Outcome and Prognosis of Supported Self-management in Thumb Base Osteoarthritis: A Prospective Cohort Study

1 GENERAL INFORMATION

PROTOCOL VERSION 4.0 20.05.24

This protocol has regard for the HRA guidance and order of content.

RESEARCH REFERENCE NUMBERS

REC Number: 23/YH/0113

IRAS Ref: 324356

Registration Number: clinical trials.gov Identifier: NCY05932628

Sponsor Number: UHDB/2021/042

FUNDED BY
NIHR | National Institute for Health and Care Research

+

2 SIGNATURE PAGE

The undersigned confirm that the following protocol has been agreed and accepted and that the Chief Investigator agrees to conduct the study in compliance with the approved protocol and will adhere to the principles outlined in the Declaration of Helsinki, the Host Organisation' QMS, and other regulatory requirement.

I agree to ensure that the confidential information contained in this document will not be used for any other purpose other than the evaluation or conduct of the investigation without the prior written consent of the Sponsor.

I also confirm that I will make the findings of the study publicly available through publication or other dissemination tools without any unnecessary delay and that an honest accurate and transparent account of the study will be given; and that any discrepancies from the study as planned in this protocol will be explained.

Chief Investigator:

Signature:

Victoria Jansen Digitally signed by Victoria Jansen
Date: 2024.06.03 09:31:06 +01'00'

.....

Date: 20/05/24.....

Name (please print): Victoria Jansen .....

Confidentiality Statement

This document contains confidential information that must not be disclosed to anyone other than the Sponsor, the Investigator Team, host NHS Trust, regulatory authorities, and members of the Research Ethics Committee.

FUNDED BY
NIHR | National Institute for Health and Care Research

3 ROLES & RESPONSIBILITIES

Sponsor

The Sponsor, University Hospitals of Derby & Burton NHS Foundation Trust, take on overall responsibility for appropriate arrangements being in place to set-up, run and report the research project. The sponsor is not providing funds for this study but has taken on responsibility for ensuring finances are in place to support the research.

Host Organisation

The Host Organisation, Keele University, are providing supervisory support and access to their Health and Social Care Research Quality Management System (HSCR QMS). Keele Clinical Trials Unit, Keele University are providing support and advice for the set-up, delivery and reporting of the research.

Funder

The study is funded by National Institute for Health Research, Health Education England Integrated Clinical Academic Clinical Doctoral Fellowship Scheme (HEE/NIHR ICA Programme) reference NIHR302181.

4 CONTENTS

FUNDED BY
NIHR | National Institute for Health and Care Research

5 LIST OF ABBREVIATIONS

AE	Adverse Event
CI	Chief Investigator
CRF	Case Report Form
CRN	Clinical Research Network
CTU	Clinical Trials Network
DCF	Data Collection Form
GCP	Good Clinical Practice
ICF	Informed Consent Form
HRA	Health Research Authority
HSCR	Health and Social Care Research
NHS	National Health Service
MDC	Minimum Data Collection
OA	Osteoarthritis
PAG	Patient Advisory Group
PI	Principal Investigator
PIS	Participant Information Sheet
PPIE	Patient Public Involvement Engagement
QA	Quality Assurance
QMS	Quality Management System
REC	Research Ethics Committee
REDCap	Research Electronic Data Capture
SAE	Serious Adverse Event
SMF*	Study Master File
SMG*	Study Management Group
SOP	Standard Operating Procedure
UHDB	University Hospitals of Derby & Burton NHS Foundation Trust

