GID-HTE10057 Digital technologies for managing mild to moderate hip or knee osteoarthritis; early value assessment for the National Institute for Health and Care Excellence

Final Protocol

Produced by: KSR Ltd.

Authors:

Nigel Armstrong, Health Economics Manager, KSR Ltd, United Kingdom (UK)

Sabine Grimm, Heath Economist, Maastricht UMC+, NL

Bram Ramaekers, Health Economist, Maastricht UMC+, NL

Mabel Wieman, Health Economist, Maastricht UMC+, NL

Xiaoyu Tian, Systematic Reviewer & Health Economist, KSR Ltd, UK

Lisa Stirk, Senior Information Specialist, KSR Ltd, UK

Huiqin Yang, Reviews Manager, KSR Ltd, UK

Correspondence to:

Kleijnen Systematic Reviews Ltd

FAO Nigel Armstrong

Unit 6, Escrick Business Park

Riccall Road, Escrick

York, YO19 6FD

United Kingdom

Date completed: 19th March 2025

Funding from: NIHR Evidence Synthesis Programme, reference: NIHR174559

1. Decision problem

Table 1 summarises the decision problem to be addressed in this assessment. Further detail on each element can be found in the published scope for the assessment.

Table 1. Summary table of the decision problem

Populations	Adults aged 16 and over with mild to moderate hip or knee osteoarthritis that have been assessed as suitable for digital self-management
Interventions (proposed technologies)	Digital technologies for managing mild to moderate hip or knee osteoarthritis, including: • ESCAPE-Pain • getUBetter • Good Boost • Hinge Health • Joint Academy • Pathway Through Arthritis • Phio Engage • Physio Wizard • Re.Flex • Thrive • TrackActiveMe
Comparators	Non-pharmacological standard care for people aged 16 and over with mild to moderate hip or knee osteoarthritis. Standard care varies across primary and community care, but should include therapeutic exercise, weight management (if appropriate) and information and support, delivered alongside pharmacological interventions. Manual therapy and devices (such as walking aids) may also be offered alongside therapeutic exercise, where appropriate.
Healthcare setting	Primary and community care
Outcomes	The outcome measures to consider include: **Primary outcomes** Patient reported outcomes •Health-related quality of life •Pain and stiffness •Physical function •Self-efficacy Clinical outcomes •Referrals for injections •Medicine use and appointments

	Secondary outcomes Patient reported outcomes •Psychological outcomes •User satisfaction and acceptability •Activity impairment **Intermediate outcomes** • Intervention adherence, rates of attrition and completion (including but not limited to the number of exercise/therapy sessions completed, interaction with health professionals, education contents reviewed) • Intervention related adverse events • Work productivity/return to full activity • Healthcare professional satisfaction **Clinical outcomes** •Secondary care referrals •Referrals for surgery Costs will be considered from an NHS and Personal Social Services perspective. Costs and resource use outcomes for consideration should include: • Costs of the technologies (including license fees and maintenance) • Cost related to supporting digital technologies (including but not limited to additional hardware or software, cost of staffing and training) • Cost of resource use o Primary, community and secondary care appointments o Medicine use, manual therapy and device use o Healthcare professional grade and time
Time horizon	The time horizon for estimating the clinical and economic value should be sufficiently long to reflect any differences in costs or outcomes between the technologies being compared.

1.1 Objectives

The objectives of this project are:

- to identify and assess the evidence relating to a wide range of digital technologies for managing mild to moderate hip or knee osteoarthritis

- to identify the evidence gaps and how these can be filled by further research

2. Evidence review methods

Full details of the search methods are provided in Appendix A – Search methods

2.1 Inclusion criteria

Table 2. Inclusion and exclusion criteria

	Inclusion Criteria
Population	As in Table 1.*
Intervention	As in Table 1.
Comparators	As in Table 1.
Setting	As in Table 1.
Outcomes	As in Table 1.*
Study design	Any of the following: • Randomised controlled trials • Prospective controlled studies • Retrospective controlled studies • Single arm studies
*If no studies are identified for a specific intervention using the inclusion criteria, then the EAG will expand the criteria to look at a broader evidence base. For example, for the population if there are no studies in people with hip or knee osteoarthritis then studies with a mixed osteoarthritis and joint pain not specified as osteoarthritis will be considered. The aim is to include at least one study for each intervention in the evidence review.	

