiotherapy and medical students reported knowledge of guidelines to be an applicable barrier to care (77% and 86%, respectively).

Evidence and interventions

Most clinicians (73–87%) and students (72–77%) identified that OA guidelines were relevant to their practice and their case-mix. Despite this perception, guideline accessibility and interpretability were cited as applicable barriers to OA care delivery by 43–59% and 30–52%, respectively, of clinicians and 40–53% and 43–51%, respectively, of students.

Workplace setting

For the majority of physiotherapists (71%) and students (70–78%), time was not a barrier to high-value OA care, whereas for nurses (44%), GPs (57%) and GP registrars (41%) time was an applicable barrier. While just over one-third of physiotherapists (35%), nurses (36%) and GP registrars (41%) cited practice behaviours of colleagues to be a barrier to OA care delivery; half of GPs (50%) cited this as a barrier. Similarly, more medical students (51%) compared to physiotherapy students (35%) cited colleagues' behaviour to be a barrier to care. Whereas physiotherapists (53%) and GPs (62%) identified lack of team-based care in their workplace as a barrier to care, nurses (35%), GP registrars (34%) and students (35%) considered this less applicable to their settings. Infrastructure issues were identified as a barrier to OA care delivery by 37–57% of clinicians.

Health system factors

More than half (48–70%) of clinicians identified financing as a barrier to high-value OA care, particularly GPs, with 70% citing this

Table I
Clinicians' and students' demographic characteristics. Data presented as mean (SD), unless stated otherwise

Descriptor	Physiotherapists	Primary care nurses	General practitioners	General practitioner registrars	Pooled clinicians	Medical students	Physiotherapy students	Pooled students
Total population available§	AU: 28,921† CA: 11,355‡ NZ: 2,854§	AU: 43,271‖ CA: 500¶ NZ: 3,354#	AU: 19,749** NZ: 4,242††	AU: 5,489‡‡	119,735	1215	1000	2215
Respondents, *n* (% population)	1380 (3.2)	158 (0.3)	267 (1.1)	81 (1.5)	1886 (1.6)	465 (38.3)	696 (69.6)	1161 (52.4)
Gender, *n* (% female)	1026 (74.5)	155 (98.1)	185 (69.1)	56 (69.1)	1422 (75.4)	279 (60.0)	458 (65.9)	737 (63.5)
Age, years	40.1 (12.3)	48.0 (11.7)	44.1 (11.6)	33.4 (6.6)	41.0 (12.3)	25.1 (3.4)	24.0 (3.5)	24.5 (3.5)
Years registered to practice [min, max]	16.1 (12.3) [1–56]	20.0 (13.1) [1–50]	13.4 (12.2) [1–52]	3.2 (2.0) [1–12]	15.5 (12.5) [1–56]			
Years registered including care for people with OA [min, max]	13.7 (11.1) [0–56]	12.7 (10.4) [0–47]	13.1 (11.9) [0–45]	2.6 (1.5) [0–6]	13.1 (11.2) [0–56]			
Clinical practice hours/ week [min, max]	28.8 (12.3) [0–69]	25.2 (11.1) [0–50]	29.1 (11.2) [0–70]	30.8 (11.6) [0–60]	28.6 (12.0) [0–70]			
Clinical role includes OA care – *n* (%) yes	1207 (88.6)	118 (78.7)	252 (96.6)	75 (96.2)	1652 (89.2)			
Currently caring for patients with OA – *n* (%)								
0 patients/week	21 (1.7)	2 (1.7)	0 (0)	3 (4.1)	26 (1.6)			
1–5 patients/week	419 (34.9)	58 (49.6)	76 (30.3)	43 (58.1)	596 (36.6)			
6–10 patients/week	405 (33.7)	31 (26.5)	105 (41.8)	23 (31.1)	564 (34.3)			
11–20 patients/week	222 (18.5)	17 (14.5)	56 (22.3)	4 (5.4)	299 (18.2)			
>20 patients/week	135 (11.2)	9 (7.7)	14 (5.6)	1 (1.4)	159 (9.7)			
Completed OA-specific PD in last 5 years^ - *n* (%) yes	454 (33.3)	22 (14.7)	59 (22.6)	2 (2.6)	537 (29.0)			
Awarded postgraduate qualification in MSK health – *n* (%) yes	520 (38.2)	5 (3.3)	26 (10.0)	2 (2.6)	553 (29.9)			
Primary site of clinical practice – *n* (%) yes								
Private practice	709 (52.4)	116 (78.4)	227 (87.6)	63 (81.8)	1115 (60.7)			
Public community health centre	120 (8.9)	15 (10.1)	19 (7.3)	3 (3.9)	157 (8.5)			
Residential aged-care facility	70 (5.2)	1 (0.7)	0 (0)	0 (0)	71 (3.9)			
Tertiary hospital	236 (17.4)	4 (2.7)	0 (0)	5 (6.5)	249 (13.3)			
Non-tertiary hospital	115 (8.5)	2 (1.4)	3 (1.2)	2 (2.6)	122 (6.6)			
Other	104 (7.7)	10 (6.8)	10 (3.9)	4 (5.2)	128 (7.0)			
Registrar training year - %								
0 (not started)				3 (3.7)				
1				20 (24.7)				
2				16 (19.8)				
3				29 (35.8)				
4				12 (14.8)				
5				0 (0)				
6				1 (1.2)				
Previous qualification – *n* (%) yes:						246 (52.9)	332 (47.7)	578 (49.8)
PhD*						3 (1.2)	0 (0)	3 (0.5)
Master (by research)						12 (4.9)	6 (1.8)	18 (3.1)
Master (by coursework)						8 (3.3)	24 (7.2)	32 (5.5)
Post-grad certificate/diploma						7 (2.8)	3 (0.9)	10 (1.7)
Bachelor with honours						72 (29.3)	103 (31.0)	175 (30.3)
Bachelor						173 (70.3)	206 (62.0)	379 (65.6)
Other						6 (2.4)	14 (4.2)	20 (3.5)
Experience in clinical training - % yes								
Managing or assessing a person with OA						425 (91.8)	584 (84.0)	1009 (87.1)
Developing or implementing a chronic disease management plan						370 (79.9)	441 (63.5)	811 (70.0)

§ represents the maximum possible population size for each group. For clinicians, this does not necessarily reflect the total size of the population invited to participate as the researchers had no control over the fidelity of invitations. For students, the population reflects the size of the population invited to participate.
OA: osteoarthritis; PD: professional development; MSK: musculoskeletal.
^PD defined as a duration of at least half a day of OA-specific education.
* Qualification subgroups may sum to greater than 100% as respondents could select more than one qualification option.
† Based on physiotherapists holding general registration in Australia in 2017.
‡ Based on 2017 membership of Canadian Physical Therapy Association.
§ Based on 2017 working members of Physiotherapy New Zealand.
‖ Based on 2016 Australian workforce census data.
¶ Based on 2017 membership of Canadian Family Practice Nurses Association.
# Based on 2017 workforce census data from New Zealand Nursing Council.
** Based on 2016/17 members of the Royal Australian College of General Practitioners.
†† Based on registered General Practitioners in 2017 in New Zealand reported by Medical Council of New Zealand.
‡‡ Based on 2017 enrolments in the Australian General Practice Training Program.

Table II
Perceived applicability of the barriers to delivery of high-value OA care across domains, by discipline, as *n* (%). The number of non-responders is also indicated for each item