FUNDED BY
NIHR | National Institute for Health and Care Research

6 KEY STUDY CONTACTS

Chief Investigator	Mrs Victoria Jansen, Physiotherapist & HEE/NIHR ICA Fellow, Pulvertaft Hand Centre, Kings Treatment Centre, Royal Derby Hospital, Uttoxeter Road, Derby DE22 3NE. Email: Victoria.jansen@nhs.net, Tel: 01332 786985
Site Principal Investigators (PI)	Rachael Bamford, Advanced Hand Practitioner, Nottingham City Care MOSAIC team, Mary Potter Centre, 76 Gregory Boulevard, Nottingham, NG7 5HY. Email:rachaelbamford@nhs.net, Tel:(0115) 8838300. Cheryl Flint, Extended Scope Hand Therapist, Clinic 10 Kings Mill Hospital, King's Mill Hospital, Mansfield Road, Sutton-In-Ashfield NG17 4JL Email: cheryl.flint@nhs.net, Tel: 01623 622515 ext 4271 Jill Firth, Consultant Nurse Rheumatology / Director for Service Improvement, Pennine MSK Partnership Ltd, Integrated Care Centre, New Radcliffe Street, Oldham OL1 1NL. Email: Jill.Firth@nhs.net, Tel: 0161 352 5270 Chloe Kirk, Hand Therapist, Pulvertaft Hand Centre, Kings Treatment Centre, Royal Derby Hospital, Uttoxeter Road, Derby DE22 3NE. Email: Chloe.kirk1@nhs.net, Tel: 01332 786985
Sponsor	University Hospitals of Derby & Burton NHS Foundation Trust, Royal Derby Hospital, Uttoxeter Road, Derby DE22 3NE. Email: uhdb.sponsor@nhs.net, Tel: 01332 786509
Funder(s)	Mal Palin, ICA CDRF Senior Programme Manager, National Institute of Health, and Care Research, NIHR Academy, 21 Queen Street Leeds LS1 2TW, Email: academy-awards@nihr.ac.uk, Tel: 0113 532 8401
Study Management	Mrs Victoria Jansen, Physiotherapist & HEE/NIHR ICA Fellow, Pulvertaft Hand Centre, Kings Treatment Centre, Royal Derby Hospital, Uttoxeter Road, Derby DE22 3NE. Email: Victoria.jansen@nhs.net, Tel: 01332 786985
Key Protocol Contributors	Keele Clinical Trials Unit (CTU), David Weatherall Building, Keele University, Staffordshire, ST5 5BG. Tel: 01782 732950; Fax: 01782 733911 Ctu.operations@keele.ac.uk Professor Danielle Van Der Windt, Professor of Primary Care Epidemiology, Keele University, Keele, ST5 5BG, Email: d.van.der.windt@keele.ac.uk Tel: 01782 734830 Dr Michelle Marshall, Senior Research Fellow, Keele University, Keele, ST5 5BG Email:m.marshall@keele.ac.uk, Tel: 01782 734872 Dr Elaine Nicholls, Research Fellow in Biostatistics, Keele University, Keele, ST5 5BG Email: e.nicholls@keele.ac.uk, Tel: 01782 734750

FUNDED BY
NIHR | National Institute for Health and Care Research

	Dr Charlotte Woodcock, Lecturer in Applied Health Research, Keele University, Keele, ST5 5BG Email: c.woodcock@keele.ac.uk, Tel: 01782 734878
Data Custodian	Victoria Jansen, (details as above)
Committees	Study management Group (SMG): Victoria Jansen Professor Danielle Van Der Windt Dr Michelle Marshall Dr Elaine Nicholls Dr Charlotte Woodcock Keele CTU representative (Full contact details including phone, email are supplied above). Mr Clamp: PPIE representative, PPIE member of the Keele University Research User Group, School of Medicine, David Weatherall Building, Keele University, ST5 5BG Email: mail@ken.clamp.co.uk Study Administrator, Keele Clinical Trials Unit (CTU), Keele University, Staffordshire, ST5 5BG. Email: Ctu.operations@keele.ac.uk, Tel:01782 732950

FUNDED BY
NIHR | National Institute for Health and Care Research

7 STUDY SUMMARY

Thumb base osteoarthritis occurs in 21-45% of the adult population over 40 and can cause severe pain and difficulty with essential everyday hand use. Guidelines recommend that those seeking care should receive education and exercises (supported self-management), and, if needed, splints. However, these guidelines are based on research reporting outcomes at three months or less, often excluding those with other hand conditions and co-morbidities. In these studies, self-management was found to provide pain relief for about half of study participants, with the remaining individuals not benefiting significantly in terms of pain at three months. Furthermore, there is no research on the patient's experience of care.