2.2 Search strategy

Searches will be conducted to identify studies of digital technologies for managing osteoarthritis of hip/knee, as recommended in the Centre for Reviews and Dissemination (CRD) guidance for undertaking reviews in health care. A single set of searches will be conducted to identify both clinical and economic evidence. The searches will be conducted in a range of resources including research published in the journal literature, conference abstracts and ongoing research.

Search strategies will combine relevant search terms comprising indexed keywords (e.g. Medical Subject Headings, MeSH) and free text terms appearing in the titles

and/or abstracts of bibliographic database records. Search terms will be identified through discussion between the review team, by scanning background literature and 'key articles' already known to the project team, and by browsing database thesauri. The search strategies will be developed specifically for each database and the keywords adapted according to the configuration of each database. Searches will be limited to English, but not limited by study design, or publication status (unpublished or published). Only studies in humans will be sought. A publication date range of 2013-date will be applied to the searches to reflect digital technologies currently in use.

The following databases will be searched from 2013 to the most recent date available:

- MEDLINE (Ovid)
- Embase (Ovid)
- Cochrane Database of Systematic Reviews (CDSR) (https://www.cochranelibrary.com/)
- Cochrane Central Register of Controlled Trials (CENTRAL) (https://www.cochranelibrary.com/)
- NHS Economic Evaluation Database (NHS EED) (https://www.crd.york.ac.uk/CRDWeb/)
- KSR Evidence (https://ksrevidence.com/)

Completed and ongoing trials will be identified by searches of the following resources:

- ClinicalTrials.gov (https://clinicaltrials.gov/)
- WHO International Clinical Trials Registry Portal (ICTRP) (https://www.who.int/clinical-trials-registry-platform)
- To identify conference proceedings, searches in Embase will not be restricted to exclude conference abstracts. In addition, a search will be undertaken of the following conference proceedings resource:
- Northern Light Life Sciences Conference Abstracts (Ovid)

An additional search of the medRxiv PrePrint server will be undertaken. All results retrieved from this resource will be treated with due caution as these are preliminary reports of work that have not been certified by peer review.

- MedRxiv (Internet) (https://www.medrxiv.org)

A pragmatic approach will be taken to the identification of health-related quality of life (HRQoL)/utility and cost/resource use studies to inform the economic model.

An example search strategy is presented in Appendix 1. Strategies may be adapted following consultation with clinical experts.

2.3 Study selection

Titles and abstracts will be sifted by one reviewer (the first 10% assessed by two reviewers independently) based on the intervention and population; depending on the volume of literature identified, studies in people with MSK pain/osteoarthritis will be excluded unless the abstract lists osteoarthritis hip/knee as subgroup. Full text papers will be retrieved and examined by one reviewer (first 10% assessed by two reviewers) to select those meeting the scope definition of an eligible technology. The EAG will limit studies to only those of the interventions listed in the final scope.

Any design of study from the following will be included, but prioritising by reduced risk of bias:

- Randomised controlled trials (RCTs)
- Prospective controlled studies
- Retrospective controlled studies
- Single arm studies

This means that all but extremely poor RCTs will be included, but evidence of a lower quality will only be included for data extraction if there are no RCTs, with the aim of including at least one study per intervention. In addition, a table of all studies regardless of study design by outcome will be produced for the Evidence Gap Analysis. Reasons for exclusion of studies at the stage of full paper screening will be presented in an appendix.

Documents provided by companies will be examined and relevant studies not identified by the EAG searches will be added to full text screening.

2.4 Data extraction strategy

Data will be extracted by one reviewer and checked by another reviewer, with the project lead responsible for resolving any disagreements between the two reviewers.

2.5 Quality assessment strategy

All RCTs will have a formal risk of bias assessment. Although there will be no formal quality assessment of non-RCTs, a discussion will be included in the EAG report on potential biases in key studies (published or unpublished) and how the risk of bias could affect key outcomes. The report will explicitly detail the potential sources of bias such as the main confounding factors and comment on the generalisability of the results to clinical practice in the NHS.

