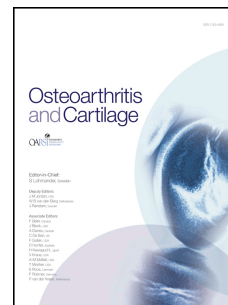


Journal Pre-proof

Development of a core capability framework for qualified health professionals to optimise care for people with osteoarthritis: an OARSI initiative

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PII: S1063-4584(19)31276-2

DOI: <https://doi.org/10.1016/j.joca.2019.12.001>

Reference: YJOCA 4561

To appear in: *Osteoarthritis and Cartilage*

Received Date: 12 August 2019

Revised Date: 24 October 2019

Accepted Date: 2 December 2019

Please cite this article as: Hinman RS, Allen KD, Bennell KL, Berenbaum F, Betteridge N, Briggs AM, Campbell PK, Dahlberg LE, Dziedzic KS, Eyles JP, Hunter DJ, Skou ST, Woolf A, Yu SP, van der Esch M, Development of a core capability framework for qualified health professionals to optimise care for people with osteoarthritis: an OARSI initiative, *Osteoarthritis and Cartilage*, <https://doi.org/10.1016/j.joca.2019.12.001>.

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1 **Development of a core capability framework for qualified health professionals to optimise care**
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57 **Running title:** OA core capability framework

58 **Key words:** osteoarthritis; OA; capability; competency; quality care; health professionals; education.

59 **Word Count:** 3959

60 **Abstract**

61 **Objective:** Develop a generic trans-disciplinary, skills-based capability framework for health
62 professionals providing care for people with OA.

63 **Design:** e-Delphi survey. An international inter-professional Delphi Panel (researchers; clinicians;
64 consumer representatives) considered a draft framework (adapted from elsewhere) of 131 specific
65 capabilities mapped to 14 broader capability areas across four domains (A: person-centred approaches;
66 B: assessment, investigation and diagnosis; C: management, interventions and prevention; D: service
67 and professional development). Over three rounds, the Panel rated their agreement (Likert or numerical
68 rating scales) on whether each specific capability in Domains B and C was essential (core) for all
69 health professionals when providing care for all people with OA. Those achieving consensus ($\geq 80\%$ of
70 Panel) rating of \geq seven out of ten (Round 3) were retained. Generic domains (A and D) were included
71 in the final framework and amended based on Panel comments.

72 **Results:** 173 people from 31 countries, spanning 18 disciplines and including 26 consumer
73 representatives, participated. The final framework comprised 70 specific capabilities across 13 broad
74 areas i) communication; ii) person-centred care; iii) history-taking; iv) physical assessment; v)
75 investigations and diagnosis; vi) interventions and care planning; vii) prevention and lifestyle
76 interventions; viii) self-management and behaviour change; ix) rehabilitative interventions; x)
77 pharmacotherapy; xi) surgical interventions; xii) referrals and collaborative working; and xiii)
78 evidence-based practice and service development).

79 **Conclusion:** Experts agree that health professionals require an array of skills in person-centred
80 approaches; assessment, investigation and diagnosis; management, interventions and prevention; and
81 service and professional development to provide optimal care for people with OA.

82

83 **Introduction**

84 Osteoarthritis (OA), particularly of the knee and hip is the 12th highest contributor to global disability
85 in adults aged 50-69 years¹. Around 240 million people (1 in 11) have OA, with a substantial increase
86 expected in the future². Osteoarthritis can be debilitating, with pain being the dominant symptom that
87 often becomes persistent and more limiting as OA progresses³. Physical function can become
88 increasingly impaired over time, impacting substantially on quality of life and ability to participate in
89 social, leisure and occupational activities³. Management of people with OA typically involves a wide
90 range of clinicians, including medical practitioners, an array of allied health professionals, and spans
91 primary to tertiary care settings⁴. Unfortunately, current care for people with OA is variable and
92 frequently inconsistent with clinical guideline recommendations. A meta-analysis of studies evaluating
93 community-based care in developed countries for people with OA, based on adherence to evidence-
94 based quality indicators, showed a median overall pass rate of 41%⁵. Alarming, the pass rates for core
95 first-line OA treatments (such as exercise, education and weight control) were below 40%.
96 Osteoarthritis is highly prevalent in low- and middle-income countries⁶, and it is likely that the quality
97 of care received by people with OA in these countries is also sub-optimal⁷.

98
99 A major contributor to the quality of care received by people with OA is the capability of the healthcare
100 workforce to deliver care that is aligned with evidence-based recommendations and a biopsychosocial
101 approach to management⁸. Clinicians feel ‘under-prepared’ to manage OA, lacking knowledge about
102 recommended practice and/or how to implement recommendations into routine care as well as the skills
103 to support patients to make lifestyle changes (such as exercise or weight loss)^{9,10}. This is particularly
104 important given that common misconceptions about knee OA influence patients’ acceptance of non-
105 surgical evidence-based treatments¹¹. A “capability” may be defined as an integration of knowledge,
106 skills, personal qualities and understanding used appropriately and effectively- not just in familiar and
107 highly focused specialist contexts, but in response to new and changing circumstances¹².

108

109 Defining the core capabilities of health professionals delivering care for people with OA is required to
110 inform improvements to pre-licensure curricula and to ensure professional development programs are
111 appropriately targeted to workforce needs¹³. This is particularly relevant in contemporary healthcare,
112 where skills are often no longer unique to one health professional group¹⁴ and innovative service re-
113 design is advocated for implementation of OA evidence-based recommendations into practice¹⁵.
114 Although a UK framework exists for first point of contact musculoskeletal practitioners¹⁶ and EULAR
115 has recommendations about generic core competencies for nurses, physiotherapists and occupational
116 therapists in rheumatology¹⁷, there is no framework describing the core capabilities generic to all health
117 professionals specifically for OA management.

118

119 This study aimed to develop a generic trans-disciplinary, skills-based core capability framework for
120 health practitioners to optimise care for people with OA, using consumer participation and an
121 international inter-professional consensus process. The framework is intended to be applicable to all
122 qualified health professionals involved in OA care across the disease spectrum and healthcare settings.

123

124 **Methods**

125 **Overview**

126 We established a Delphi Panel and conducted an e-Delphi survey between February and April 2019 to
127 achieve expert consensus on the core capability framework. The study was overseen by an international
128 inter-professional Steering Group, established by the *International Osteoarthritis Management*
129 *Programs 'Joint Effort' Initiative* endorsed by OARSI in 2018¹⁸. A Steering Group of 14 members
130 from Australia, USA, UK, Netherlands, Denmark, France and Sweden and comprising physiotherapists
131 (RSH; KLB; AMB; JPE; STS; KSD; ME), rheumatologists (DJH; SPY; AW; FB), an orthopedic

132 surgeon (LED), an exercise physiologist (KDA) and a consumer with OA (NB), was convened. Ethical
133 approval was obtained from the University of Melbourne. Fig 1 overviews the study phases.