The aim of this study is to investigate, using a mixed methods approach the outcomes, prognosis, and experiences of care in patients receiving usual National Health Service (NHS) care which consists of a supported self-management programme, and to generate recommendations for optimising care for thumb base Osteoarthritis (OA). The design will be a prospective longitudinal cohort study linked with a qualitative interview (and focus group) study. Four NHS sites will recruit 150 people with symptomatic thumb base OA. The primary outcome is the AUSCAN hand pain scale, additionally baseline assessments will be carried out for measures of hand function, quality of life and known musculoskeletal prognostic factors. The study endpoint is six months. Outcome assessments will be conducted by postal/online questionnaire (as applicable) at three and six months. The qualitative and quantitative results from this study will be integrated and presented to a stakeholder group meeting, where participants will be guided to generate recommendations for future care.

FUNDED BY
NIHR | National Institute for Health and Care Research

Plain English Summary

Background

Thumb base osteoarthritis (OA) is common in adults 40 years and over. It affects a person's ability to work, be independent and care for others. Sufferers complain of severe pain and difficulty in completing everyday tasks. The main treatment for the condition is advice on how a person can manage their condition (self-management), reduce their pain, strengthen their hands with exercises and practical tips on tackling painful tasks, sometimes providing a hand splint for support. The treatment is provided by occupational and physiotherapists. We know that this treatment helps suffers in the short term (up to three months). But the research was done in people with few other health problems and while self-management support helps provide pain relief for most people, there are some people who don't benefit. The aim of this research is to see how pain and other hand problems change over a period of six months after the start of treatment, to understand people's experience of care, and examine why some people improve, and some do not.

Research Plan

In patients receiving treatment for thumb base OA at four NHS sites, who are willing to take part, this research will: -

1. Record changes in symptoms and quality of life at three and six months from when treatment began in a postal questionnaire/survey.
2. Discuss the experience of care and people's beliefs about what makes treatment a success by interviewing a small group of patients.
3. Analyse patient characteristics, to see if it is possible to determine how they will respond to treatment.
4. Develop recommendations for improving care.

Burden

The questionnaires required will take up to 30 minutes to complete (at three time points). The treatment given is usual NHS care for thumb base OA and will not present any additional risks.

Benefits

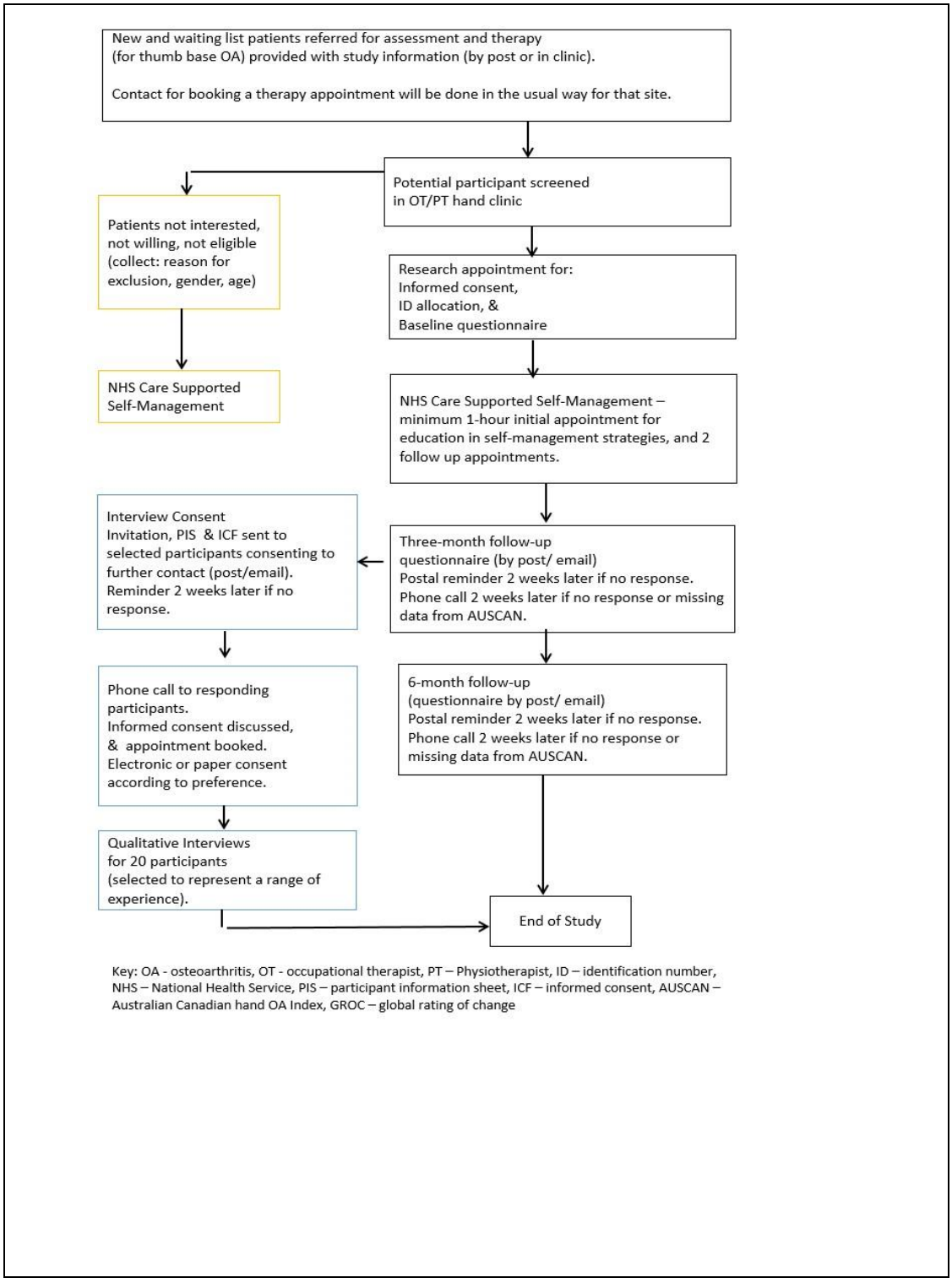
The study will help researchers investigate ways of improving the care of people with thumb base OA in the future.