Level of applicability	Disciplines					
	Physiotherapists	Primary care nurses	General practitioners	GP registrars	Medical students	Physiotherapy students
Domain 1: Personal knowledge and skills						
1.1: I am not aware of the current clinical guidelines describing best-practice non-pharmacologic and non-surgical care for osteoarthritis(OA), so I don't know what care to provide						
Not at all applicable	623 (48.8)[a]	17 (12.7)[b]	115 (46.6)[a]	36 (48.6)[a]	60 (14.5)[x]	158 (23.0)[y]
Somewhat applicable	525 (41.1)[a]	63 (47.0)[a]	103 (41.7)[a]	29 (39.2)[a]	212 (51.3)[x]	408 (59.5)[y]
Applicable	109 (8.6)[a]	38 (28.4)[b]	25 (10.1)[a]	8 (10.8)[a]	116 (28.1)[x]	104 (15.2)[y]
Highly applicable	20 (1.6)[a]	16 (11.9)[b]	4 (1.6)[a]	1 (1.4)[a]	25 (6.1)[x]	16 (2.3)[y]
Non-responders	103	24	20	7	52	10
1.2: I find dealing with comorbid conditions associated with OA too complex						
Not at all applicable	639 (50.0)[a]	40 (29.9)[b]	124 (50.2)[a,c]	25 (33.8)[b,c]	116 (28.1)[x]	220 (32.0)[x]
Somewhat applicable	558 (43.7)[a]	68 (50.7)[a]	103 (41.7)[a]	38 (51.4)[a]	241 (58.4)[x]	403 (58.7)[x]
Applicable	72 (5.6)[a]	24 (17.9)[b]	17 (6.9)[a]	9 (12.2)[a,b]	50 (12.1)[x]	63 (9.2)[x]
Highly applicable	8 (0.6)[a]	2 (1.5)[a]	3 (1.2)[a]	2 (2.7)[a]	6 (1.5)[x]	1 (0.1)[y]
Non-responders	103	24	20	7	52	9
1.3: I feel comfortable in what care to provide, but lack skills in how to deliver the care*						
Not at all applicable	804 (63.0)[a]	47 (35.1)[b]	101 (40.9)[b]	23 (31.1)[b]	112 (27.1)[x]	179 (26.1)[x]
Somewhat applicable	386 (30.2)[a]	68 (50.7)[b]	124 (50.2)[b]	41 (55.4)[b]	199 (48.2)[x]	356 (51.9)[x]
Applicable	79 (6.2)[a]	13 (9.7)[a]	18 (7.3)[a]	8 (10.8)[a]	88 (21.3)[x]	131 (19.1)[x]
Highly applicable	8 (0.6)[a]	6 (4.5)[b]	4 (1.6)[a,b]	2 (2.7)[a,b]	14 (3.4)[x]	20 (2.9)[x]
Non-responders	103	24	20	7	52	10
Domain 2: Evidence and interventions						
2.1: Providing guideline-consistent care is difficult because clinical guidelines are difficult to access						
Not at all applicable	673 (53.2)[a]	54 (40.9)[b]	120 (48.8)[a,b]	42 (56.8)[a,b]	246 (60.4)[x]	319 (46.6)[y]
Somewhat applicable	465 (36.8)[a]	50 (37.9)[a]	99 (40.2)[a]	22 (29.7)[a]	127 (31.2)[x]	312 (45.4)[y]
Applicable	114 (9.0)[a]	22 (16.7)[b]	22 (8.9)[a,b]	10 (13.5)[a,b]	31 (7.6)[x]	50 (7.3)[x]
Highly applicable	13 (1.0)[a]	6 (4.5)[b]	5 (2.0)[a,b]	0 (0)[a,b]	3 (0.7)[x]	4 (0.6)[x]
Non-responders	115	26	21	7	58	11
2.2: Providing guideline-consistent care is difficult because clinical guidelines are difficult to interpret						
Not at all applicable	807 (63.8)[a]	64 (48.5)[b]	144 (58.5)[a,b]	52 (70.3)[a]	231 (56.8)[x]	336 (49.0)[y]
Somewhat applicable	396 (31.3)[a]	50 (37.9)[b]	82 (33.3)[a]	15 (20.3)[a]	146 (35.9)[x]	289 (42.1)[y]
Applicable	51 (4.0)[a]	15 (11.4)[b]	19 (7.7)[a,b]	7 (9.5)[a,b]	26 (6.4)[x]	59 (8.6)[x]
Highly applicable	11 (0.9)[a]	3 (2.3)[a]	1 (0.4)[a]	0 (0)[a]	4 (1.0)[x]	2 (0.3)[x]
Non-responders	115	26	21	7	58	10
2.3: Clinical guidelines are not relevant to my practice because the profile of my patients with OA is different to those from which clinical guidelines have been derived						
Not at all applicable	924 (73.0)[a]	96 (72.7)[a]	182 (74.0)[a]	64 (86.5)[a]	314 (77.1)[x]	484 (71.4)[y]
Somewhat applicable	278 (22.0)[a]	28 (21.2)[a]	56 (22.8)[a]	9 (12.2)[a]	84 (20.6)[x]	165 (24.3)[x]
Applicable	52 (4.1)[a]	8 (6.1)[a]	7 (2.8)[a]	1 (1.4)[a]	9 (2.2)[x]	26 (3.8)[x]
Highly applicable	11 (0.9)[a]	0 (0)[a]	1 (0.4)[a]	0 (0)[a]	0 (0)[x]	3 (0.4)[x]
Non-responders	115	26	21	7	58	18
Domain 3: Workplace/clinical placement factors						
3.1: Delivery of best-practice non-pharmacologic and non-surgical care is too time consuming for me						
Not at all applicable	896 (71.1)[a]	74 (56.5)[b]	106 (43.1)[b]	44 (59.5)[a,b]	284 (69.8)[x]	532 (77.7)[y]
Somewhat applicable	302 (23.9)[a]	42 (32.1)[a,b]	106 (43.1)[b]	25 (33.8)[a,b]	98 (24.1)[x]	125 (18.2)[y]
Applicable	48 (3.8)[a]	10 (7.6)[a,b]	23 (9.3)[b]	4 (5.4)[a,b]	23 (5.7)[x]	27 (3.9)[x]
Highly applicable	15 (1.2)[a]	5 (3.8)[a,b]	11 (4.5)[b]	1 (1.4)[a,b]	2 (0.5)[x]	1 (0.1)[x]
Non-responders	119	27	21	7	58	11
3.2: Colleagues within my workplace/clinical placement do not follow best-practice non-pharmacologic and non-surgical care for OA						
Not at all applicable	820 (65.0)[a]	84 (64.1)[a]	122 (49.6)[b]	44 (59.5)[a,b]	200 (49.1)[x]	442 (64.6)[y]
Somewhat applicable	296 (23.5)[a]	36 (27.5)[a,b]	92 (37.4)[b]	21 (28.4)[a,b]	150 (36.9)[x]	198 (28.9)[y]
Applicable	106 (8.4)[a]	9 (6.9)[a]	25 (10.2)[a]	7 (9.5)[a]	53 (13.0)[x]	38 (5.6)[y]
Highly applicable	39 (3.1)[a]	2 (1.5)[a]	7 (2.8)[a]	2 (2.7)[a]	4 (1.0)[x]	6 (0.9)[x]
Non-responders	119	27	21	7	58	12
3.3: Team-based or interdisciplinary care, required for some patients, is not possible within my workplace/clinical placement						
Not at all applicable	591 (46.9)[a]	85 (64.9)[b]	94 (38.2)[a]	49 (66.2)[b]	264 (64.9)[x]	446 (65.3)[x]
Somewhat applicable	394 (31.2)[a,b]	29 (22.1)[b]	95 (38.6)[a]	17 (23.0)[a,b]	107 (26.3)[x]	188 (27.5)[x]
Applicable	176 (14.0)[a]	9 (6.9)[a]	34 (13.8)[a]	6 (8.1)[a]	30 (7.4)[x]	46 (6.7)[x]
Highly applicable	100 (7.9)[a]	8 (6.1)[a]	23 (9.3)[a]	2 (2.7)[a]	6 (1.5)[x]	3 (0.4)[x]
Non-responders	119	27	21	7	58	13
3.4: I lack infrastructure (e.g., space, equipment) or other resources (e.g., written information resources, administrative support or staffing) to deliver best practice non-pharmacologic and non-surgical care*						
Not at all applicable	685 (54.3)[a,b]	56 (42.7)[b,c]	106 (43.1)[c]	47 (63.5)[a]	–	–
Somewhat applicable	389 (30.8)[a]	45 (34.4)[a]	82 (33.3)[a]	18 (24.3)[a]	–	–
Applicable	134 (10.6)[a]	19 (14.5)[a]	37 (15.0)[a]	8 (10.8)[a]	–	–
Highly applicable	53 (4.2)[a]	11 (8.4)[a,b]	21 (8.5)[b]	1 (1.4)[a,b]	–	–
Non-responders	119	27	21	7	–	–
Domain 4: Health system factors						
4.1: There are no financial incentives to deliver best practice non-pharmacologic and non-surgical care for OA						
Not at all applicable	658 (52.4)[a]	58 (45.0)[a]	73 (29.7)[b]	36 (49.3)[a]	256 (63.2)[x]	446 (65.5)[x]
Somewhat applicable	289 (23.0)[a]	37 (28.7)[a]	70 (28.5)[a]	19 (26.0)[a]	81 (20.0)[x]	147 (21.6)[x]
Applicable	182 (14.5)[a]	22 (17.1)[a,b]	56 (22.8)[b]	11 (15.1)[a,b]	50 (12.3)[x]	68 (10.0)[x]
Highly applicable	127 (10.1)[a]	12 (9.3)[a,b]	47 (19.1)[b]	7 (9.6)[a,b]	18 (4.4)[x]	20 (2.9)[x]

Table II (*continued*)

Level of applicability	Disciplines					
	Physiotherapists	Primary care nurses	General practitioners	GP registrars	Medical students	Physiotherapy students
Non-responders	124	29	21	8	60	15
Domain 5: Patient-related factors						
5.1: My patients seek care that does not align with current evidence						
Not at all applicable	369 (29.4)[a]	65 (50.8)[b]	55 (22.4)[a]	18 (24.7)[a]	121 (29.8)[x]	266 (39.0)[y]
Somewhat applicable	546 (43.5)[a]	47 (36.7)[a]	116 (47.2)[a]	31 (42.5)[a]	169 (41.6)[x]	284 (41.6)[x]
Applicable	258 (20.6)[a]	13 (10.2)[b]	53 (21.5)[a]	19 (26.0)[a]	96 (23.6)[x]	111 (16.3)[y]
Highly applicable	82 (6.5)[a]	3 (2.3)[a]	22 (8.9)[a]	5 (6.8)[a]	20 (4.9)[x]	21 (3.1)[x]
Non-responders	125	30	21	8	59	14
5.2: My patients are unable to access appropriate care options due to their financial or geographic circumstances						
Not at all applicable	3838 (30.5)[a]	37 (28.7)[a]	38 (15.4)[b]	18 (24.7)[a,b]	121 (28.6)[x]	266 (34.7)[y]
Somewhat applicable	518 (41.2)[a]	57 (44.2)[a]	97 (39.4)[a]	27 (37.0)[a]	180 (44.3)[x]	318 (46.)8[x]
Applicable	264 (21.0)[a]	20 (15.5)[a]	62 (25.2)[a]	21 (28.8)[a]	93 (22.9)[x]	111 (16.3)[y]
Highly applicable	91 (7.2)[a]	15 (11.6)[a,b]	49 (19.9)[b]	7 (9.6)[a,b]	17 (4.2)[x]	15 (2.2)[x]
Non-responders	124	29	21	8	59	16

^ represents valid percentage only, i.e., not including non-responders.
a, b, or c: denotes the proportion is not different to other practicing clinician disciplines with the same symbol ($P < 0.05$). For example, two or more disciplines with an 'a' symbol would have proportions that are not different to each other, while two disciplines with different symbols (e.g., 'a' and 'b') would have proportions that are significantly different to each other.
x or y denotes the proportion is not different from other student discipline with the same symbol ($P < 0.05$). Where both student groups have the same symbol, there is no difference in proportions. Where one student group has an x and the other y, there is a difference in proportions.
* linked to free-text response, where respondents were asked to provide an explanation for their selection.
Domain 6: 'Other factors' was a free-text response only (see Table V).
The specific question presented to respondents was: "In your day-to-day work (or clinical study for students), you may have encountered specific barriers to delivering best-practice non-pharmacologic and non-surgical care to people with OA, such as education, supporting physical activity and nutritional/weight management. Below is a list of barriers that people have told us about. Please indicate the relevance of each item to your situation."