134

135 **Survey development**

136 In the formative phase, the Steering Group debated whether the final framework should be discipline-
137 specific, or more generic and thus relevant to all health professionals who may provide care to people
138 with OA. The Group recognised the array of health professions involved in OA care, in a wide variety
139 of healthcare settings across countries, and with variable access to different health disciplines. To
140 maximise generalisability, the Group decided upon a capability framework generic to all health
141 professionals, which could provide a “scaffold” for professional groups to expand (if necessary) into
142 specialised capability frameworks for specific health professions.

143

144 The Steering Group selected the “Musculoskeletal core capabilities framework for first point of contact
145 practitioners” recently published by the Health Education England, Skills for Health and NHS England,
146 UK¹⁶ for adaptation in the current study. This framework describes the capabilities that are applicable
147 to clinicians with a role as a first point of contact for adults presenting with undiagnosed
148 musculoskeletal conditions. It consists of 105 specific capabilities (mapped to 14 broader capability
149 areas) across four domains, two describing more ‘generic’ capabilities relevant for all clinical
150 encounters irrespective of health condition (Domain A: person-centred approaches; Domain D: service
151 & professional development) and two describing capabilities relevant to assessment, care planning and
152 management of patients with musculoskeletal conditions (Domain B: assessment, investigation and
153 diagnosis; Domain C: management, interventions and prevention) and amenable to tailoring for a
154 specific musculoskeletal condition.

155

156 With permission from Skills for Health, the Steering Group revised the specific capabilities to ensure
157 they were as specific and relevant to OA as much as possible (rather than musculoskeletal conditions
158 more broadly), and to acknowledge the varying scope and roles of health professionals involved in OA
159 care. To do this, the Steering Group considered other relevant frameworks^{19,20}, used their knowledge of
160 research evidence as well as their clinical expertise. For example, “Understand the role of common
161 rehabilitative interventions for musculoskeletal conditions” was revised to “Understand the role of
162 common rehabilitative interventions including pain education, therapeutic exercise, weight loss,
163 manual therapy, cognitive behavioural approaches, aids and assistive devices, orthotic, braces and
164 splints for managing OA, based on the best available evidence” and “Understand the role of joint
165 injections, informed by the evidence base, in musculoskeletal practice” was revised to “Understand the
166 role of intra-articular injections in managing OA (including corticosteroids, platelet rich plasma,
167 hyaluronic acid and stem cells), based on best available evidence”. The Steering Group also suggested
168 12 additional capabilities for inclusion (mapping each to the most relevant broad capability area based
169 on consensus of opinion, Appendix 1) and re-ordered the broad groupings of capabilities in a flow
170 better suited to OA care. One specific capability was excluded as it was outside the scope of a
171 capability framework for OA (Domain B: Diagnose common problems that can usually be managed at
172 the first point of contact) and another was excluded because re-wording of other capabilities rendered it
173 redundant (Domain C: Advise on the effects of smoking, obesity and inactivity on musculoskeletal
174 health and conditions and, where appropriate promote change or refer to relevant services).

175

176 **Delphi Panel**

177 An international inter-professional Delphi Panel of experts (including Steering Group members) was
178 established to reach consensus on a framework of capabilities, comprising:

179 a) Health professionals involved in OA human research (researchers);

180 b) Health professionals who provide clinical care for people with OA (clinicians); and

181 c) Consumer representatives.

182

183 Inclusion criteria for researchers were i) qualified and registered health professional and; ii) at least
184 one of the following a) first or last author on at least two papers per year on primary human research
185 in OA in the past five years or; b) invited to give a plenary or keynote presentation on OA at an
186 international conference in the last five years. Inclusion criteria for clinicians were i) registered to
187 practice as a health professional in their home country; and ii) have managed, on average, at least one
188 patient with OA per week over the past six months. Inclusion criteria for consumer representatives
189 were currently employed by an arthritis consumer advocacy organisation and/or previous diagnosis of
190 OA from a doctor. All Panel participants understood English.

191

192 A list of potential Panel participants was developed by the Steering Group, drawing from their
193 academic, research and clinical networks, the OARSI membership, and the field of published OA
194 research. This was supplemented by an internet search of arthritis consumer advocacy organisations
195 internationally. Potential Panel members were invited to participate via email (n=976 invitations sent).
196 We also advertised for additional clinicians using advertisements in social media (Facebook).
197 Potentially eligible Panellists completed a series of screening questions embedded at the beginning of
198 the Round 1 e-Delphi survey to ensure they fulfilled the eligibility criteria. Ineligible volunteers were
199 not admitted to the Delphi Panel and did not complete the Round 1 e-Delphi survey. For subsequent
200 Delphi rounds, only those participants who had completed the preceding Delphi round were emailed
201 the survey.

202

203 **e-Delphi Survey**

204 The Delphi Panel were asked to rate the specific capabilities in Domains B (assessment, investigation
205 and diagnosis) and C (management, interventions and prevention) only. This was to reduce the time

206 burden on Panellists in completing iterative surveys and to focus efforts on the domains where opinions
207 on “core” capabilities were likely to vary the most. In addition, the Steering Committee determined a
208 priori that the more generic Domains A (person-centred approaches) and D (service & professional
209 development) were core capabilities relevant to all health professionals and people with all health
210 conditions, and thus should automatically be included in the final framework, given they had already
211 been validated in another Delphi process¹⁶. However, the Delphi Panel was invited to provide optional
212 feedback on specific capabilities within these domains at the end of Round 1 if they wished. The survey
213 was constructed using SurveyGizmo (SurveyGizmo; Colorado), an online survey software tool and
214 administered iteratively over three rounds (Fig 1), with two weeks between each. Each round was open
215 for 2 weeks, with three reminder emails sent over that time to non-responders to encourage completion.
216 Each round took approximately 30-40 minutes to complete.

217

218 *Round 1*

219 In Round 1, the Panel was asked to rate each specific capability (in Domains B and C) as either “not
220 important” “somewhat important” “important” or “essential” to the care of people with OA. They were
221 invited to add new capabilities not already included in the draft framework (which were later mapped
222 by the Steering Group to the most relevant broad capability area based on consensus of opinion).
223 Specific capabilities that reached Panel consensus (defined as at least 80% of the Panel to ensure only
224 the “core” capabilities remained and considering that 75% is a median threshold of consensus²¹) as
225 “important” or “essential” were retained for further consideration in Round 2.

226

227 *Round 2*

228 In Round 2, the Panel was asked to reconsider and rate the capabilities retained from Round 1, as well
229 as any new capabilities identified by the Panel in Round 1. Summary Panel data from Round 1
230 (presented as n (%) across response categories) were provided against each capability to assist in this

231 process. For this Round, each Panel member was asked to rate how much they agreed/disagreed that
232 each capability was essential (core) for ALL health professionals when providing care for ALL people
233 with OA. Panel members were prompted to think about the wide range of health professionals involved
234 in providing healthcare for people with OA (e.g. physicians, surgeons, nurses, physiotherapists,
235 dieticians etc), and the wide variation in clinical presentation of people with OA. Panellists rated their
236 level of agreement on an 11-point numerical rating scale (ranging from 0=strongly disagree to
237 10=strongly agree). Only capabilities that achieved a consensus (at least 80% of Panel) rating of at least
238 six were retained for Round 3.