FUNDED BY
NIHR | National Institute for Health and Care Research

Study Title	Outcome and Prognosis of Supported Self-management in Thumb Base Osteoarthritis: A Prospective Cohort Study.
Short Title	TOPS Study
Study Design	Observational Cohort Study with interviews and focus groups.
Trial Intervention (where applicable)	N/A
Study Participants	Adults with thumb base osteoarthritis
Planned Sample Size	150
Follow-up Duration	6 months
Planned Study Period	May 2023 – July 2025
Objectives:	**Outcome Measures for Each Objective:**
Determine the 6-month outcomes in a cohort of patients receiving supported self-management.	AUSCAN – pain & function EQ-5D–5L – quality of life OMERACT/OARSI Responder Criteria (AUSCAN & Global rating of change) PROMIS SFv2 4a – participation in social roles & activities PSEQ pain self-efficacy
To evaluate patient experiences with care and determine what factors patients and clinicians perceive contribute to outcome.	OA-QI – quality of care Qualitative data from interviews and focus groups
To investigate the association of prognostic factors with pain and function outcomes.	AUSCAN and OMERACT/OARSI responder criteria
Abbreviations: AUSCAN – Australian Canadian Hand Index, EQ-5D-5L - Quality of Life EuroQol 5 Dimensions 5-levels, OMERACT-OARSI Outcome Measures in Rheumatology Committee and Osteoarthritis Research Society International, *PROMIS – Patient-reported outcome measurement information system, PSEQ – patient self-efficacy questionnaire, OA-QI - Osteoarthritis Quality Indicator.*	

FUNDED BY
NIHR | National Institute for Health and Care Research

8 STUDY FLOW CHART



Key: OA - osteoarthritis, OT - occupational therapist, PT – Physiotherapist, ID – identification number, NHS – National Health Service, PIS – participant information sheet, ICF – informed consent, AUSCAN – Australian Canadian hand OA Index, GROC – global rating of change

FUNDED BY
NIHR | National Institute for Health and Care Research

9 BACKGROUND AND RATIONALE

Thumb base osteoarthritis

Osteoarthritis (OA) is the most common cause of chronic joint pain and disability in older adults, and in the UK one third of those over 45 years seek treatment for the condition[1]. Prevalence, incidence, and years lived with the disease is rising globally[2]. Individuals with OA have poorer physical and mental health. There are also socio-economic impacts, health resource use and work impairment impacts[3-5]. As such OA poses a major public health challenge. Better ways are needed for reducing demand on healthcare and managing the more complex treatment needs of an aging population with multiple co-morbid conditions.