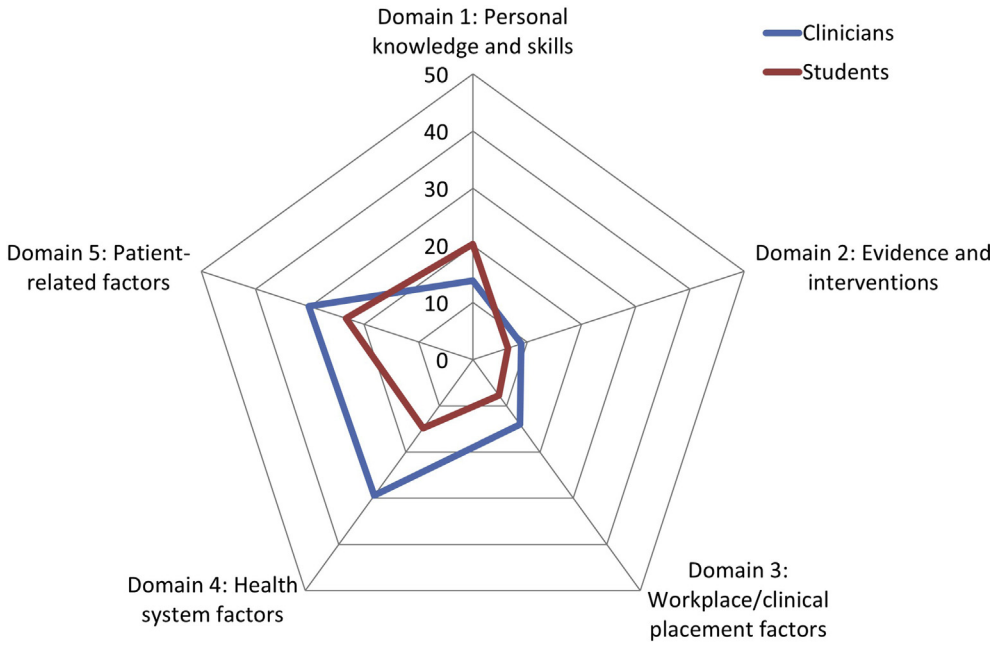

Fig. 1. Radar plot of mean percentages of clinicians and students (pooled) who cited barriers to delivery of OA care as applicable or highly applicable across five domains.

as an applicable barrier. A moderate proportion of students (35–37%) considered health financing as a barrier to OA care.

Patient-related factors

Whereas half (49%) the nursing respondents cited patients' expectations as a barrier to OA care, this factor was substantially more applicable to all other clinicians (71–78%) and students (65–71%). The majority of clinicians (69–85%) and students (65–71%) identified their patients' inability to access care options as a barrier.

Qualitative responses

The outcomes of the content analysis of free-text responses are summarised in Tables III–V. A meta-synthesis of the main themes and sub-themes identified for skills, infrastructure and 'other' barriers are provided below and summarised in Fig. 3.

Skills barriers

Specific skills-related barriers were perceived by 538 (29%) clinicians and 456 (39%) students, resulting in 1042 and 1035,

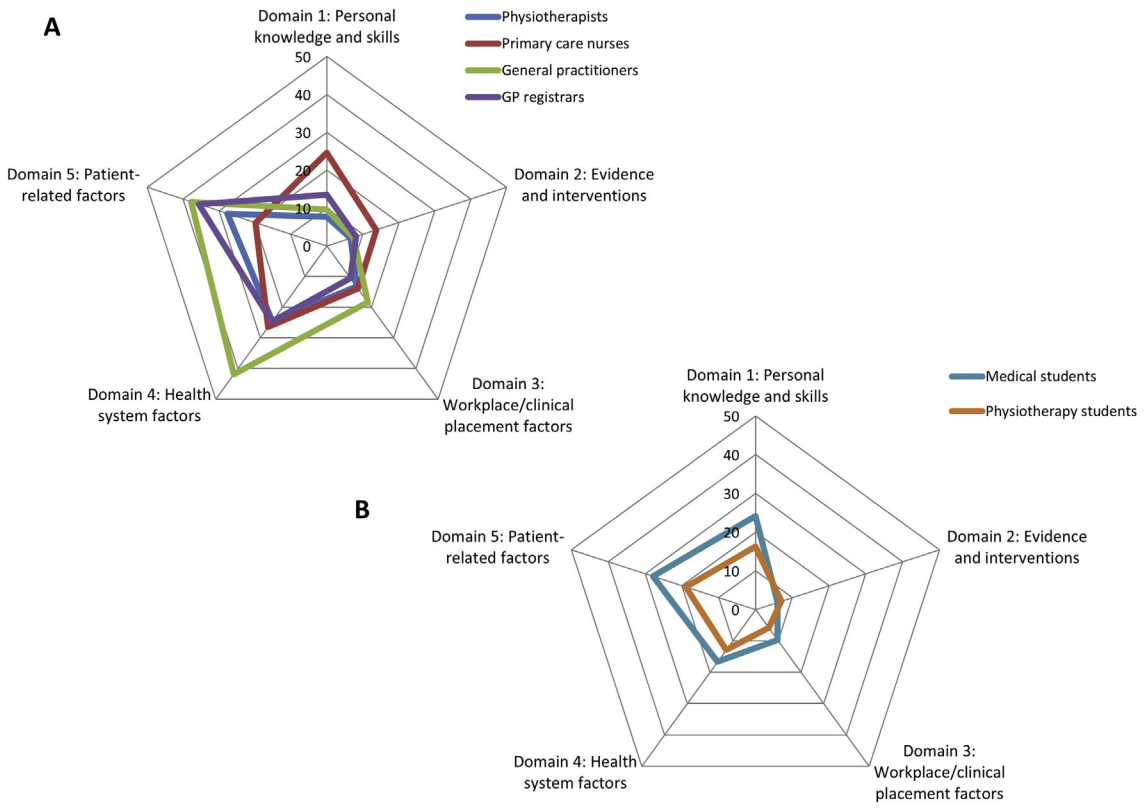

Fig. 2. Radar plot of mean percentages of clinicians (A) and students (B), disaggregated by discipline, who cited barriers to delivery of OA care as applicable or highly applicable across five domains.

respectively, coded responses across 35 first-order codes (Table III). Five overarching themes, supported by sub-themes, were identified.

Theme 1: Lacking skills in specific components of OA care

A range of specific skills gaps were identified across clinical disciplines and students, spanning the following sub-themes:

- Communication, education about OA and the inconsistent relationship between pain and joint structure, and establishing a therapeutic alliance. This perceived skills deficit also extended to a lack of skills in managing patients with unhelpful beliefs about pain; explaining low-value treatment options, prognosis and recovery; and managing patients' expectations relating to surgical care, pharmacological interventions, passive therapies and imaging. Skills gaps in communication, education and co-design of management plans were most notable for GPs, nurses, GP registrars and students.
- Care co-ordination and support for self-management.
- Exercise prescription, including tailoring and selecting appropriate dose parameters. This was particularly relevant for GPs. Physiotherapists, GPs and students noted a skills gap in delivery of adjunctive therapies, such as manual therapies, aids and appliances, and electrotherapies.
- Behavioural and psychological support, particularly related to motivational interviewing and supporting lifestyle changes.
- Nutritional and weight management care delivery, communication, education and motivation focusing on optimising nutrition, diet and effective management of weight loss for overweight or obese patients. This skill gap was strongly noted across disciplines.
- The general approach to non-pharmacological and non-surgical care, including inadequate knowledge of what care to provide, and skills in delivery of the appropriate care.
- Delivery of pharmacological care/advice and procedures care.
- Peri-operative care.

Theme 2: Lacking skills in assessment, measurement, and monitoring

A lack of skills in using OA specific outcomes was identified. Nurses and students identified a lack of skills in clinical assessment (examination, assessing disease severity), diagnostic criteria and knowing when to reassess.

Theme 3: Lacking skills in tailoring care

The ability to tailor components of care was cited as a skills gap across disciplines, most commonly by physiotherapy students. Specific limitations in tailoring were attributed to socioeconomic, demographic and geographic factors.

Theme 4: Lacking skills in managing case complexity

Managing complexity was identified as a skills gap by approximately 10% of clinicians and students. Complexity included managing patients with severe unremitting pain, co- and multimorbidities, and patients with unhelpful beliefs about pain (e.g., hurt being equated with harm, fear avoidance).

Table III
Summary of themes, subthemes and first-order codes relating to skills barriers in delivery of OA care