239

240 *Round 3*

241 In Round 3, the Panel was asked to reconsider and rate the capabilities retained from Round 2 using the
242 same rating scale as Round 2. Panel summary data from Round 2 (presented as n (%) rating 4 or below;
243 5-6; 7-8 and; 9-10) were provided for consideration. Only capabilities that achieved a consensus (at
244 least 80% of Panel) rating of seven or more were retained for inclusion in the final framework²².

245

246 At the end of the e-Delphi Survey process, the Steering Group considered the free text optional
247 comments provided by the Delphi Panel on Domains A and D in Round 1, with a view to amending the
248 text and/or merging or removing capabilities, based on the feedback received.

249

250 **Consumer involvement**

251 A consumer was a member of the project Steering Group. As a research partner²³, the role of the
252 consumer was to provide input at all stages, with a particular focus on reviewing capabilities included
253 in the draft survey (including inserting additional capabilities if required), participating in the Delphi
254 Panel, advising on content and design of the infographics for communicating key findings, as well as
255 reviewing and co-authoring the manuscript.

256

257 Results

258 Table 1 describes the Delphi Panel. In Round 1, 173 participants from 31 different countries spanning
259 18 different health professions and including 26 (15%) consumer representatives participated. Over
260 half of the Panel (58%) were currently involved in clinical care of people with OA. We retained 131
261 Panel members for Round 2 and 118 Panel members for Round 3 (Table 1, Fig 1), representing 76%
262 and 68% retention of the initial (Round 1) Panel respectively.

263

264 Fig 1 summarises outcomes of each Delphi Round. In Round 1, 19 (21%) specific capabilities did not
265 reach consensus as being “important” or “essential” for inclusion in Domains B and C of the core
266 capability framework for health professionals managing people with OA and were excluded from
267 Round 2 (Appendix 2). Furthermore, 34 individual members Panel suggested additional capabilities for
268 consideration, generating an additional 17 unique capabilities for inclusion into Round 2. A total of 34
269 Panel members provided optional feedback on the generic capabilities within Domains A and D. This
270 feedback was used to amend wording of 10 specific capabilities. The Steering Group merged six
271 specific capabilities into three under Domain A to reduce redundancy. In Round 2, 23 (26%) specific
272 capabilities did not reach consensus agreement for retaining in Round 3 (Appendix 3) and were thus
273 excluded from the final round. In Round 3, 17 (25%) of capabilities considered across Domains B and
274 C did not achieve Panel consensus for retention in the final capability framework and were excluded
275 (Appendix 4). The final core capability framework comprised 70 specific capabilities mapped to 13
276 broader capability areas (Table 2, summarised in Fig 2).

277

278 Discussion

279 This study aimed to develop a generic trans-disciplinary, skills-based core capability framework for
280 health professionals who deliver care to people with OA, using an international inter-professional

281 consensus process. This framework is a model that communicates the key capabilities required of
282 health professionals to ensure excellence in best practice OA care. The final framework comprised 70
283 specific capabilities mapped to 13 broader capabilities i) communication; ii) person-centred care; iii)
284 history-taking; iv) physical assessment; v) investigations and diagnosis; vi) interventions and care
285 planning; vii) prevention and lifestyle interventions; viii) self-management and behaviour change; ix)
286 rehabilitative interventions; x) pharmacotherapy; xi) surgical interventions; xii) referrals and
287 collaborative working; and xiii) evidence-based practice and service development, across four
288 domains.

289
290 Our framework was adapted from an existing UK musculoskeletal capability framework¹⁶. There are
291 thus many similarities across the two, particularly regarding Domains A (person-centred approaches)
292 and D (service and professional development), which remain largely unchanged in our framework for
293 managing OA. Our framework does not include the broader capability area of injection therapy,
294 probably because of the limited role that injections have in managing a subset of people with OA²⁴. In
295 contrast to the musculoskeletal framework, which was developed for first point of contact practitioners
296 who require advanced skills in diagnosis and management across a range of diseases, our framework
297 is intended solely for those health professionals who manage people with OA, which probably
298 explains why ours comprises 33% fewer specific capabilities (70 versus 105). Patient-reported
299 outcomes²⁵ and objective measures of physical function²⁶ are widely advocated in hip and knee OA
300 management, and capabilities relating to these were included in the draft framework by the Steering
301 Group at the formative phase (Appendix 1). It is thus surprising that these capabilities did not reach a
302 consensus for inclusion in the final framework. It is unclear why these items were excluded. Many of
303 these measures have been developed, validated and endorsed primarily for knee, and to a lesser extent,
304 hip OA, and experts may have considered them less important in the context of all patients with OA
305 (which may involve the hand, foot or spine for example) or healthcare settings where measurement of

306 these is impractical for all.

307

308 As our framework is not specific to any health discipline, we acknowledge that different professional
309 groups may bring specialist knowledge and/or skills in addition to the core set. Specific professional
310 groups may wish to validate our work in the future by subjecting our OA capability framework to a
311 similar Delphi or other consensus process, which may lead to the inclusion of additional capabilities,
312 or exclusion of others as appropriate for the different health professions involved in OA care. In
313 addition, many of the capabilities within the framework have relevance to clinicians managing patients
314 with other health conditions, particularly those with chronic conditions, where lifestyle strategies
315 (exercise and weight control), pain control, prevention, self-management, rehabilitation and behaviour
316 change are critical. Thus, our framework may be suited for future adaptation in other chronic
317 conditions, such as low back pain, for example. It adds to the growing body of work articulating
318 competencies for training of European rheumatologists²⁷, in pain assessment and management for
319 prelicensure health professionals¹⁹, of nurses, physiotherapists and occupational therapists in
320 rheumatology¹⁷ and in health promotion and prevention of non-communicable diseases for
321 physiotherapists²⁸, all of which serve to increase capability of the healthcare workforce.

322

323 Contemporary models of OA care demand a workforce of adequate volume capable of delivering
324 safe, effective, evidence-based care (i.e. high-value care)⁸. This includes knowledge and skills to
325 disinvest in ineffective (low-value) care. This is particularly important given the misconceptions held
326 by people with OA that ultimately influence acceptance of first-line (non-surgical) evidence-based
327 treatments such as exercise and weight loss¹¹. A skilled workforce is required to combat inappropriate
328 beliefs about OA and empower individuals to engage with effective evidence-based interventions. A
329 survey of general practitioners, physiotherapists and nurses in Australia, New Zealand and Canada
330 showed that 37-88% of clinicians and 68-85% of students perceived that their knowledge and skills

331 were barriers to implementing OA care²⁹. Skills gaps were evident regarding assessment, measurement
332 and monitoring; exercise and nutritional/overweight management; supporting positive behaviour
333 change; tailoring care; managing case complexity; and translating knowledge to practice. Confidence in
334 OA knowledge and skills was consistently greatest among physiotherapists and lowest in primary care
335 nurses³⁰. These findings are supported by qualitative research¹⁰ showing rheumatologists, orthopedic
336 surgeons, physiotherapists and general practitioners perceive a lack of healthcare provider expertise as
337 a major barrier to providing non-pharmacological, non-surgical OA care. Suboptimal organization of
338 care, including inadequate inter-professional communication and lack of clarity about roles and
339 responsibilities of disciplines, is also a barrier¹⁰. Recognising these problems, Australia's National
340 Strategic Action Plan for Arthritis³¹ has prioritised the need to define skill sets and competencies for
341 arthritis management and care across clinical disciplines, care settings, and levels of professional
342 practice, in order to identify educational needs across professions, including general practitioners,
343 nurses, allied health professionals and pharmacists. This study addresses this important priority with
344 relevance to nations beyond Australia.