Hand OA is more common, and yet, less researched than OA at other joint sites such as the knee and hip[6]. Patients report that the impact of OA in the hand is underestimated by health professionals[7]. The hand is composed of multiple joints and as such hand OA is a complex model to study. The focus of this research is thumb base OA, which involves the trapeziometacarpal and scapho-trapezial joints. There is a high prevalence of radiographic thumb base OA (21% in 40-year-olds, increasing to 45% in those over 80 years)[8, 9]. Thumb base OA sufferers typically experience tenderness, pain and difficulty with essential pinching tasks (writing, dressing, opening packets) during which the greatest load is taken through the basal thumb joint[10]. Patients consulted for this proposal point out that its effects therefore carry over into work, hobbies, sports, and caring roles. Thumb base OA is considered to be a more biomechanically driven phenotype of hand OA[11] (than nodal or erosive hand OA), and thus progression of disease is suspected to differ.

Treatment for thumb base OA

NICE Guidelines[12] recommend a stepped-care approach to treatment, with the following steps: (1) all patients should be offered education about the condition and self-management principles[13] or supported self-management provided by a therapist; (2) if required, intra-articular steroid injections (3) if required, surgical consideration. However only 21-45% of patients seeking treatment in primary and secondary care receive supported self-management from a therapist and the treatments provided vary[14, 15]. Supported self-management should comprise of education, task modification advice and exercise, it should be comprehensive and tailored to each patient. Opportunities to review the information, progress exercises and problem-solve with a therapist should be provided, the provision of leaflets alone is ineffective[16]. Hand splints are recommended by guidelines and routinely used[13, 17], however, recent evidence showed that splinting offered no additional improvement in pain

FUNDED BY NIHR | National Institute for Health and Care Research

or function when combined with a comprehensive supported self-management programme[18]. A systematic review of randomised controlled trials (RCTs) of physical therapies (exercise and mobilisation techniques, splints and heat) for thumb base OA[19] estimates that the therapies provide clinically worthwhile improvements in pain intensity of 3.1 [95% CI 2.5 to 3.8] on a 0–10 scale (4 weeks post intervention). Longer-term outcomes of treatments have not been investigated. Two large randomised controlled trials with broad inclusion criteria have found that while supported self-management is effective for pain relief on average at three months [18, 20], there are still significant proportions of patients who are classified as non-responders according to Osteoarthritis Research Society International (OARSI) responder criteria[21]. This suggests that response to treatment varies widely, and the variation may be due to the strong biomedical and biomechanical focus of current treatments.

Randomised clinical trials typically exclude participants with other hand disorders, but 15-35% of people presenting with thumb base OA or hand OA have another distinct hand condition[22, 23]. Other studies exclude patients with anxiety and depression, which has been reported to be present in 20% of OA patients[24]. Current guidelines are based on this evidence and therefore do not reflect a substantial proportion of patients treated in the NHS.

The experience of care

Limited qualitative research exists for hand and thumb base OA. One study exploring the perceptions of patients with hand OA in England[7] concluded a perceived lack of help and advice regarding treatment. The authors suggested this was due to the clinical uncertainty of treatment, with a lack of high-quality trials and limited written information available. This study was conducted in 2010, and it would be important to know if more recent research evidence and guidelines reveal a change in perceptions. The study also emphasised the need to understand patient illness and treatment beliefs to facilitate the use of evidence-based approaches to care. A more recent study explored the experiences of having thumb base OA in New Zealanders[25] and results suggested that education and information on the disease was not readily available. Constant pain was of greatest concern, and resultant poor hand function led to reduced physical activity with significant mental and emotional impacts. A Dutch study explored patients' perceptions of prescribed splints, concluding that beliefs around the mechanism of effect influenced splint use[26]. There is no research assessing the patient's experience of care, whether patient needs are addressed, or assessing the quality of care received.