Subthemes	First-order codes	Respondents providing a response to the first-order code, *n* (%)						Demonstrative quote
		PT	NU	GP	GPr	MStu	PTStu	
Theme 1: Lacking skills in specific components of OA care								
1.1 Lack of skills in communication, education and establishing therapeutic alliance	1.1.1 Lack skills to effectively communicate/educate/explain pathophysiology of OA and the inconsistent relationship between pain and joint structural changes.	21 (6.0)	0 (0)	1 (0.9)	1 (2.7)	1 (0.4)	12 (5.9)	It can be challenging to educate people regarding imaging and how pain isn't correlated necessarily a result of structural damage. I often find it challenging to ask about other psychosocial/personal factors that may seem intrusive, but relevant to pain, as it's beyond the physical nature of their condition. We learn some communication and interview strategies in school but soft skills are hard to develop and implement in an individual-specific manner. Although I often know the message I want to get across it is often challenging as one wrong word or phrase can set up fear beliefs in your patient. [Physiotherapist; ID1291]
	1.1.2 Lack skills in building trust/managing expectations related to treatment options (including expectations/requests for 'hands on' passive therapy, imaging, surgical/pharmacological intervention, alternative/complementary and other passive therapies including internet-sourced therapies) in patients who expect passive therapies and rapid responses to treatment.	24 (6.8)	0 (0)	7 (6.5)	4 (10.8)	8 (3.2)	5 (2.5)	
	1.1.3 Generally lack skills in communicating with, and educating patients in health behaviour change, developing appropriate management plans and providing a realistic prognosis.	8 (2.3)	7 (16.3)	21 (19.6)	11 (29.7)	56 (22.2)	66 (32.4)	
	1.1.4 Lack skills in assessing the need for on-referral (e.g., indication for referral to surgeon, dietician, psychologist etc.) and actioning the on-referral.	30 (8.5)	4 (9.3)	8 (7.5)	4 (10.8)	29 (11.5)	17 (8.3)	
	1.1.5 Lack skills to communicate across cultural/language barriers.	3 (0.9)	0 (0)	0 (0)	0 (0)	1 (0.4)	0 (0)	
1.2 Lack of skills in care coordination and support for self-management	1.2.1 Lack skills in coordinating a multidisciplinary team.	23 (6.6)	6 (14.0)	7 (6.5)	0 (0)	5 (2.0)	1 (0.5)	Even though I may know which resources to use, I don't know how to access these resources or organise these services for the patient. [Medical student; ID103]
	1.2.2 Lack skills in co-designing a self-management plan with patients.	10 (2.8)	1 (2.3)	3 (2.8)	0 (0)	5 (2.0)	5 (2.5)	
	1.2.3 Lack skills in directing patients to non-clinical services and community based resources (web-based resources, community support groups).	7 (2.0)	2 (4.2)	7 (6.5)	5 (13.5)	4 (1.6)	1 (0.5)	
1.3 Lack of skills in exercise prescription and adjunctive therapies	1.3.1 Lack skills to appropriately tailor an exercise program and select appropriate dosage parameters (i.e., frequency, intensity, pacing, exercise mode, format: group vs individual, part of body to exercise, duration of treatment) to a broad range of patients.	37 (10.5)	7 (16.3)	37 (34.6)	5 (13.5)	22 (8.7)	32 (15.7)	I had minimal musculoskeletal training at medical school and GP training which only included very minimal training on what exercises to do when etc. I feel comfortable in providing very basic exercises but lack the skills for more intense and focused exercises. [GP registrar; ID340]
	1.3.2 Lack skill in manual therapy techniques.	12 (3.4)	0 (0)	1 (0.9)	0 (0)	1 (0.4)	14 (6.9)	
	1.3.3 Lack skills in utilising equipment for OA care, such as braces, orthotics, walking aids.	3 (0.9)	0 (0)	2 (1.9)	0 (0)	3 (1.2)	3 (1.5)	
	1.3.4 Lack skills in using transcutaneous electrical nerve stimulation.	2 (0.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
1.4 Lack of skills in behavioural and psychological support	1.4.1 Lack skills in counselling/providing psychological support (e.g., to address or discuss depression, anxiety).	34 (9.7)	0 (0)	2 (1.9)	1 (2.7)	3 (1.2)	6 (2.9)	Could be better in motivating patients and promoting self-efficacy, and dealing with the psychological management of chronic pain. [GP; ID1035]
	1.4.2 Lack skills in motivational interviewing/educating patients in regards to lifestyle changes (participating in rehabilitation, increasing physical activity, quitting smoking, making positive dietary changes).	47 (13.4)	4 (9.3)	13 (12.1)	10 (27.0)	26 (10.3)	27 (13.2)	
1.5 Lack of skills in nutritional and weight management care	1.5.0 Lack skills in management of nutrition/diet problems, particularly related to obesity and overweight management.	118 (33.6)	5 (11.7)	25 (23.4)	12 (32.4)	28 (11.1)	33 (16.1)	Being an experienced musculoskeletal physiotherapist I have many patients with comorbid conditions and psychosocial issues. I still find difficulty in educating these more "difficult" patients into adopting a programme for only one (or even several) of their many issues. Weight loss and adherence, over the longer term, to an activity programme are particular areas that I find I am unsuccessful. [Physiotherapist; ID1173]

(*continued on next page*)

Table III (*continued*)

Subthemes	First-order codes	Respondents providing a response to the first-order code, *n* (%)						Demonstrative quote
		PT	NU	GP	GPr	MStu	PTStu	
1.6 No subthemes	1.6.0 Generally lack of skills in non-pharmacologic/non-surgical care (specific components of care not identified).	3 (0.9)	2 (4.7)	4 (3.7)	2 (5.4)	26 (10.3)	6 (2.9)	As a medical student, the types and roles of non-pharmacologic and non-surgical care are often glossed over quickly, and for a good reason. Our colleagues in allied health are much more skilled in providing this type of care. My job will be in the phase of assessment, and subsequent pharmacological or surgical care down the line. However, it means that in my time on the wards/community when considering patients with OA, I have not known how to deliver this first line care. [Medical student; ID96]
1.7 Lack of skills in pharmacologic and procedures care	1.7.1 Lack skills in providing pharmacologic advice.	0 (0)	0 (0)	1 (0.9)	1 (2.7)	0 (0)	0 (0)	I am not confident to do steroid injections for Joint OA. [GP; ID673]
	1.7.2 Lack medicine prescribing skills (medication types, dosing, education around medications, motivation for compliance).	2 (0.6)	0 (0)	0 (0)	1 (2.7)	20 (7.9)	0 (0)	I don't exactly know how to medically manage OA in terms of specific types of NSAIDs and their dosages [Medical student; ID330]
	1.7.3 Lack skill in administering injections.	1 (0.3)	0 (0)	3 (2.8)	1 (2.7)	2 (0.8)	0 (0)	
1.8 Lack of skills in peri-operative care	1.8.1 Lack skills in providing surgical care generally.	6 (1.7)	0 (0)	0 (0)	0 (0)	4 (1.6)	1 (0.5)	I mainly have had clinical contact with patients post-joint replacement, so have not had to use any skills for preoperative management. [Physiotherapy student; ID154]
	1.8.2 Lack skills delivering pre-operative care.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (2.0)	
	1.8.3 Lack skills delivering post-operative care.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	
Theme 2: Lacking skills in assessment, measurement, and monitoring								
No subthemes	2.0.1 Lack skills in obtaining outcome measures.	10 (2.8)	1 (2.3)	4 (3.7)	0 (0)	5 (3.0)	6 (2.9)	I lack the assessment and implementation skills. [Nurse; ID573]
	2.0.2 Lack skills in patient assessment (clinical examination, severity grading, diagnosis, determining appropriate frequency for reassessments).	6 (1.7)	7 (16.3)	9 (8.4)	1 (2.7)	68 (27.0)	64 (31.4)	I lack the skills to initially diagnose OA and recommend imaging, and the skills to explain the process to my patients. [Physiotherapy student; ID407]
	2.0.3 Lack skills in assessing need for imaging.	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.4)	2 (1.0)	
Theme 3: Lacking skills in tailoring care								
No subthemes	3.0.1 Lack skills to tailor treatment to patients' needs across all components of OA care.	0 (0)	2 (4.7)	0 (0)	2 (5.4)	12 (4.8)	27 (13.2)	I believe I am lacking some knowledge in best care and how to individualize this for patients so that it is most effective for them. [Physiotherapy student; ID1104] (Lack skills in) tailoring to specific patient needs. [Nurse; ID485]
	3.0.2 Lack skills to tailor treatment to patients from a lower socioeconomic area where disparities in access to care may be highly applicable.	0 (0)	0 (0)	0 (0)	1 (2.7)	1 (0.4)	0 (0)	
	3.0.3 Lack skills to tailor treatment to patients living in rural/remote communities.	1 (0.3)	1 (2.3)	1 (0.9)	1 (2.7)	0 (0)	0 (0)	
Theme 4: Lacking skills in managing case complexity								
No subthemes	4.0.1 Lack skills to provide care to patients with complex presentations, including severe and/or difficult to manage pain and/or those with prevalent multi-morbidities (e.g., cognitive, hearing impairments).	54 (15.4)	4 (9.3)	10 (9.3)	3 (8.1)	14 (5.6)	19 (9.3)	Mainly around comorbidity situations where we are dealing with OA, COPD and maybe a heart condition. I am not always certain which takes priority and how much we can push or progress, especially when a patient is reluctant or nervous. [Physiotherapist; ID1555]
	4.0.2 Lack skills to manage pain including pain-related fears, unhelpful beliefs (e.g. "*hurt = harm*"), and patients experiencing severe unremitting pain.	39 (11.1)	2 (4.7)	5 (4.7)	2 (5.4)	16 (6.3)	15 (7.4)	
Theme 5: Generally lacking skills in translation of knowledge to practice								
No subthemes	5.0.1 Lack skills in translating knowing what care to provide into actual care delivery	20 (5.7)	6 (13.9)	3 (2.8)	2 (5.4)	45 (17.9)	106 (52.0)	With minimal experience dealing with OA as a medical student, I believe I have the core knowledge required to deal with OA, but have not had the repetitive experiences to feel comfortable delivering the care without consulting guidelines or superiors. [Medical student; ID107] Being somewhat junior in my profession, I feel that I have not had adequate experience to yet deliver 'best care', I feel that practical skills taught in university studies are somewhat lacking. [Physiotherapist; ID502]
	5.0.3 Lack skills in accessing professional development opportunities since clinicians need to be continually updating their skills.	19 (5.4)	2 (4.7)	1 (0.9)	1 (2.7)	3 (1.2)	4 (2.0)	
	5.0.4 Lack of skills delivering components of OA care that are typically or historically within the scope of other disciplines.	50 (14.2)	4 (9.3)	21 (19.6)	4 (10.8)	21 (8.3)	31 (15.2)	
	5.0.5 Lack confidence in skills to manage patients with OA within the scope of practice.	3 (0.9)	1 (2.3)	2 (1.9)	0 (0)	29 (11.5)	64 (31.4)	
	5.0.6 Lack skills in assessing the limitations or identifying the parameters of one's own scope of practice.	1 (0.3)	2 (4.7)	0 (0)	0 (0)	2 (0.8)	2 (1.0)	

PT = physiotherapists ($n = 351$ (25.4%) respondents; 3251 coded responses); NU = nurses ($n = 43$ (27.2%) respondents; 339 coded responses); GP = general practitioners ($n = 107$ (40.1%) respondents; 853 coded responses); GPr = general practitioner registrar ($n = 37$ (45.7%) respondents; 193 coded responses); MStu = medical student ($n = 252$ (54.2%) respondents; $n = 1053$ coded responses); PTStu = physiotherapy student ($n = 204$ (29.4%) respondents; $n = 1228$ coded responses).