2.6 Methods of synthesis and analysis

A narrative approach will be taken, and formal meta-analysis will only be employed where there are more than one study considered to be similar enough in design, population and outcome measurement.

3. Economic analysis methods

The primary purpose of this analysis is to assess whether it is plausible that using digital technologies for managing mild to moderate hip or knee osteoarthritis is a cost-effective intervention when used alongside standard care for people aged 16 years and over who have been assessed as suitable for digital management. The secondary aim of the analysis is to identify the value of future evidence generation, understand the likely key drivers of the results, and highlight the current evidence gaps. For this purpose, we will develop a simple cost-utility model with a 1-year time horizon. Clinical expert opinion will be sought to assess the face validity of model structure, model inputs and assumptions. The number of economic evaluations with a similar scope is likely to be extremely limited – hence a de novo model will likely be developed.

3.1 Model development

A de novo early cost-utility model will be developed to estimate resource use, costs and quality-adjusted life years (QALYs) across the different treatment arms. The 1-year time horizon is used because the long-term benefit of treatment is likely very uncertain, a longer time horizon may be explored to illustrate the uncertainty with

different scenarios. The interventions are assumed to only impact HRQOL and not survival. Cost-effectiveness is evaluated using a cost-effectiveness threshold of £20,000 per QALY in line with NICE's reference case. The modelling approach takes the perspective of the NHS and personal social services.

Evidence identified through our searches will be used to populate model inputs regarding effectiveness, resource use and HRQoL. Information from companies will be used for estimating the cost of the digital technologies, if possible. Standard sources will be used for estimating cost inputs, including but not limited to BNF, PSSRU, NHS cost collection, information from companies. Where evidence directly related to the decision problem is unavailable, indirect evidence may be used, assumptions will be made (which will as much as possible be supported with clinical expert opinion) and uncertainty clearly highlighted.

Planned sensitivity analyses include deterministic one-way sensitivity analyses on key model inputs, as well as scenario analyses, for example exploring a wider societal perspective, which will include the days of work saved. Probabilistic analysis will be performed with 1,000 iterations.

3.2 Conceptual modelling

A decision analytic model will be developed in MS excel or R. Patients are either allocated to the interventions (standalone digital technology or add-on digital technology to standard care) or the comparator (standard care) and transit through the decision analytic model. The intervention arm will include a node for patient uptake and patient adherence or engagement with the digital technology. Resource use, costs and QALYs will be estimated for each treatment arm. Relevant scenarios may be explored depending on the evidence available.

3.3 Cost of reversing a decision

The costs of reversing the decision will be explored and incorporated in scenario analysis, if data are available.

4. Evidence gap analysis

A table will be produced, which indicates the nature of the gap using the following colour code:

- RED indicates no comparative evidence for the scoped population
- AMBER indicates weak comparative evidence for the scoped population
- GREEN indicates robust comparative evidence for the scoped population

Evidence needed for robust economic modelling will be identified.

5. Handling information from the companies and other stakeholders

All data submitted by the companies in information and evidence requests to NICE, or data submitted by other stakeholders will be considered by the EAG if received by 31st March 2025. Information arriving after this date will not be considered. If the data included in the information provided meets the inclusion criteria for the review, they will be extracted and quality assessed following the procedures outlined in this protocol. The EAG may seek clarification or additional information from companies and other stakeholders where necessary. All correspondence between the EAG and companies will happen through NICE.

6. Competing interests of authors

None.

7. References

See the NICE style guide:
https://www.nice.org.uk/corporate/ecd1/chapter/referencing-and-citations.