The course and outcome of thumb base OA

OA is a common multifactorial disease that affects the whole joint and has a heterogenous outcome[27]. Currently, treatments provide symptom relief and there are no disease-modifying drugs or cure[4]. In

FUNDED BY
NIHR | National Institute for Health and Care Research

thumb base OA radiographic disease progression, visible deformity and significant loss of strength, movement, and hand function are observed compared to healthy controls[28, 29]. However, weak associations have been reported to exist between the severity of radiographic hand OA and patient-reported measures of pain and function over time[30] indicating that other factors may explain variations in pain and function[31]. A systematic review conducted for this proposal (Jansen et al, in preparation) has identified potential prognostic factors for symptomatic progression in hand OA. The factors can be divided into clinical signs, general health, psychological factors, and perceived symptom severity. Each factor is supported by limited evidence but can be assessed in the clinical cohort study proposed.

Patients involved in developing this proposal suggested that outcomes of treatment are influenced by patient psychology and confidence in the treating clinician. Research driven psychologically enhanced packages of care have been successful for knee OA[32]. An understanding of prognostic factors in relation to outcome has led to the effective use of enhanced treatments for those at risk of persistent low back pain[33]. This stratified approach is endorsed by expert working groups as ideal for OA, where the disease course varies[34]. It is important in conditions with a high prevalence (such as thumb base OA) to ensure enhanced treatment is targeted quickly at those who need it, while those with a good prognosis are not subject to unnecessary investigations and interventions[35].

In summary three issues exist with the supported self-management provided for thumb base OA in the NHS:

1. While providing pain relief, supported self-management and splint use is based predominantly on trials with follow up of less than three months[19], which exclude those with other health and hand conditions.
2. Treatments for thumb base OA are reported to have variable outcomes, with a significant proportion of non-responders (50-67%)[18].
3. Patient experiences of supported self-management in a stepped care approach have not been assessed.

This research proposes to determine the six-month outcome of current care, in a sample that represents the population treated in the NHS. It will evaluate the quality and patient experience of care, identify factors that are associated with outcomes and make recommendations to improve care of patients. If the findings of the proposed research are that the response to treatment in thumb base OA is influenced by modifiable prognostic factors, then this can lead to the development, evaluation and implementation of new enhanced interventions or more optimal pathways of care. The qualitative research within this proposal also sits well with a person-based approach to behaviour

FUNDED BY
NIHR | National Institute for Health and Care Research

change which suggests a first step in intervention development for behaviour change is to identify the key issues, needs and challenges that the intervention must address[36].

FUNDED BY
NIHR | National Institute for Health and Care Research

10 AIMS AND OBJECTIVES

Aim

To investigate, using a mixed methods approach, the outcomes, prognosis, & experiences of care in patients receiving a supported self-management programme.

Objectives

1. To determine the 6-month outcomes (change in pain, hand function, participation in social roles and activities, and quality of life) in a cohort of patients with thumb base OA receiving supported self-management in specialist NHS services. And to estimate the proportion of those who respond after treatment.
2. To evaluate patient experiences with care and determine what factors patients and clinicians perceive contribute to outcome (candidate prognostic factors).
3. To investigate the association of prognostic factors with pain and function outcomes.
4. To integrate qualitative and quantitative findings to generate recommendations for optimising current care.

FUNDED BY
NIHR | National Institute for Health and Care Research

11 STUDY DESIGN

This study is a mixed methods convergent parallel design, and is divided into three parts:

1. Prospective cohort study in people with symptomatic thumb base OA receiving a supported self-management programme to provide 3- and 6-month outcome data; and record any subsequent stepped care provided according to existing guidelines.

2. Qualitative Research: semi-structured interviews will describe the experience of care and explore patient perception of factors related to outcome, and a focus group will explore treating therapist perceptions of factors related to outcome.

3. Stakeholder and PPIE meeting to discuss and disseminate the results with patients and clinicians and to generate recommendations for improving care for patients.

Supported self-management for thumb base OA (Optimal NHS Care)

All participants will receive an occupational or physiotherapist led supported self-management programme, delivered in a community or secondary care setting. This programme was developed to provide optimal NHS care[49] and was found to be effective at reducing pain and improving hand function in thumb base OA over three months[18]. This programme equates to normal NHS care, having been adopted by the sites involved. The educational materials used, and a minimum number of appointments will be consistent across the study sites. The programme is described below adhering to guidance in the TIDieR checklist[50].