Table IV
Summary of themes, subthemes and first-order codes relating to infrastructure barriers in delivery of OA care (clinicians only)

Subthemes	First-order codes	Respondents providing a response to the code, *n* (%)				Demonstrative quote
		PT	NU	GP	GPr	
Theme 1: General infrastructure barriers						
1.1 Limitations with equipment and facilities	1.1.1 Lack access to necessary exercise equipment (i.e., parallel bars, stairs with bilateral rails, weights, pulleys) and/or community facilities (e.g., exercise centres and hydrotherapy pools) to deliver care, especially in rural areas.	317 (92.4)	18 (85.7)	58 (100)	8 (80)	I can sometimes feel helpless in having the resources to facilitate weight loss - in particular cheap and accessible exercise programs targeted to patients with OA. [GP registrar; ID261]
	1.1.2 Lack access to appropriate mobility aids or joint protection devices (braces, splints, crutches).	8 (2.3)	0 (0)	2 (3.4)	0 (0)	I try and improvise as best I can but sometimes, it would be more conducive to my and my client's time if I had more resources to execute exercises. I feel having
	1.1.3 Lack equipment to make home visits (e.g., appropriate and transportable exercise equipment).	12 (3.5)	0 (0)	0 (0)	0 (0)	actual equipment would also further solidify that sense of trust and professionalism between the elder and myself … instead of me using make-shift weight bags etc. [Physiotherapist; ID1000]
1.2 Infrastructure support for complex clinical presentations	1.2.1 Lack infrastructure to address multi-morbidities (e.g., hearing aids, non-chlorinated pools).	2 (0.6)	0 (0)	0 (0)	0 (0)	With interventions which rely heavily on language, like relaxation & imagery, it is too difficult to work with those who have even a moderately severe hearing loss, and this seems to be despite the use of prescribed aids. I am hopeful the technology will advance rapidly. [Physiotherapist; ID128]
1.3 Limitations with the service environment	1.3.1 Lack administrative/human resources support staff.	59 (17.2)	3 (14.3)	9 (15.5)	0 (0)	No space or equipment to teach exercise activities. No printed resources to provide
	1.3.2 Lack technology to deliver care (e.g., liaise with patients, record outcome measures).	14 (4.1)	14 (4.1)	1 (1.7)	0 (0)	to patients for education. Limited structural support within the practice for my role to be anything more than a paper exercise.
	1.3.3 Lack of clinical consulting space and/or office space.	15 (4.4)	4 (19.0)	8 (13.8)	3 (30.0)	[Nurse; ID580]

PT = physiotherapists ($n = 343$ (24.9%) respondents; 699 coded responses); NU = nurses ($n = 21$ (13.3%) respondents; 26 coded responses); GP = general practitioners ($n = 58$ (21.7%) respondents; 78 coded responses); GPr = general practitioner registrar ($n = 10$ (12.3%) respondents; 11 coded responses).

Theme 5: Generally lacking skills in translation of knowledge to practice

Knowing-into-doing gaps were identified across disciplines, particularly for students, highlighting deficits in general skills in OA care delivery and the need for continual upskilling. Respondents identified skills deficits in components of care that were more routinely managed by other disciplines (e.g., nutritional management) as well as confidence in their skills to manage patients within the scope of their own practice, particularly physiotherapy students.

Infrastructure barriers

Specific infrastructure-related barriers were described by 432 (23%) clinicians, resulting in 814 coded responses across 7 first-order codes (Table IV). One theme, 'General infrastructure barriers' was identified, consisting of three sub-themes:

- Limitations with equipment and community-based facilities, particularly in rural areas.
- Infrastructure support for complex clinical presentations.
- Limitations with the service environment, including inadequate human resources and information and communication technology support, and inadequate administrative and clinical consulting space.

Other barriers

'Other barriers', were described by 1250 (66%) clinicians and 494 (43%) students resulting in 3052 and 1246 respectively, coded responses across 33 first-order codes (Table V). Three overarching themes, supported by sub-themes, were identified:

Theme 1: Patient-related factors

Patient-related factors were grouped into intra-personal and extra-personal.

Clinicians and students strongly identified intrapersonal factors potentially affecting engagement, adherence, and compliance. These included unhelpful beliefs, expectations and attitudes to care. Poor psychosocial health and the presence of co-morbidities that created complexity in care delivery (e.g., obesity, persistent pain and other chronic health conditions) were also identified. Limited health literacy in OA and chronic disease management and level of education posed a barrier to patients' understanding of the need to make positive lifestyle and behavioural changes. Extra-personal factors included patients' socioeconomic, cultural and linguistic, education and work circumstances that could potentially compromise their ability to participate in rehabilitation. These factors extended to sub-optimal social and financial circumstances that could preclude access to, or participation in, OA care (e.g., childcare and work responsibilities, inadequate support from caregivers, partners or family) and generally low education levels. Respondents also cited an inadequate and inaccurate societal understanding of the neurobiology of persistent pain and non-pharmacologic and non-surgical management of OA as a barriers.

Theme 2: Workforce-related factors

This theme included clinical practice and workforce training issues.

Physiotherapists in particular identified heterogeneity in clinicians' beliefs, messaging and clinical care recommendations and/or

Table V
Summary of themes, subthemes and first-order codes relating to other barriers in delivery of OA care

Subthemes	First-order codes	Respondents providing a response to the code, *n* (%)						Demonstrative quote
		PT	NU	GP	GPr	MStu	PTStu	
Theme 1: Patient-related factors								
1.1 Intrapersonal factors	1.1.1 Barrier imposed by patients' unhelpful beliefs/ expectations/attitudes related to treatment (including expectations/requests for 'hands on' passive therapy, imaging, surgical/pharmacologic intervention, alternative/complementary and other passive therapies including internet-sourced therapies) and compliance with care plans.	303 (33.9)	27 (26.0)	63 (30.7)	16 (34.8)	68 (25.7)	64 (27.9)	Patient's expectations - they hope that medications/ surgery will cure them/restore full function, which is not the case. Enhancing patient acceptance and understanding of the disease is one of the toughest parts. [Medical student; ID498] Patient knowledge and expectations are often for a quick fix or cure. [GP; ID1407]
	1.1.2 Poor psychosocial health and/or presence of other comorbidities (e.g., obesity, persistent pain, other chronic health conditions) act as a barrier to treatment initiation, co-ordination and compliance.	56 (6.3)	4 (3.8)	15 (7.3)	4 (8.7)	22 (8.3)	15 (6.6)	General public do not realise there is non surgical intervention for OA related musculoskeletal conditions so they don't seek help from Physio's until their function has decreased and rendered them more de-conditioned.
	1.1.3 Barrier imposed by patients' limited health literacy related to OA care and management of chronic diseases, or level of education that limits understanding of need to change health behaviours.	27 (3.0)	1 (1.0)	8 (3.9)	1 (2.2)	27 (10.2)	34 (14.8)	Many patients insist there is nothing to do I can help them and it's inevitable with old age. [Physiotherapist; ID3110]
	1.1.4 Patients' reliance on medicines acts as barrier to non-pharmacologic care (i.e., fear of decreasing prescriptions).	8 (0.9)	0 (0)	7 (3.4)	4 (8.7)	3 (1.8)	1 (0.4)	
	1.1.5 Patients' mobility impairments make follow-up difficult.	8 (0.9)	1 (1.0)	2 (1.0)	0 (0)	4 (1.5)	0 (0)	
1.2 Extra-personal factors	1.2.1 Patients' work demands or other socioeconomic or educational circumstances or responsibilities that compromise rehabilitation regime (e.g., military service, sole income provider, childcare).	25 (2.8)	5 (4.8)	14 (6.8)	5 (10.9)	18 (6.8)	10 (4.4)	Elderly patients that live alone and do not have the support to access multidisciplinary care. Only come to the clinic when absolutely necessary - often don't seek advice on preventive healthcare measures. [Nurse; ID04]
	1.2.2 Lack of cooperation or support from patients' caregivers or family.	15 (1.7)	1 (1.0)	0 (0)	0 (0)	7 (2.6)	6 (2.6)	Financial, cultural, and linguistic barriers to accessing allied health professionals. [GP; ID989]
	1.2.3 Religious or cultural barriers to participating in care.	13 (1.5)	1 (1.0)	5 (2.4)	0 (0)	6 (2.3)	6 (2.6)	These patients often cannot work or have limitations on what they can do which affect job performance, finance, relationship and emotional stability. [Medical student; ID447]
	1.2.4 Language barrier to participating in care and receiving effective and appropriate treatment.	11 (1.2)	2 (1.9)	6 (2.9)	0 (0)	9 (3.4)	11 (4.8)	
	1.2.5 Lack of culturally appropriate/tailored resources (i.e., paper/online information that are not culturally sensitive).	4 (0.4)	1 (1.0)	6 (2.9)	0 (0)	2 (0.8)	0 (0)	Overall understanding of chronic pain management in society. [Physiotherapy student; ID1136]
	1.2.6 Inadequate societal understanding about pain and OA care, particularly non-pharmacologic and non-surgical care, imposes a barrier to care delivery and societal understanding of effective management options.	10 (1.1)	0 (0)	3 (1.5)	0 (0)	0 (0)	1 (0.4)	
Theme 2: Workforce-related factors								
2.1 Clinical practice issues	2.1.1 Inconsistent messaging (i.e., disparate messaging leading to confusion or unhelpful beliefs) and care delivery from varying clinicians often leading to unnecessary procedures, absence of conservative management, and difficulty in coordinating care across clinical disciplines.	222 (24.8)	4 (3.8)	7 (3.4)	2 (4.3)	8 (3.0)	14 (6.1)	Education from other medical professionals, often setting up fear beliefs in patients by saying phrases such as, "your joint is bone on bone and you shouldn't exercise" or "this just happens with age and it's progressive". This often leads to patients giving up on exercise and relying on medication as they wait for the go ahead on a scope or joint replacement. I also noticed other healthcare professionals tend to build a heightened dependence on passive treatments. [Physiotherapist; ID1291]
	2.1.2 Availability of non-evidence-based therapies, over-prescription of medicines and access to surgery, compared with evidence-based non-pharmacologic and non-surgical care.	85 (9.5)	1 (1.0)	10 (4.9)	1 (2.2)	3 (1.0)	1 (0.4)	