345
346 Strengths of our study include our large Delphi Panel, with high retention. We assembled 173 experts
347 and retained two-thirds of them through all three survey rounds. There is no agreement on ideal Delphi
348 panel size³². For example, a systematic review of 80 Delphi studies reported a median panel size of 17,
349 with a minimum of 3 and a maximum of 418 members³³. Thus, our Delphi panel may be considered
350 large. Importantly, over half of the Panel were active clinicians involved in care of people with OA.
351 Another strength of our Panel was its diversity, comprising experts from 31 different countries,
352 spanning 18 different health professions and including 26 consumer representatives. Panel breadth
353 ensured the final framework was relevant to a range of health professions, spanning first contact
354 primary care though to tertiary management, across the globe. However, our Panel did not include
355 experts from South Asia or Sub-Saharan Africa or low-income or lower-middle-income economies³⁴,

356 which may be due to the requirement that Panellists be fluent in English. This limits the generalisability
357 of our framework to culturally and linguistically diverse populations, and to low and middle-income
358 countries where health worker cadres differ to those of high-income settings. Our framework is non-
359 specific to the joint affected by OA. Although this increases the generalisability of the capability
360 framework to the wider population of people with OA, it is possible that particular sub-groups of
361 people with OA (e.g. those with hand OA) may benefit from additional core capabilities.

362

363 Our Panel comprised more physiotherapists and rheumatologists relative to other professions. Best
364 practice management of OA may require clinical expertise from a range of health professionals to
365 accommodate individual patient needs, however people with OA experience substantial challenges in
366 accessing treatment, including difficulty obtaining referrals and appointments, long waiting times and
367 limited availability of primary and specialist care in some areas³⁵. The under-representation of some
368 professions in our Panel may be partially related to our inclusion criteria, whereby clinicians were
369 required to have managed at least one patient with OA per week over the past six months to qualify as
370 an “expert”. It is likely that few pain physicians, psychologists and dieticians (for example) could meet
371 such criteria, due to the difficulties experienced by patients with OA in accessing care from these
372 professions. Nonetheless, the framework outlines a core set of capabilities to ensure that any health
373 professional managing OA is able to implement evidence-based pathways, either directly themselves or
374 as part of an integrated multi-professional team. The core capability framework is not intended to
375 dictate what any clinician should be doing within their specialist scope of practice. Rather, it aims to set
376 a common standard across all professionals involved in OA care, at any point on the care pathway,
377 across the disease spectrum and across healthcare settings.

378

379 Implementation of the core capability framework into the OA health workforce requires a multi-faceted
380 approach (including but not limited to endorsement by discipline-specific professional bodies,

381 integration into pre-licensure curricula and focused training for the current workforce) across
382 stakeholders including higher education, public and private healthcare and professional and consumer
383 advocacy sectors. The framework is intended as a reference guide to be applied according to local
384 priorities and needs. For example, in higher education, the framework may be used to audit, develop
385 and refine pre-licensure educational curricula for health professionals, as well as guide assessment of
386 learning. Private and public health service managers may use the framework when recruiting and
387 training staff to deliver OA services, by identifying and articulating the skills required of individuals,
388 including those employed in advanced practice roles and/or working as part of a broader integrated
389 multi-disciplinary OA management “program”. The framework may be used at the level of individual
390 clinicians as a self-evaluation tool to identify areas for personal professional development. This core
391 capability framework will be used by the International Osteoarthritis Management Programs ‘Joint
392 Effort’ Initiative of OARSI¹⁸ to inform the future development of strategies for training and
393 educational activities. Implementation of this framework will likely encounter similar barriers
394 experienced by clinical guidelines³⁶, including clinician factors (e.g. knowledge of and attitudes
395 towards the framework, self-efficacy, motivation and confidence to change behaviours), framework-
396 related factors (e.g. complexity, accessibility and applicability) and external factors (e.g. organizational
397 constraints, healthcare funding models).

398

399 **Conclusions**

400 To provide optimal care for all people with OA, health professionals require a diverse array of skills in
401 person-centred approaches; assessment, investigation and diagnosis; management, interventions and
402 prevention; and service and professional development. Implementation of the core capability
403 framework will help individual health professionals and organisations identify training and
404 development needs of the OA workforce, ultimately improving the quality of care and effectiveness of
405 OA services and improving outcomes for people with OA.

406

407 Acknowledgements

408 We wish to acknowledge all members of the Delphi Panel for the time and effort to participate. We
409 also wish to acknowledge Skills for Health (UK) for granting permission to adapt the “Musculoskeletal
410 core capabilities framework for first point of contact practitioners”,¹⁶ the support of OARSI in
411 establishing the OARSI Joint Effort Initiative and assisting with recruitment for this study, and the
412 broader Initiative membership who stimulated this project.

413

414 Author contributions

415 All authors conceived the study, contributed to its design and interpretation of findings, and read and
416 approved the manuscript. RSH and ME oversaw data analysis and drafted the manuscript. PKC
417 coordinated the survey and data collection and read and approved the final manuscript.

418

419 Funding

420 This study was supported by funding from a National Health and Medical Research Council (NHMRC)
421 Centre of Research Excellence (#1079078). RSH is supported by an National Health and Medical
422 Research Council Senior Research Fellowship (#1154217). KB is supported by an NHMRC Principal
423 Research Fellowship (#1058440). DJH is supported by an NHMRC Practitioner Fellowship
424 (#1079777). STS is funded by the European Research Council under the European Union’s Horizon
425 2020 research and innovation program (grant agreement #801790), the Independent Research Fund
426 Denmark (DFF-6110-00045) and the Lundbeck Foundation. KDA is supported by the Department of
427 Veterans Affairs Health Service Research and Development Service (CIN-13-410, RCS 19-332) and
428 the National Institute of Arthritis and Musculoskeletal and Skin Disorders (P60 AR064166). KSD is a
429 National Institute for Health Research (NIHR) Senior Investigator.

430

431 Competing interest statement

432 DJH provides consulting advice to Pfizer, Lilly, Merck Serono and TLCBio. NB has received
433 consultancy fees from Amgen, Eli Lilly, Grunenthal, GSK, the Global Alliance for Patient Access,
434 Pfizer, and Sanofi Genzyme. STS is co-founder of Good Life with Osteoarthritis in Denmark
435 (GLA:D®), a not-for profit initiative hosted at University of Southern Denmark aimed at implementing
436 clinical guidelines for osteoarthritis in clinical practice. LED is co-founder and Chief Medical Officer
437 of Joint Academy, a company which provides digital first line treatment for patients with hip and knee
438 OA. LED owns stocks in, is a board member of, and is since May 1st 2019, a paid part-time consultant
439 of Joint Academy.