The goal of this programme is to teach the person with thumb base OA about the condition, how they can reduce pain, improve motion and strength, and to adapt tasks to use the hand in more healthy postures. This programme involves an hour-long initial appointment during which education is provided about: thumb base OA; diet; pain management; holistic medicine; and the principles of ergonomic task modification. Exercises are taught to improve the control, motion, and strength of the thumb. Patients are advised to continue the exercises three times a week. The exercise regime is graded, with progression through three stages incorporated into the programme. Progression to the next stage occurs when the exercises can be performed correctly in a pain free manner.

The delivery of the education incorporates behavioural approaches to encourage the use of ergonomic task modification techniques and exercises (such as discussion of the barriers and facilitators to self-management, and goals setting and signing of contracts). Adherence is supported with the use of an exercise and reflection diary (this diary will not be used for data collection).

FUNDED BY
NIHR | National Institute for Health and Care Research

To provide support there is a follow-up phone call appointment at an agreed time (approximately two weeks later) to encourage adherence to the self-management programme, and to provide further advice with any issues relating to the exercises and functional difficulties. Then there is a 30-minute appointment between four and six weeks after the initial appointment to review and progress exercises, to practice ergonomic task modification and discuss issues. This appointment (and any others deemed necessary) will be conducted face to face or remotely according to patient and clinician requirements.

According to findings of the OTTER trial[18] and in line with guidance from NICE[12], splints to support the thumb base will not be provided routinely, but as required as part of a shared decision-making approach[13] for example if a participant does not improve with the supported the self-management programme alone[12]. The splints used will be chosen and fitted at the discretion of the treating therapist, providing informed choice for the patient on the options available. This splint prescription process will be according to normal clinical practice, to meet the needs of that participant. The evidence suggests there is no difference in efficacy between different splints, and that splints can have a longer-term benefit on pain[51]. Patients will be advised on their use according to the usual clinical practice. This is a pragmatic choice as the cohort needs to reflect optimal best practice which means: the splint will need to be the best fit; the most appropriate to use with aggravating functional tasks; provide the right level of comfort, positioning, and support according to symptom severity and the condition of the local joints and soft tissues.

There are no validated measures of adherence to therapy programmes, and Patient Public Involvement Engagement (PPIE) work for this study and the research teams experience from other studies, did not support the use of diaries for assessing adherence. So, participants and therapists will self-report on perceived adherence to the programme using a published assessment[52], this assessment allows participants the options to report not adhering and partially or completely adhering to different elements of the programme, and was seen by PPIE representatives as being most likely to elicit a true response.

Care for other co-existing hand conditions

There will be no alterations to usual care for co-existing hand conditions (such as OA wrist or hand, carpal tunnel syndrome, trigger digits or De Quervain's disease). Data will be collected on the provision of splints, the number of appointments attended and the presence of co-existing hand conditions. A self-report questionnaire will capture whether a patient has purchased their own splint, or sought other treatments, or had a steroid injection for their thumb base OA or a co-existing condition or been placed on a surgical waiting list or had surgery.

FUNDED BY
NIHR | National Institute for Health and Care Research

Study Training

All collaborating therapists will be trained in standard protocols for the study. This training will include screening and study procedures; the consent process; study monitoring and data collection forms; the measures to encourage adherence; and communication with the chief investigator and the trial co-ordinator. The training will be conducted by the chief investigator. The principal investigator at each site will be responsible for ensuring the local therapists delivering care have the clinical skills required to assess and treat the participants. Additionally, as the baseline questionnaire asks about mood the principal investigator will be responsible for having a procedure in place, as per normal clinical practice, to provide appropriate sign posting or support to a participant who reports they are struggling with their mental health.

12 STUDY SETTING

Participants will be recruited from new and waiting list referrals to occupational therapy or physiotherapy departments in rheumatology, hand surgery or hand specialist community services at four NHS recruitment sites.

Eligibility criteria

This study will recruit participants with a clinical diagnosis (signs and symptoms) of thumb base OA. Radiographs are not required to diagnose and provide therapy treatment for thumb base OA, clinical assessment alone will be used[12]. Ensuring there is at least one positive clinical sign of thumb base OA, will enable the assessing clinicians to confirm the diagnosis on the referral, and exclude other sources of radial sided wrist pain[37, 38]. This diagnosis, or confirmation of diagnosis, is part of normal clinical assessment that occurs prior to providing treatment for this condition.