	2.1.3 Treatment of OA is secondary to the treatment of other more acute conditions.	30 (3.4)	5 (4.8)	9 (4.4)	1 (2.2)	7 (2.6)	4 (1.8)	The push by the pharmacies to promote and sell homeopathic/herbal products that prove no benefit to OA without encouraging the patient to seek medical advice from their GP. [GP; ID266]
	2.1.4 Institutional/legal limitations on scope of practice (e.g., ability to diagnose, prescribe medications, inject).	11 (1.2)	5 (4.8)	0 (0)	0 (0)	4 (1.5)	10 (4.4)	
	2.1.5 Discordance between best practice and clinical supervisors' or senior clinicians' views.	2 (0.2)	0 (0)	0 (0)	0 (0)	4 (1.5)	9 (3.9)	In my experience, OA gets treated as a "background disease" and usually tends to be treated as a secondary problem in consults, particularly in primary care settings. Similar to this would be the issue of hypertension or cholesterol. I think because of the lax view we might take on OA as not a so serious issue, results in patients not also taking their issue seriously, and therefore resulting in poorer compliance. [Medical student; ID349]
	2.1.6 Inappropriate or inadequate pharmacological care (e.g., inappropriate use of opioids)	2 (0.2)	0 (0)	2 (1.0)	0 (0)	5 (1.9)	1 (0.4)	
2.2 Workforce training issues	2.2.1 Inadequate clinical experience in OA care or inadequate training in undergraduate curriculum, including a lack of awareness of clinical guidelines.	19 (2.1)	5 (4.8)	3 (1.5)	3 (6.5)	15 (5.7)	14 (6.1)	The patients are not educated in best practice OA as their care plans are being written by administration staff. [Nurse; ID530]
	2.2.2 Lack of available/appropriate supervision/training to improve knowledge and skills.	14 (1.6)	5 (4.8)	4 (2.0)	3 (6.5)	6 (2.3)	14 (6.1)	Lack of teaching about non-pharmacologic/non-surgical treatment options in medical school (for OA and many other chronic diseases). [Medical student; ID132]
	2.2.3 Generally lacking knowledge in components of high-value OA care, including: not knowing what care to provide, when to refer and what community-based services are available.	135 (15.1)	42 (40.4)	44 (21.5)	11 (23.9)	79 (29.8)	117 (51.7)	Lacking in the [OA] guidelines and there is no space for this to be done in the clinic and the Drs are not always happy as this does not bring in money to the practice. [Nurse; ID618]
	2.2.4 Lack of resources/programs to help clinicians stay updated on high-value care and newest techniques, including ready access to guidelines.	70 (7.8)	13 (12.5)	9 (4.4)	4 (8.7)	0 (0)	0 (0)	
Theme 3: System (macro) and service (meso)-level factors								
3.1 System (macro)-level barriers	3.1.1 Systemic barriers to accessing healthcare in the public sector, in particular long waitlists, poor follow-up, specific criteria for referral and patients being prematurely waitlisted	130 (14.5)	8 (7.7)	28 (13.7)	3 (6.5)	11 (4.2)	6 (2.6)	Lack of resources in the public health system to cope with the overwhelming demand. [GP; ID665]
	3.1.2 Conflicting industry sector interests (i.e., patients best interest vs industry best interest)	8 (0.9)	1 (1.0)	1 (0.5)	0 (0)	0 (0)	0 (0)	There should be no financial incentives either way, but the current system does provide incentive for surgeons to operate even when there is no evidence to support surgical intervention. This is a systemic problem. [Physiotherapist; ID1179]
	3.1.3 Inadequate financial support provided to patients to access healthcare (e.g., limited number of consultations covered, transportation costs, cost of medicines, cost of orthopaedics) creating inability of pay for care.	179 (20.0)	26 (25.0)	80 (39.0)	15 (32.6)	115 (43.4)	174 (76.0)	Financial difficulties of patient - unable to afford or in some way not able to fully access the interdisciplinary care needed for management. [Physiotherapy student; ID475]
3.2 Service delivery (meso)-level barriers	3.2.1 Lack network of healthcare professionals, particularly allied health clinicians, for appropriate and efficient referral/support, especially in rural areas.	92 (10.3)	8 (7.7)	76 (37.1)	12 (26.1)	11 (4.2)	5 (2.2)	There are times when I don't know where or how to access specific services that would benefit a patient who lives in a specific area. The patients are willing but the services don't seem to be there, particularly with hydrotherapy. [Nurse; ID16]
	3.2.2 Geographic barrier to patients accessing healthcare or other facilities necessary for care, such as exercise venues. This included access to care facilities and transport costs, especially for those in rural and remote settings.	104 (11.6)	16 (15.4)	20 (9.8)	5 (10.9)	18 (6.8)	15 (6.6)	
	3.2.3 Lack time to provide best practice care (i.e., high patient to clinician ratio, long waitlists, limited appointments available).	252 (28.2)	24 (23.1)	68 (33.2)	6 (13.0)	33 (12.5)	31 (13.5)	Time is the greatest barrier. The remuneration is not commensurate with the amount of time I have to spend with one patient. With the current freeze on Medicare rebate to the patient, I have to work on volume of patients to make up a decent income in the face of absorbing higher practice running costs. [GP; ID390]
	3.2.4 Lack funding to services to provide care (i.e., extended consultations, home visits, specific equipment, funding for non-evidence-based treatments only, limited funding to support access to allied health services).	144 (16.1)	13 (12.5)	40 (19.5)	2 (4.3)	18 (6.8)	9 (3.9)	Allied health services such as physiotherapy are often expensive and not covered by Medicare. [Medical student; ID101]
	3.2.5 Lack treatment options for different age groups (i.e., programs targeted at different age groups).	10 (1.1)	1 (1.0)	2 (1.0)	0 (0)	0 (0)	0 (0)	
	3.2.6 Care setting can limit opportunities to deliver high-value components of care (e.g., post-surgical or acute health setting).	10 (1.1)	1 (1.0)	0 (0)	0 (0)	1 (0.4)	5 (2.2)	

(*continued on next page*)

Table V (*continued*)

Subthemes	First-order codes	Respondents providing a response to the code, *n* (%)						Demonstrative quote
		PT	NU	GP	GPr	MStu	PTStu	
3.3 Clinical resources limitations	3.3.1 Lack electronic or paper resources to provide to patients with information on nutrition, diet, weight loss.	5 (0.6)	0 (0)	3 (1.5)	0 (0)	0 (0)	1 (0.4)	Lack of resources and education about the positive role of exercise in OA management
	3.3.2 Lack electronic or paper resources to provide to patients with information related to the role of exercise and non-pharmacologic care, and effective strategies for pain management.	7 (0.8)	0 (0)	4 (2.0)	0 (0)	68 (25.7)	64 (27.9)	Lack of resources on the multidimensional role of pain in OA and how other treatment modalities can treat this. [Physiotherapy student; ID259]
	3.3.3 Lack electronic or paper resources to provide to patients with information on management of OA generally.	114 (12.8)	22 (21.2)	38 (18.6)	9 (19.6)	8 (3.0)	12 (5.3)	

PT = physiotherapists (n = 895 (64.9%) respondents; 2125 coded responses); NU = nurses (n = 104 (65.8%) respondents; 243 coded responses); GP = general practitioners (n = 205 (76.8%) respondents; 577 coded responses); GPr = general practitioner registrar (n = 46 (56.8%) respondents; 107 coded responses); MStu = medical student (n = 265 (57.0%) respondents; n = 591 coded responses); PTStu = physiotherapy student (n = 229 (32.9%) respondents; n = 655 coded responses).

delivery as resulting in inconsistent high-value care. This was associated with an over-reliance on, and increased availability of, treatment options that favoured low-value care options. OA care was de-prioritized where clinicians had dominantly acute clinical case mixes.

Clinicians cited a lack of clinical experience, including the availability of appropriate supervision and training, as a barrier to delivery of high-value care. Students identified a lack of OA-specific education in their undergraduate curriculum and inadequate exposure to patients with OA in clinical placements as a barrier to high-value care delivery. Students identified a lack of university training in the application of OA clinical guidelines and discordance between guideline recommendations for OA and managing multimorbidity in 'real-world' practice. Across disciplines and students, there was a strong general lack of knowledge about what constituted high-value care, such as non-pharmacologic care, when to refer, and what community-based services are available. Clinicians also identified a lack of mechanisms to maintain knowledge and skills in high-value care.

Theme 3: System (macro) and service (meso)-level factors

System-level barriers, particularly in the public sector, included extended waitlists for specialist or allied health review, poor follow-up, and inexplicit clinical pathways (e.g., referral criteria and premature waitlisting for surgery). Perceived conflicts between industry sector interests and what might be best for the patient were also highlighted by some. Inadequate resourcing at a system level for some patients was strongly cited across disciplines as negatively impacting patients' ability to access appropriate care (e.g., cost of interventions/medicines, number of consultations).

At the service level, an inadequate network of healthcare professionals was identified, particularly allied health clinicians and especially in rural areas. Geographic factors could potentially limit access to care and availability of appropriate care options. Respondents also identified inadequate consultation time and inappropriate funding models to support OA services; in particular consultation length, equipment and allied health services. A lack of readily accessible resources to support clinical service delivery included deficits in self-management materials related to nutrition, diet, weight loss, exercise, pain management and the clinical course of OA.

Discussion

Clinicians and students encounter varied barriers to the delivery of high-value OA care at all levels of a delivery system: during training and at the clinical encounter (micro-level), within service organisations (meso-level), and at the system (macro)-level. These findings are consistent with those reported for delivery of care for chronic health conditions generally[37,38] and for achieving change in primary care settings[24]. For clinicians, macro-level and intrinsic patient-related factors were the most commonly reported applicable barriers to delivery of OA care and consistent across disciplines, suggesting system-level reform and broader societal reframing of OA care are needed. Intuitively, knowledge and skills, and patient-related factors proved the most relevant barriers for students.