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544 **Table 1: Characteristics of the Delphi Panel.**

	Round 1	Round 2	Round 3
	(n=173)	(n=131)	(n=118)
Type of expert, n (%)			
Researcher	47 (27)	36 (27)	34 (29)
Clinician	47 (27)	38 (29)	36 (30)
Clinician researcher	53 (31)	40 (31)	34 (29)
Consumer representative	26 (15)	17 (13)	14 (12)
Health profession, n (%)[†]			
Physiotherapist	74 (50)	59 (51)	55 (53)
Rheumatologist	32 (21)	23 (20)	21 (20)
Orthopaedic surgeon	9 (6)	7 (6)	7 (7)
General practitioner/family physician	7 (4)	6 (5)	6 (5)
Sport & exercise medicine physician	4 (3)	3 (3)	2 (2)
Dietician	3 (2)	1 (1)	1 (1)
Podiatrist	3 (2)	3 (3)	3 (3)
Radiologist	3 (2)	3 (3)	3 (3)
Chiropractor	2 (1)	2 (1)	1 (1)
Pain physician	2 (1)	0 (0)	0 (0)
Athletic trainer	1 (1)	1 (1)	0 (0)
Diagnostic radiographer	1 (1)	1 (1)	1 (1)
Exercise physiologist	1 (1)	1 (1)	1 (1)
Nurse	1 (1)	1 (1)	1 (1)
Occupational therapist	1 (1)	1 (1)	1 (1)
Orthotist	1 (1)	1 (1)	0 (0)
Osteopath	1 (1)	0 (0)	0 (0)
Psychologist	1 (1)	1 (1)	1 (1)
Country of residence, n (%)			

Australia	56 (32)	43 (33)	37 (31)
United States	26 (15)	18 (13)	16 (14)
United Kingdom	16 (9)	14 (10)	12 (10)
Netherlands	15 (9)	11 (8)	11 (9)
Canada	9 (5)	6 (4)	6 (5)
Denmark	6 (3)	6 (4)	6 (5)
France	6 (3)	6 (4)	6 (5)
China	4 (2)	3 (2)	3 (3)
Malaysia	4 (2)	1 (1)	0 (0)
Norway	4 (2)	4 (3)	4 (2)
Spain	3 (2)	1 (1)	1 (1)
Brazil	2 (1)	2 (1)	2 (1)
Ireland	2 (1)	1 (1)	1 (1)
Japan	2 (1)	1 (1)	1 (1)
New Zealand	2 (1)	1 (1)	1 (1)
Belgium	1 (1)	1 (1)	1 (1)
Czech Republic	1 (1)	0 (0)	0 (0)
Germany	1 (1)	1 (1)	1 (1)
Greece	1 (1)	1 (1)	0 (0)
Hungary	1 (1)	1 (1)	1 (1)
Israel	1 (1)	1 (1)	1 (1)
Italy	1 (1)	1 (1)	1 (1)
Lebanon	1 (1)	1 (1)	1 (1)
Malta	1 (1)	1 (1)	1 (1)
Poland	1 (1)	1 (1)	0 (0)
Portugal	1 (1)	0 (0)	0 (0)
Romania	1 (1)	1 (1)	1 (1)
Serbia	1 (1)	1 (1)	1 (1)
Singapore	1 (1)	1 (1)	1 (1)
Sweden	1 (1)	1 (1)	1 (1)
Switzerland	1 (1)	0 (0)	0 (0)

[†]n=147 health professional members of Delphi panel in Round 1; n= 114 in Round 2; n= 104 in Round 3

Table 2. The core capability framework for health professionals involved in the clinical care of people with osteoarthritis.

<p>DOMAIN A: Person-centred approaches</p> <p><u>Capability 1. Communication</u> Within their role and scope of professional practice in OA, the health professional can do the following:</p> <ol style="list-style-type: none"> Apply a critical self-awareness of their own values, beliefs, prejudices, assumptions and stereotypes especially related to pain and overweight/obesity to mitigate the impact of these in how they interact with others. Listen to and communicate with others, recognising that both are an active, two-way process. Modify conversations to optimise engagement and understanding, and convey information in ways that avoid jargon, negative or potentially threatening descriptors and assumptions. Respond to individuals' communication and information needs by adapting communication style (verbal and non-verbal) and supporting the use of accessible information as needed. Engage with individuals and carers and respond appropriately to questions and concerns about their OA and its impact on their current situation and potentially in the future. Direct individuals appropriately and effectively to sources of accurate and reliable information and support. Communicate efficiently and effectively with colleagues to serve individuals' best interests and to expedite and integrate care. Respect and draw on colleagues' knowledge and expertise within the inter-disciplinary team (where available) to serve individuals' best interests. <p><u>Capability 2. Person-centred care</u> Within their role and scope of professional practice in OA, the health professional can do the following:</p> <ol style="list-style-type: none"> Recognise the expertise that individuals bring to managing their own care, demonstrating sensitivity to the individuals' background, identity, language, culture, resources, values, needs, preferences and experiences of pain and functional limitations related to OA. Explore the impact of persistent pain and disability on individuals' lives, including on their relationships, family and social roles, self-esteem and ability to participate in what they need and want to do (including paid and unpaid work). Take account during care planning of the burden (financial and time) of treatment for individuals with OA, including regular appointments that may also be for the management of their other healthcare needs. Progress care, recognising that meaningful positive outcomes (such as restoring and maintaining function and independence, and improving quality of life) may be achieved without a reduction in pain (whilst preferable). Enable individuals to make decisions about their care by: <ul style="list-style-type: none"> · empowering them to identify the priorities and outcomes that are important to them and supporting them to set goals · explaining in non-technical language all available options (including doing nothing), and the evidence base underpinning the interventions · exploring with them the risks, benefits and consequences of each available option and discussing what these mean in the context of their life and goals
<p>DOMAIN B: Assessment, Investigation & Diagnosis</p> <p><u>Capability 3. History-taking</u> Within their role and scope of professional practice in OA, the health professional can do the following:</p> <ol style="list-style-type: none"> Listen to individuals, ask questions and obtain appropriate additional information, with due sensitivity and consideration of what information needs to be sought to optimise the effectiveness and efficiency of the subjective examination. Gather and synthesise information on the nature of the individual's symptoms taking account of how these issues relate to the presenting and past history, their activities, any prior injuries, falls, frailty, comorbidities or other determinants of health and the characteristics of OA. Assess patient preferences and values to determine pain-related goals and priorities. Assess the impact of individuals' presenting symptoms on their quality of life, including the impairment of function, limitation of activities and restriction on participation, including work, social roles and relationships. Gather information on the treatments the individual has previously undertaken to manage their OA symptoms, including whether these were

effective or ineffective.

- f) Record the information gathered through taking individuals' history concisely and accurately for clinical management, and in compliance with local protocols, legal and professional requirements.