Appendix A: Draft search strategy

Draft Embase search strategy

Embase (Ovid): 1974 to 2025 March 05
Date searched: 6.3.25
Records found: 1968

1 exp *osteoarthritis/ 97169
2 ((degenerative or noninflammatory) adj2 arthritis).ti,ab. 2075
3 (osteoarthr$ or osteo-arthr$).ti,ab. 144210
4 arthrosis.ti,ab. 6853
5 (coxartherosis or coxartheroses or coxarthrosis or coxarthroses).ti,ab. 1694
6 malum coxae senilis.ti,ab. 4
7 (gonarthrosis or gonarthroses).ti,ab. 1699
8 osteoarthropathy.ti,ab. 2411
9 or/1-8 171711
10 exp *mobile application/ 15663
11 *internet/ 39088
12 exp *mobile phone/ 19710
13 *text messaging/ 3677
14 *personal digital assistant/ 671
15 *computer assisted therapy/ 2779
16 *healthcare software/ 203
17 exp *self-care software/3173
18 exp *activity tracker/ 1425
19 *wearable computer/ 1914
20 exp *telemedicine/ 41378
21 assistive technology/ or wearable technology/ 3235
22 *remote sensing/ 6997
23 *personal monitor/ 226
24 (online or web or internet or digital$ or app or apps).ti. 197719
25 ((online or web or internet or digital$ or app or apps) adj3 (based or application$ or intervention$ or program$ or therap$ or technolog$)).ab. 144125
26 ((computer or tech or technolog$ or wearable or cyber) adj3 (based or application$ or intervention$ or consult$ or therap$ or program$)).ti,ab. 138292
27 (phone$ or telephone$ or smartphone$ or cellphone$ or smartwatch$ or text messag$ or SMS or Iphone or Android).ti. 40492
28 ((phone$ or telephone$ or smartphone$ or cellphone$ or smartwatch$ or text messag$ or SMS or Iphone or Android) adj3 (based or application$ or intervention$ or program$ or therap$)).ab. 30127
29 (mobile health or mhealth or m-health or ehealth or e-health).ti.10699
30 ((mobile health or mhealth or m-health or ehealth or e-health) adj3 (based or application$ or intervention$ or program$ or therap$)).ab. 7668
31 (digital tech$ or digital health$).ti,ab. 16884
32 (telemedicine or tele-medicine or telehealth or tele-health or telemanagement or tele-management or telenursing or tele-nursing or telecare or tele-care or tele-consult$ or teleconsult$ or tele-rehab$ or telerehab$ or tele-physi$ or telephysi$ or teletherap$ or tele-therap$ or tele-psyc$ or telepsyc$ or tele-exercis$ or teleexercis$).ti,ab. 54320
33 ((remote$ or online or digital$ or virtual or mobile or cyber or distance) adj3 (consult$ or deliver$ or program$ or schedul$ or advisor$ or group$ or participat$ or tracker$ or application$ or intervention$ or device$ or technolog$ or care)).ti,ab. 130897
34 ((selfmanag$ or self-manag$ or wearable) adj3 (digital$ or computer$ or software or tech or technolog$)).ti,ab. 5262
35 "Re.Flex".ti,ab. 93426
36 or/10-35 719098
37 9 and 36 2654
38 ("ESCAPE-pain" or "Orthopaedic Research UK" or Salaso).ti,ab. 50
39 getUBetter.ti,ab. 3

40 "Good Boost".ti,ab. 4
41 "Hinge Health".ti,ab. 6
42 "Joint Academy".ti,ab. 38
43 "Phio Engage".ti,ab. 0
44 Physio Wizard.ti,ab. 0
45 "Re Flex".ti,ab. 13
46 (TrackActiveMe or "TrackActive Me" or "Active Health Tech").ti,ab. 0
47 "Pathway Through Arthritis".ti,ab. 0
48 (Thrive adj3 "Sword Health").ti,ab. 0
49 or/38-48 113
50 37 or 49 2734
51 animal/ 1691217
52 animal experiment/ 3283575
53 (rat or rats or mouse or mice or murine or rodent or rodents or hamster or hamsters or pig or pigs or porcine or rabbit or rabbits or animal or animals or dogs or dog or cats or cow or bovine or sheep or ovine or monkey or monkeys).ti,ab,ot,hw. 8077856
54 or/51-53 8077856
55 exp human/ 27629599
56 human experiment/ 684344
57 or/55-56 27632684
58 54 not (54 and 57) 5986161
59 50 not 58 2632
60 limit 59 to english language 2426
61 limit 60 to yr="2013 -Current" 1968