Knowledge and skills (micro-level) barriers were relevant across all disciplines and students, consistent with aligned research[29]. This was particularly evident among nurses, suggesting that professional development initiatives should adopt an interdisciplinary focus with attention targeted to primary care nursing practice. For example, it may be helpful to establish core competencies in OA care (or musculoskeletal care that explicitly includes OA) that are

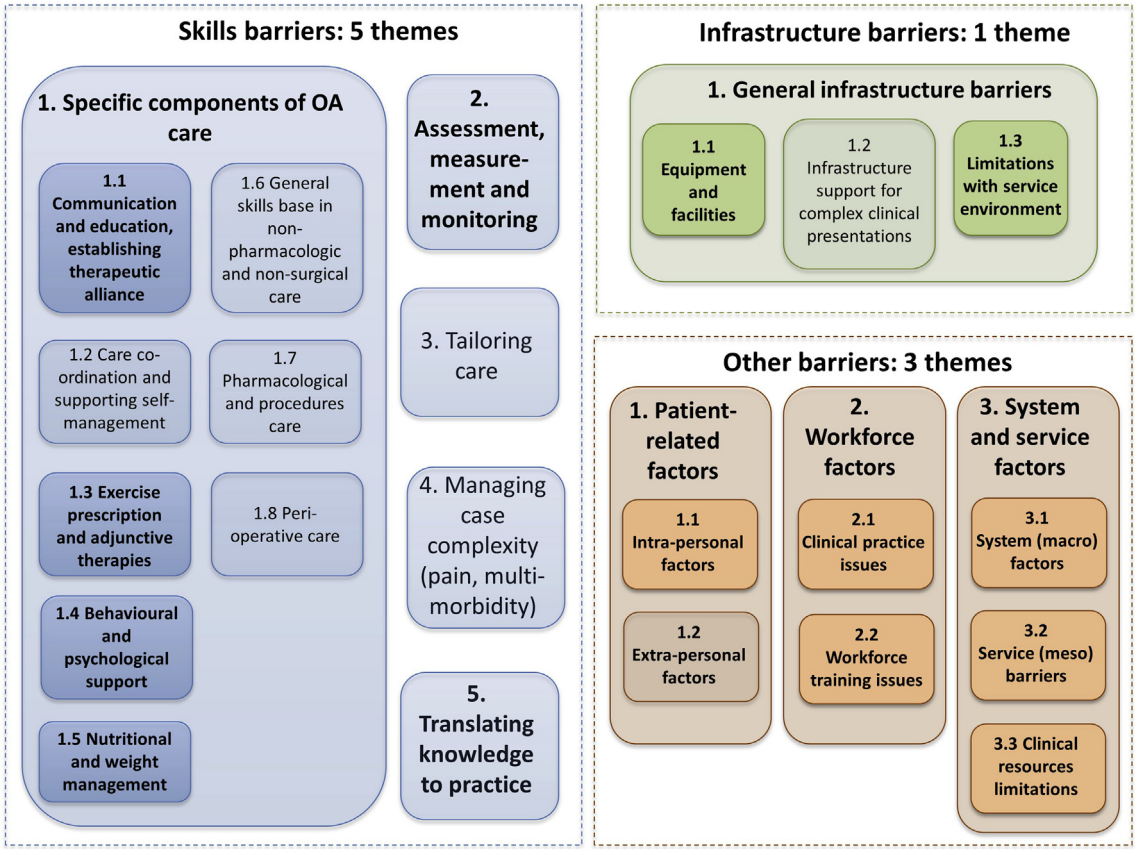

Fig. 3. Summary of the themes and subthemes derived from content analysis of free-text responses for skills (blue), infrastructure (green) and other (orange) barriers to delivery of OA care. Bolded items refer to a theme or subtheme where 20% or more of respondents provided a response aligned to a first-order code that contributed to the subtheme or theme.

relevant across disciplines and applicable for integration into pre-licensure discipline-specific curricula. Attention to aiding interpretation of clinical guidelines through emphasising the translation of knowledge (knowing) to practice (doing) will be important. For students in particular, enhancing training opportunities in primary care settings will be important and likely facilitate improved management of chronic health conditions generally. Relative to other disciplines, physiotherapists were less likely to identify knowing *how* to deliver care as a barrier. This may reflect key components of first-line OA care as being within the scope of practice of this discipline. Nonetheless, physiotherapy students cited translating 'knowing' to 'doing' as a key skills deficit, consistent with findings from other research[39]. While the qualitative data highlight a range of gaps in skills-based competencies across disciplines, skills gaps in nutritional management and overweight/obesity management were the most strongly identified. Development of training resources should consider these issues and bring a stronger focus to targeted skills training in this complex area[40].

Macro-level barriers centred around financing models that tended to support low-value care (or inadequately incentivise high-value care) and inadequately supported access to care, particularly for those in rural areas and for allied health services. These macro factors extended to include community-based infrastructure limitations. The significance of such system barriers to care delivery underlines the importance of development and implementation of models of care for OA and national policy. This is particularly relevant in the context of supporting reform in health financing to support high-value care, workforce capacity building strategies and resourcing for the community sector to support care delivery[41,42].

Meso-level barriers to OA care highlighted time pressures (particularly for nurses, GPs and GP registrars) and behaviours of peers as applicable barriers to high-value care. Compared with other disciplines, physiotherapists in particular identified inconsistent messaging from other clinicians (physiotherapists and non-physiotherapists) and interventions that were discordant with evidence to be a significant barrier to high-value care for OA. This may partly reflect contemporary practices in primary care management of OA, which do not routinely include on-referral to physiotherapy services, resulting in patients often engaging with physiotherapists downstream from other interventions and practitioners[43]. It may also reflect beliefs held by clinicians that symptoms and impairments associated with OA cannot be effectively addressed by non-pharmacologic or non-surgical care options[33,44], resulting in low proportions of patients engaging with these strategies[45].

While a range of patient-related factors were identified as barriers to care, consistent with evidence[46], beliefs and expectations were perceived as the most applicable patient-related factors. Unhelpful beliefs about OA and persistent pain and expectations for passive therapies and low-value care options relate to a misaligned public understanding of OA and effective pain care[47]. This highlights the need for reform to reorient a societal approach to musculoskeletal care at multiple levels, from clinical education and clinical care through to public health and policy[48–50].

The strength of this study lies in the large multi-national sample of multidisciplinary clinicians and students and rich data acquired through mixed-methods. The mixed-methods approach is important to provide insights into stakeholders' perspectives that would not otherwise be identified through survey-based outcomes alone, particularly for health services and systems research[51]. Rigorous

analysis of the qualitative data ensured all relevant issues were coded and meta-synthesised, providing important foci for training resources in OA care and considerations for developing models of care for OA in Australia, New Zealand and Canada. Although consistent with aligned research[32,44,52], the outcomes reported should be considered in the context of recruitment limitations, including a selection bias towards Australian clinicians and no representation from Canadian GPs, and limited samples sizes for clinician groups. This selection bias may have led to an over- or under-estimation of the frequency of barriers reported. The estimates provided are crude and unadjusted for potentially important covariates related to nation, workplace setting and demographic characteristics and this represents an important area for further research. The threshold used to define 'applicability' may also influence its interpretation. The findings also relate to high-income health systems, so may not be transferable to low- and middle-income settings.

Conclusions

Multi-level barriers are encountered by students and clinicians in the delivery of OA care. It is likely that each of these levels will need to be addressed in order to improve OA care and outcomes for patients. For clinicians, system (macro) issues, particularly current inflexible financing models, represent the most significant barrier to the delivery of high-value care, rather than their knowledge and skills. Supporting skills-based competencies in nutrition/weight management, effectively managing patients' beliefs and supporting positive behaviour change will be important foci for developing capacity in the current and emerging workforce. For students, improving knowledge and skills in OA-specific care is needed; with clinical training needing to more comprehensively integrate OA care and more explicitly translate knowledge to practical skills and competencies.

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Supplementary data

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Authors' contributions

Individuals named as authors have participated in the research in the following ways:

- Conception and design: AMB, HS.
- Analysis and interpretation of the data: AMB, EH, LAD, RSH, KLB, BD, TP, ML, CM, PJL, AB, HS.
- Drafting of the article: AMB, EH, HS.
- Critical revision of the article for important intellectual content: AMB, EH, RSH, KLB, BD, TP, ML, CM, PJL, AB HS.
- Final approval of the article: AMB, EH, LAD, RSH, KLB, BD, TP, ML, CM, PJL, AB, AMG, AFC, JEJ, HS.
- Data analysis expertise: AMB, JEJ, HS.
- Obtaining of funding: AMB, RSH, KLB, HS.
- Administrative, technical, or logistic support, AMB, EH, LAD, JEJ, HS.
- Collection and assembly of data: AMB, RSH, BD, TP, ML, CM, PJL, AB, AMG, AFC, JEJ, HS.

Andrew Briggs (A.Briggs@curtin.edu.au) and Helen Slater (H.Slater@curtin.edu.au) take responsibility for the integrity of the work as a whole, from inception to finished article.

Competing interests

The authors declare no competing interests.

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References

1. World Health Organisation. World Report on Ageing and Health. Geneva: WHO; 2015.
2. Araujo de Carvalho I, Epping-Jordan J, Pot AM, Kelley E, Toro N, Thiyagarajan JA, *et al*. Organizing integrated health-care services to meet older people's needs. Bull World Health Organ 2017;95:756–63.
3. Briggs AM, Araujo de Carvalho I. Actions required to implement integrated care for older people in the community using the World Health Organization's ICOPE approach: a global Delphi consensus study. PLoS One 2018;13:e0205533, https://doi.org/10.1371/journal.pone.0205533.
4. Duffield SJ, Ellis BM, Goodson N, Walker-Bone K, Conaghan PG, Margham T, *et al*. The contribution of musculoskeletal disorders in multimorbidity: implications for practice and policy. Best Pract Res Clin Rheumatol 2017;31:129–44, https://doi.org/10.1016/j.berh.2017.09.004.
5. Elshaug AG, Rosenthal MB, Lavis JN, Brownlee S, Schmidt H, Nagpal S, *et al*. Levers for addressing medical underuse and overuse: achieving high-value health care. Lancet 2017;390:191–202, https://doi.org/10.1016/S0140-6736(16)32586-7.
6. World Health Organization. Transforming and Scaling up Health Professionals' Education and Training. World Health Organization Guidelines 2013. Geneva: WHO; 2013.
7. World Health Organization. Global Strategy on Human Resources for Health: Workforce 2030. Geneva: WHO; 2016.
8. World Health Organization. Framework on Integrated, People-Centred Health Services. Geneva: World Health Organization; 2016.
9. Allen KD, Choong PF, Davis AM, Dowsey MM, Dziedzic KS, Emery C, *et al*. Osteoarthritis: models for appropriate care