Capability 4. Physical assessment

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Appropriately obtain individuals' consent to physical examination, respect and maintain their privacy, dignity and comfort, as far as practicable, and comply with infection prevention and control procedures.
- b) Adapt their practice to meet the needs of different groups and individuals (including cultural and religious factors, and those with particular needs such as cognitive impairment or learning disabilities), working with care-givers, where appropriate.
- c) Undertake observational and functional assessments of individuals, relevant to their OA and problem(s), to identify and characterise any impairments.
- d) Record the information gathered through assessments concisely and accurately, for clinical management and in compliance with local protocols, legal and professional requirements.

Capability 5. Investigations and diagnosis

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Understand that diagnosis of OA is based on clinical presentation (symptoms) rather than structural changes observed on imaging, and that routine use of imaging is not necessary for a clinical diagnosis of OA.
- b) Assess the importance and meaning of presenting features from the clinical assessment, recognising the wide variation in how OA may manifest.
- c) Identify potential serious pathology and make appropriate onwards referral.
- d) Identify risk factors for symptomatic, functional and/or structural OA progression.
- e) Recognise and act where an early referral and diagnosis may be particularly important for optimising individuals' long-term outcomes.
- f) Recognise how OA and its impact can interact with other comorbidities (eg mental health, cardiovascular disease, obesity), and identify when this is relevant.
- g) Use accurate and non-threatening language in talking about the diagnosis of OA, including avoidance of phrases such as 'wear and tear', 'grinding', and 'bone on bone'.

DOMAIN C: Management, Interventions & Prevention

Capability 6. Interventions and care planning

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Work in partnership with the individual to develop management plans that take account of individuals' needs, goals, preferences, local service availability and relevant guidelines.
- b) Recognize that different types of pain (nociceptive, neuropathic, nociplastic) may require different management approaches.
- c) Identify pain treatment options that can be accessed by the individual in a comprehensive pain management plan.
- d) Ensure the management plan considers all options that are appropriate for the care pathway, as well as the benefits and risks of available treatments, and the underlying evidence for each.
- e) Advise on pharmacological and non-pharmacological aspects of pain management.
- f) Review management plans regularly, including monitoring of the individual's symptoms and effectiveness and tolerability of treatments, and adjust the plan of care as needed.

Capability 7. Prevention and lifestyle interventions

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Advise on the effects of inactivity on OA, promote participation in physical activity (that is appropriate for and acceptable to the individual), and refer to relevant services where appropriate.
- b) Advise on the effects of overweight and obesity on OA (including risk of OA development), promote weight management, and refer to relevant services where appropriate.
- c) Use interactions to encourage changes in behaviour that can have a positive impact on the health and wellbeing of individuals, communities and populations.
- d) Facilitate behaviour change using evidence-based approaches that support self-management.

Capability 8. Self-management and behaviour change

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Explain how health promotion and self-management strategies are important to the management of pain.
- b) Support individuals to self-manage and fulfil their role in their management plan, and where appropriate use principles of behaviour change theory and patient activation, to optimise their physical activity, mobility, fulfilment of personal goals and independence relevant to their OA.
- c) Support individuals to explore the consequences of their actions and inactions on their health status and the fulfilment of their personal health goals (e.g. their engagement in exercise and their use of medication).
- d) Support individuals to get the most from conversations about the management of their OA and its impacts (e.g. loss of independence) by supporting and encouraging them to ask questions about what is a priority or concern for them.
- e) Identify risk factors for the persistence and impact of OA on pain and functional ability.

Capability 9. Rehabilitative interventions

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Understand the role of common rehabilitative interventions, including pain education, therapeutic exercise, weight loss, manual therapy, cognitive behavioural approaches, aids and assistive devices, orthotics, braces and splints for managing OA, based on best available evidence.
- b) Advise on the expected benefits, limitations and risks of different rehabilitative interventions used in managing OA, providing impartial information and advice on the advantages and disadvantages of specific interventions in the context of other management options.
- c) Provide advice on managing pain and optimising function, including graded activity, navigation to self- management resources, and activity pacing.
- d) Understand that some individuals such as those living with mental health issues, co-morbidities or frailty might need additional support during rehabilitation.
- e) Work in partnership with individuals to explore suitability of rehabilitation interventions, including community- based exercise programmes where appropriate.
- f) Refer individuals to specialist rehabilitation practitioners (e.g. physiotherapists, dieticians, occupational therapists, psychologists) where this is appropriate.

Capability 10. Pharmacotherapy

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Understand the role of medications used in managing OA, including acetaminophen, non-steroidal anti-inflammatory drugs, corticosteroids and opioids, based on best available evidence.
- b) Refer for advice about pharmacotherapy, when considered appropriate.

Capability 11. Surgical interventions

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Understand the role of arthroscopy and arthroplasty in managing OA, based on best available evidence.
- b) Advise on the expected benefits, limitations and risks of arthroscopy and arthroplasty in managing OA (where these are relevant to individuals' care) and inform them impartially on the advantages and disadvantages in the context of other management options.
- c) Refer for surgical opinion when an appropriate course of non-surgical management does not provide sufficient control of pain.

Capability 12. Referrals and collaborative working

When managing people with OA, the health professional can do the following:

- a) Practise within their professional and personal scope of practice and access specialist advice or support for the individual or for themselves when appropriate.
- b) Engage in effective inter-professional communication and collaboration with clear documentation to optimise the integrated management of the individual with OA.
- c) Engage in effective inter-professional communication and collaboration to optimise care for OA within the population.
- d) Know and be able to draw on the expertise of all members of the inter-disciplinary team and social support to meet individuals' best interests and optimise the integration of their care.
- e) Contribute effectively to inter-disciplinary team activity (including service delivery processes and learning and development).
- f) Participate as an effective team member and understand the importance of effective team dynamics.
- g) Make appropriate referrals using appropriate documentation to other health and care professionals and agencies when this is in individuals' best interests.

DOMAIN D: Service & Professional Development**Capability 13. Evidence-based practice and service development**

Within their role and scope of professional practice in OA, the health professional can do the following:

- a) Critically apply relevant national clinical practice guidelines and other best available evidence on OA care and service delivery, identifying where local modifications may be required.
- b) Monitor and evaluate their practice and its outcomes, including through data collection and analysis to assure and improve the quality of OA care, service delivery and address health inequalities.
- c) Engage in the distinct activities of clinical audit, service evaluation and research (leading or contributing, as appropriate) adhering to the national and local requirements, and regulatory frameworks that relate to each.
- d) Seek input from individuals and their carers to improve the person-centred design and quality of services.
- e) Act appropriately when service deficiencies are identified (e.g. frequent long waiting times) that have the potential to affect the effective management of individuals' OA care, including by taking or advocating for corrective action, where needed.
- f) Plan, engage in and record learning and development relevant to their role and in fulfilment of professional, regulatory and employment requirements.
- g) Engage in reflective practice and clinical supervision as an integral part of their professional development and to inform OA service development and quality improvement with reference to local needs.

Appendix 1: Additional capabilities suggested by the Steering Group in the survey formative phase

Overarching broad capability	Specific capability
# 3- History taking	<ul style="list-style-type: none"> - Assess patient preferences and values to determine pain-related goals and priorities. - Administer and score patient-reported outcome measures to assess pain, and the impact of OA on function, informed by an understanding of the measures' respective validity, reliability, specificity and sensitivity in people with OA. - Gather information on the treatments the individual has previously undertaken to manage their OA symptoms, including whether these were effective or ineffective.
#4- Physical assessment	<ul style="list-style-type: none"> - Apply outcome measures of physical performance that enable objective measurement of physical function, informed by an understanding of the measures' respective validity, reliability, specificity and sensitivity in people with OA.
#5- Investigations & diagnosis	<ul style="list-style-type: none"> - Understand that diagnosis of OA is based on clinical presentation (symptoms) rather than structural changes observed on imaging, and that routine use of imaging is not necessary for a clinical diagnosis of OA.
#6- interventions & care-planning	<ul style="list-style-type: none"> -Understand how contextual factors may influence the magnitude of treatment effects on OA symptoms, in order to optimize outcomes of management. - Identify pain treatment options that can be accessed by the individual in a comprehensive pain management plan. - Review management plans regularly, including monitoring of the individual's symptoms and effectiveness and tolerability of treatments, and adjust the plan of care as needed.
#8- Self-management & behaviour change	<ul style="list-style-type: none"> - Explain the complex, multidimensional and individual-specific nature of pain to the individual. - Explain how health promotion and self-management strategies are important to the management of pain. - Help individuals manage the psycho-social implications of OA.
#9- Rehabilitative interventions	<ul style="list-style-type: none"> - Suggest the use of digital technology (e.g. apps and wearables) to deliver treatment and support adherence.

Appendix 2: Capabilities excluded after Round 1

Overarching broad capability	Specific capability excluded
# 3- History taking	<ul style="list-style-type: none"> - Administer and score patient-reported outcome measures to assess pain, and the impact of OA on function, informed by an understanding of the measures' respective validity, reliability, specificity and sensitivity in people with OA. - Critically appraise complex, incomplete, ambiguous and conflicting information presented by individuals, distilling and synthesising key factors from the appraisal, and identifying those elements that may need to be pursued further.
#4- Physical assessment	<ul style="list-style-type: none"> - Apply outcome measures of physical performance that enable objective measurement of physical function, informed by an understanding of the measures' respective validity, reliability, specificity and sensitivity in people with OA.
#5- Investigations & diagnosis	<ul style="list-style-type: none"> - Instigate appropriate investigative tests to aid diagnosis and assessment.
#7- Prevention & lifestyle interventions	<ul style="list-style-type: none"> - Appraise the impact that a range of social, economic, and environmental factors can have on outcomes for individuals with OA, their carers and their circles of support. - Recognise and promote the importance of social networks and communities for individuals and their carers in living well with OA. - Advise individuals and relevant agencies on how OA-related work loss can be prevented through acting on effective risk assessments and providing appropriate working conditions, including adaptation to meet the individual's needs.
#8- Self-management & behaviour change	<ul style="list-style-type: none"> - Advise on and refer individuals to psychological therapies and counselling services, in line with their needs, taking account of local service provision. - Advise individuals on the effects of their OA and their response to it, including the causal links between absence from work, prolonged absence, reduced return to work and subsequent loss of employment. - Advise and assist individuals to identify and use strategies to address work instability and to improve work retention. - Advise on sources of relevant local or national self-help guidance, information and support including coaching.
#9- Rehabilitative interventions	<ul style="list-style-type: none"> - Suggest the use of digital technology (e.g. apps and wearables) to deliver treatment and support adherence. - Make recommendations to employers regarding individuals' fitness to work, including through seeking of appropriate occupational health advice.
#10- Pharmacotherapy	<ul style="list-style-type: none"> - Identify sources of further information (e.g. websites or leaflets) and advice (e.g. pharmacists) and be able to signpost individuals as appropriate to complement the advice given. - Keep individuals' response to medication under review, recognising differences in the balance of risks and benefits that may occur in the context of polypharmacy, multimorbidity, frailty and cognitive impairment.
#11- Injection therapy	<ul style="list-style-type: none"> - Advise on the expected benefits, limitations and risks of injection therapy for managing OA and inform individuals impartially on its advantages and disadvantages in the context of other management options. - Work in partnership with individuals to explore the suitability of injection therapy, addressing and seeking to allay individuals' fears, beliefs and concerns. - Refer for advice about local injections, when considered appropriate.
#13 Referrals & collaborative working	<ul style="list-style-type: none"> - Advise on local non-clinical services that individuals and their carers may benefit from accessing to help manage OA and its impact, including those relating to employment, voluntary activities, counselling services and leisure facilities.

Appendix 3: Capabilities excluded after Round 2

Overarching broad capability	Specific capability excluded
#4- Physical assessment	<ul style="list-style-type: none"> - Select and conduct an appropriate initial musculoskeletal screening assessment. - Apply a range of physical assessment techniques appropriately, systematically and effectively, informed by an understanding of techniques' respective validity, reliability, specificity and sensitivity in people with OA and the implications of the limitations they may have within an assessment. - Assess multi-directional three-dimensional movement patterns
#5- Investigations & diagnosis	<ul style="list-style-type: none"> - Understand how OA may be a manifestation of injury not only from trauma but also abuse, recognising particular at-risk groups (such as older people with frailty and those with cognitive impairment) and take appropriate action when there are grounds for concern. - Understand and interpret test results and act appropriately, demonstrating an understanding of the indications and limitations of different tests to inform decision-making. - Interpret radiographs.
#6- Interventions & care planning	<ul style="list-style-type: none"> - Advise on the links between OA symptoms and reduced mental well-being and refer individuals to sources of mental health support when in their best interests. - Understand the importance of joint load management in a patient-specific context
#7- Prevention & lifestyle interventions	<ul style="list-style-type: none"> - Understand the role of different weight reduction strategies, based on best available evidence.
#8- Self-management & behaviour change	<ul style="list-style-type: none"> - Explain the complex, multidimensional and individual-specific nature of pain to the individual. - Recognise in their management approach that OA is often coupled with mental health issues, frailty, multimorbidity or other determinants of health. - Help individuals manage the psycho-social implications of OA. - Use an understanding of contemporary pain biology in order to deliver evidence-based and accurate pain education. - Use motivational interviewing principles to engage and empower people with OA to self-manage according to evidence-based guidelines. - Advise on social welfare and sources of financial support. - Understand the important link between the language used to describe OA and how it may adversely impact pain perception and self-management behaviours.
#9- Rehabilitative interventions	<ul style="list-style-type: none"> - Prescribe tailored (personalised) rehabilitation programmes to help individuals enhance, restore and maintain their mobility, function and independence. - Manufacture custom-made orthoses. - Prescribe and modify an appropriate exercise program (including dosage) according to individual needs, considering potential barriers to adherence. - Provide advice on optimising function, including goal-orientated functional movement strategies. - Provide advice on managing pain and optimising function, including strategies to reduce joint loading.
#11- Injection therapy	<ul style="list-style-type: none"> - Appreciate that patients without an effusion will require guidance by imaging (fluoroscopy or ultrasound) to ensure adequate placement of intra articular injections.
#14- Evidence-based practice & service development	<ul style="list-style-type: none"> - Work within the constraints of the health service, including the time available for consultations and the resources available.