across the disease continuum. Best Pract Res Clin Rheumatol 2016;30:503–35, https://doi.org/10.1016/j.berh.2016.09.003.
10. McAlindon TE, Bannuru RR, Sullivan MC, Arden NK, Berenbaum F, Bierma-Zeinstra SM, *et al*. OARSI guidelines for the non-surgical management of knee osteoarthritis. Osteoarthritis Cartilage 2014;22:363–88, https://doi.org/10.1016/j.joca.2014.01.003S1063-4584(14)00016-8.
11. Nelson AE, Allen KD, Golightly YM, Goode AP, Jordan JM. A systematic review of recommendations and guidelines for the management of osteoarthritis: the chronic osteoarthritis management initiative of the U.S. bone and joint initiative. Semin Arthritis Rheum 2014;43:701–12, https://doi.org/10.1016/j.semarthrit.2013.11.012.
12. National Institute for Health and Care Excellence. Osteoarthritis: Care and Management. London: NICE; 2014.
13. Royal Australian College of General Practitioners. Guideline for the Management of Knee and Hip Osteoarthritis. 2nd edn. Melbourne: RACGP; 2018.
14. Brosseau L, Rahman P, Toupin-April K, Poitras S, King J, De Angelis G, *et al*. A systematic critical appraisal for non-pharmacological management of osteoarthritis using the appraisal of guidelines research and evaluation II instrument. PLoS One 2014;9:e82986, https://doi.org/10.1371/journal.pone.0082986.
15. Larmer PJ, Reay ND, Aubert ER, Kersten P. Systematic review of guidelines for the physical management of osteoarthritis. Arch Phys Med Rehabil 2014;95:375–89, https://doi.org/10.1016/j.apmr.2013.10.011.
16. Ferreira de Meneses S, Rannou F, Hunter DJ. Osteoarthritis guidelines: barriers to implementation and solutions. Ann Phys Rehabil Med 2016;59:170–3, https://doi.org/10.1016/j.rehab.2016.01.007.
17. Runciman WB, Hunt TD, Hannaford NA, Hibbert PD, Westbrook JI, Coiera EW, *et al*. CareTrack: assessing the appropriateness of health care delivery in Australia. Med J Aust 2012;197:100–5, https://doi.org/10.5694/mja12.10510.
18. Basedow M, Esterman A. Assessing appropriateness of osteoarthritis care using quality indicators: a systematic review. J Eval Clin Pract 2015;21:782–9, https://doi.org/10.1111/jep.12402.
19. Hagen KB, Smedslund G, Osteras N, Jamtvedt G. Quality of community-based osteoarthritis care: a systematic review and meta-analysis. Arthritis Care Res 2016;68:1443–52, https://doi.org/10.1002/acr.22891.
20. Basedow M, Williams H, Shanahan EM, Runciman WB, Esterman A. Australian GP management of osteoarthritis following the release of the RACGP guideline for the non-surgical management of hip and knee osteoarthritis. BMC Res Notes 2015;8:536, https://doi.org/10.1186/s13104-015-1531-z.
21. Porcheret M, Jordan K, Jinks C, Croft P. Primary Care Rheumatology S. Primary care treatment of knee pain–a survey in older adults. Rheumatology (Oxford) 2007;46:1694–700, https://doi.org/10.1093/rheumatology/kem232.
22. Steel N, Bachmann M, Maisey S, Shekelle P, Breeze E, Marmot M, *et al*. Self reported receipt of care consistent with 32 quality indicators: national population survey of adults aged 50 or more in England. BMJ 2008;337:a957, https://doi.org/10.1136/bmj.a957.
23. Healey EL, Afolabi EK, Lewis M, Edwards JJ, Jordan KP, Finney A, *et al*. Uptake of the NICE osteoarthritis guidelines in primary care: a survey of older adults with joint pain. BMC Muscoskelet Disord 2018;19:295, https://doi.org/10.1186/s12891-018-2196-2.
24. Lau R, Stevenson F, Ong BN, Dziedzic K, Treweek S, Eldridge S, *et al*. Achieving change in primary care–causes of the evidence to practice gap: systematic reviews of reviews. Implement Sci 2016;11:40, https://doi.org/10.1186/s13012-016-0396-4.
25. Woolf AD, Walsh NE, Akesson K. Global core recommendations for a musculoskeletal undergraduate curriculum. Ann Rheum Dis 2004;63:517–24, https://doi.org/10.1136/ard.2003.016071.
26. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci 2009;4:50, https://doi.org/10.1186/1748-5908-4-50.
27. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci 2011;6, https://doi.org/10.1186/1748-5908-6-42.
28. Atkins L, Francis J, Islam R, O'Connor D, Patey A, Ivers N, *et al*. A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. Implement Sci 2017;12:77, https://doi.org/10.1186/s13012-017-0605-9.
29. Egerton T, Diamond LE, Buchbinder R, Bennell KL, Slade SC. A systematic review and evidence synthesis of qualitative studies to identify primary care clinicians' barriers and enablers to the management of osteoarthritis. Osteoarthritis Cartilage 2017;25:625–38, https://doi.org/10.1016/j.joca.2016.12.002.
30. Basedow M, Runciman WB, Lipworth W, Esterman A. Australian general practitioner attitudes to clinical practice guidelines and some implications for translating osteoarthritis care into practice. Aust J Prim Health 2016;22:403–8, https://doi.org/10.1071/PY15079.
31. Egerton T, Nelligan RK, Setchell J, Atkins L, Bennell KL. General practitioners' views on managing knee osteoarthritis: a thematic analysis of factors influencing clinical practice guideline implementation in primary care. BMC Rheumatol 2018;2:30, https://doi.org/10.1186/s41927-018-0037-4.
32. Selten EMH, Vriezekolk JE, Nijhof MW, Schers HJ, van der Meulen-Dilling RG, van der Laan WH, *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;23:405–10, https://doi.org/10.1097/RHU.0000000000000562.
33. Cottrell E, Roddy E, Foster NE. The attitudes, beliefs and behaviours of GPs regarding exercise for chronic knee pain: a systematic review. BMC Fam Pract 2010;11, https://doi.org/10.1186/1471-2296-11-4.
34. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. Res Nurs Health 2007;30:459–67, https://doi.org/10.1002/nur.20199.
35. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res 2005;15:1277–88, https://doi.org/10.1177/1049732305276687.
36. Cunningham M, Wells M. Qualitative analysis of 6961 free-text comments from the first national cancer patient experience survey in Scotland. BMJ Open 2017;7:e015726, https://doi.org/10.1136/bmjopen-2016-015726.
37. Davy C, Bleasel J, Liu HM, Tchan M, Ponniah S, Brown A. Effectiveness of chronic care models: opportunities for improving healthcare practice and health outcomes: a systematic review. BMC Health Serv Res 2015;15, https://doi.org/10.1186/s12913-015-0854-8.

38. Kadu MK, Stolee P. Facilitators and barriers of implementing the chronic care model in primary care: a systematic review. BMC Fam Pract 2015;16, https://doi.org/10.1186/s12875-014-0219-0.
39. Gardner P, Slater H, Jordan JE, Fary RE, Chua J, Briggs AM. Physiotherapy students' perspectives of online e-learning for interdisciplinary management of chronic health conditions: a qualitative study. BMC Med Educ 2016;16:62, https://doi.org/10.1186/s12909-016-0593-5.
40. Tsai AG, Remmert JE, Butryn ML, Wadden TA. Treatment of obesity in primary care. Med Clin 2018;102:35–47, https://doi.org/10.1016/j.mcna.2017.08.005.
41. Briggs AM, Chan M, Slater H. Models of Care for musculoskeletal health: moving towards meaningful implementation and evaluation across conditions and care settings. Best Pract Res Clin Rheumatol 2016;30:359–74, https://doi.org/10.1016/j.berh.2016.09.009.
42. Dziedzic KS, Allen KD. Challenges and controversies of complex interventions in osteoarthritis management: recognizing inappropriate and discordant care. Rheumatology 2018;57:88–98, https://doi.org/10.1093/rheumatology/key062.
43. Dennis S, Watts I, Pan Y, Britt H. The likelihood of general practitioners referring patients to physiotherapists is low for some health problems: secondary analysis of the Bettering the Evaluation and Care of Health (BEACH) observational study. J Physiother 2018;64:178–82, https://doi.org/10.1016/j.jphys.2018.05.006.
44. Holden MA, Nicholls EE, Young J, Hay EM, Foster NE. UK-based physical therapists' attitudes and beliefs regarding exercise and knee osteoarthritis: findings from a mixed-methods study. Arthritis Rheum-Arthritis Care Res 2009;61:1511–21, https://doi.org/10.1002/art.24829.
45. Hinman RS, Nicolson PJ, Dobson FL, Bennell KL. Use of nondrug, nonoperative interventions by community-dwelling people with hip and knee osteoarthritis. Arthritis Care Res 2015;67:305–9, https://doi.org/10.1002/acr.22395.
46. Papandony MC, Chou L, Seneviwickrama M, Cicuttini FM, Lasserre K, Teichtahl AJ, *et al*. Patients' perceived health service needs for osteoarthritis (OA) care: a scoping systematic review. Osteoarthritis Cartilage 2017;25:1010–25, https://doi.org/10.1016/j.joca.2017.02.799.
47. Darlow B, Brown M, Thompson B, Hudson B, Grainger R, McKinlay E, *et al*. Living with osteoarthritis is a balancing act: an exploration of patients' beliefs about knee pain. BMC Rheumatol 2018;2:15, https://doi.org/10.1186/s41927-018-0023-x.
48. Lewis J, O'Sullivan P. Is it time to reframe how we care for people with non-traumatic musculoskeletal pain? Br J Sports Med 2018, https://doi.org/10.1136/bjsports-2018-099198.
49. Hunter DJ, Neogi T, Hochberg MC. Quality of osteoarthritis management and the need for reform in the US. Arthritis Care Res 2011;63:31–8, https://doi.org/10.1002/acr.20278.
50. Briggs AM, Woolf AD, Dreinhöfer KE, Homb N, Hoy DG, Kopansky-Giles D, *et al*. Reducing the global burden of musculoskeletal conditions. Bull World Health Organ 2018;96:366–8.
51. Scammon DL, Tomoaia-Cotisel A, Day RL, Day J, Kim J, Waitzman NJ, *et al*. Connecting the dots and merging meaning: using mixed methods to study primary care delivery transformation. Health Serv Res 2013;48:2181–207, https://doi.org/10.1111/1475-6773.12114.
52. Cottrell E, Roddy E, Rathod T, Porcheret M, Foster NE. What influences general practitioners' use of exercise for patients with chronic knee pain? Results from a national survey. BMC Fam Pract 2016;17, https://doi.org/10.1186/s12875-016-0570-4.