Appendix 4: Capabilities excluded after Round 3

Overarching broad capability	Specific capability excluded
#3- History taking	<ul style="list-style-type: none"> - Gather and synthesise information on the nature of individuals' issues from various appropriate sources e.g. previous histories and investigations, considering how symptoms of OA may manifest as pain, stiffness, weakness, fatigue, limitation of activities, restriction of participation, sleep disturbance and mood disorders - Explore and appraise with individuals' perceptions, ideas or beliefs about their pain and OA and whether these may act as a driver or form a barrier to improvement. - Appraise factors affecting individuals' ability to participate in life situations, including work and social activities, and their perceptions of the relationship between their work and health. - Critically appraise information obtained, taking account of the potential for OA symptoms to be features of other health conditions, compounded by psychological and mental health factors, and affected by lifestyle factors (including overweight/obesity and physical inactivity).
#4- Physical assessment	<ul style="list-style-type: none"> - Identify, analyse and interpret potentially significant information from the physical assessment (including any ambiguities).
#6- Interventions & care planning	<ul style="list-style-type: none"> - Understand how contextual factors may influence the magnitude of treatment effects on OA symptoms, in order to optimize outcomes of management. - Advise on and instigate a management plan for OA- instigating this may be through referral to digital management programs and/or to other practitioners with specific relevant capabilities. - Identify when first-line intervention has been successful and discharge the patient with appropriate advice.
#7- Prevention & lifestyle interventions	<ul style="list-style-type: none"> - Advise on the effects of joint injury on risk of OA, promote injury-prevention strategies, and refer to relevant services where required. - Advise individuals living with frailty and their carers how to adapt the physical environment to promote independence, orientation and safety (e.g. to reduce risk of falls). - Work collaboratively across agencies and boundaries to improve OA-related health outcomes and reduce health inequalities. - Develop a personalised physical activity plan to assist the individual to meet recommended levels of physical activity.
#8- Self-management & behaviour change	<ul style="list-style-type: none"> - Advise individuals on how limitations of activities and restriction of participation associated with OA can be reduced through adaptations to meet the individual's needs.
#10- Pharmacotherapy	<ul style="list-style-type: none"> - Use their understanding of the most common medications used in OA to advise individuals on the pharmacological management of their OA, the expected benefits, limitations and risks, and inform them impartially on the advantages and disadvantages in the context of other management options. - Address and seek to allay individuals' fears, beliefs and concerns
#11- Injection therapy	<ul style="list-style-type: none"> - Understand the role of intra-articular injections in managing OA (including corticosteroids, platelet rich plasma, hyaluronic acid and stem cells), based on best available evidence.
#12- Surgical interventions	<ul style="list-style-type: none"> - Work in partnership with individuals to explore suitability of surgical intervention, discussing individuals' fears, beliefs and concerns, seeking guidance when appropriate.

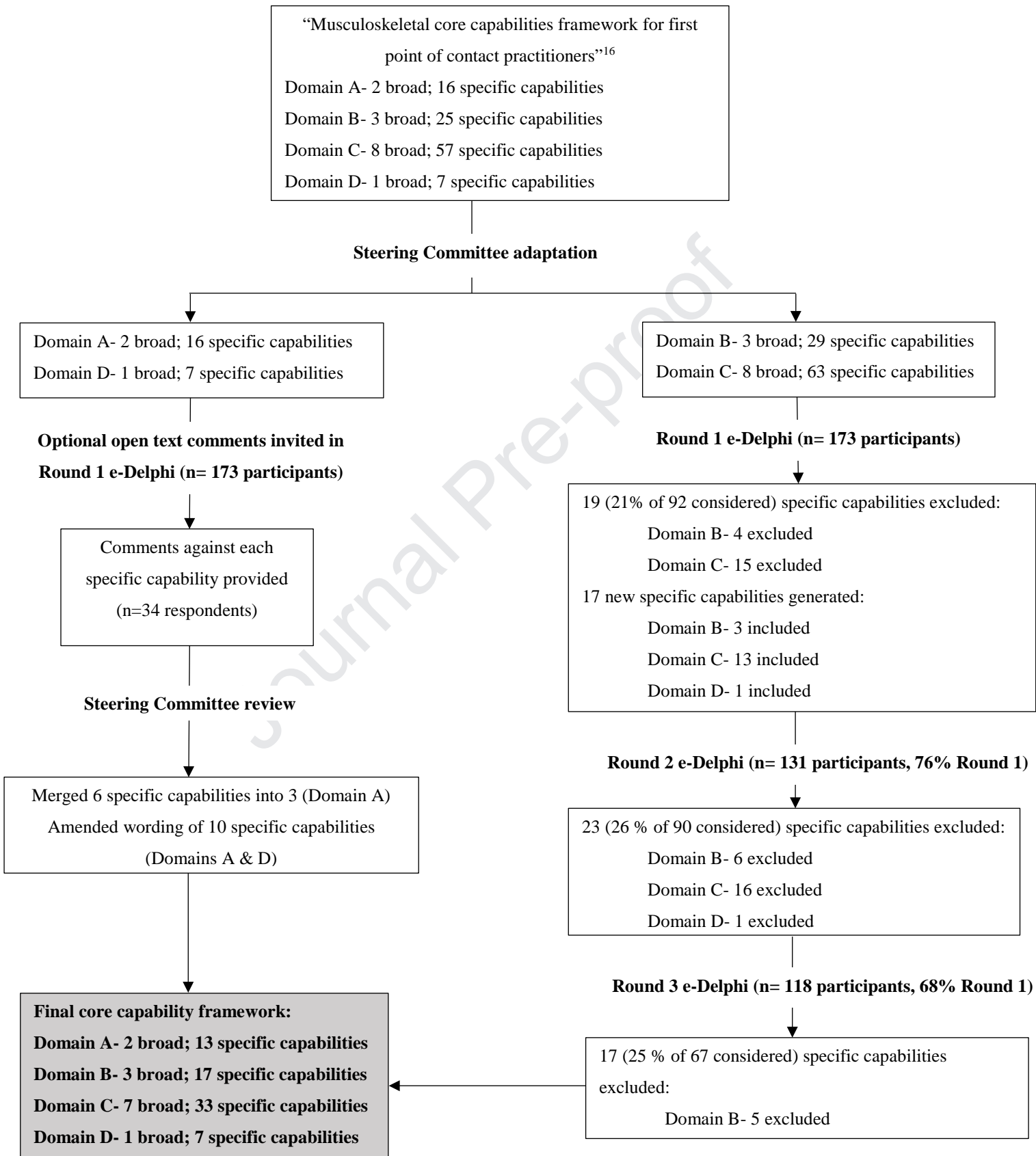
Figure 1: Overview of study phases and outcomes of e-Delphi survey

Figure 2: Infographics summarising the core capability framework for health professionals involved in the clinical care of people with osteoarthritis.