Inclusion criteria

- Aged 30 years and over.
- Symptomatic thumb base OA, confirmed with at least one of the following clinical signs:
    - Hard tissue enlargement of the thumb carpometacarpal joint
    - Squaring at the base of the thumb
    - Crepitus on movement of the thumb carpometacarpal joint
    - Positive adduction provocation test
    - Positive extension provocation test
    - Positive pressure shear test
    - Pain on palpation of the dorso-radial aspect of the thumb carpometacarpal joint

FUNDED BY
NIHR | National Institute for Health and Care Research

- Able to give written informed consent.
- Available to attend Occupational Therapy/Physiotherapy/Hand Therapy sessions.

Where there is bilateral thumb OA, the most symptomatic thumb (according to the participant, considering the preceding month) will be chosen for data collection.

Exclusion criteria

- Currently receiving therapy care for thumb base OA.
- Fractures or significant injury or surgery to the wrist or hand on the included side in the previous 6 months.
- Previous surgery to the basal thumb joint on the included side.
- Red flags i.e., diagnosed rheumatic condition (gout, rheumatoid arthritis), progressive neurological signs, any acutely swollen hand joint, serious illness, or disease.
- Participants of any drug or medical device trial in the last 12 weeks.
- Recent steroid injection in their included basal thumb joint (2 months prior to baseline appointment).

13 OUTCOME MEASURES

Primary outcome

Australian Canadian Osteoarthritis Hand Index (AUSCAN) for hand pain subscale 6 months after treatment.

Secondary outcomes

Outcome Measures in Rheumatology Committee and Osteoarthritis Research Society International (OMERACT-OARSI) agreed responder criteria for clinical studies[21] at 3, and 6 months that combines:

- Global rating of change question (GROC)
- AUSCAN hand function subscale[39]
- AUSCAN hand pain subscale[39]

AUSCAN hand pain subscale 3 months after treatment and hand function subscale 3 and 6 months after treatment.

Numerical rating scale for thumb pain and Likert scale for thumb pain frequency at 3 and 6 months after treatment[40, 41]

EuroQol 5 Dimensions 5-levels[42] (EQ-5D-5L) questionnaire for quality of life 3 and 6 months

FUNDED BY NIHR | National Institute for Health and Care Research

Patient reported outcome information system (PROMIS SF v2 4a) for participation in social roles & activities at 3 and 6 months [43]

Pain self-efficacy questionnaire (PSEQ) at 3 and 6 months[44-46]

Osteoarthritis Quality Indicator Questionnaire[47] (OA-QI) for quality of care at 3 and 6 months.

Treatment provided beyond the supported self-management programme at 3 and 6 months.

Adherence to treatment: therapy adherence assessment 3 and 6 months [48]

FUNDED BY
NIHR | National Institute for Health and Care Research

14 STUDY PROCEDURES

Recruitment

All new patients referred for initial assessment and therapy for thumb base OA at the following NHS sites will be screened for recruitment: Pulvertaft Hand Centre, Royal Derby Hospital; Nottingham City Care, MOSAIC service; Pennine MSK Partnership, Integrated Care; Kings Mill Hospital, Mansfield. Thumb base OA is not an acute condition so there is often a variable waiting time from referral to treatment.

Patient identification

All patients clinically diagnosed with thumb base OA who are referred for initial assessment and therapy, or on a waiting list for initial therapy assessment, will be identified by delegated site staff. They will be given or posted out a study invitation letter and a participant information sheet (PIS). When they are booking their therapy appointment in the normal way for that site (e.g., with a therapist or administrator, in person, by phone or by returning a slip or email) they will be asked if they are willing to consider study participation. If willing to consider being part of the study, the person will be asked pre-screening questions to ensure that they are potentially eligible for the study (i.e., not currently receiving therapy for thumb base OA, not currently part of a research trial). Potentially eligible participants will be booked into a longer research study appointment slot, to allow time for screening, and potential consent and data collection. If a patient is not interested in taking part in the study or is ineligible due to the pre-screening questions, then they will be booked into a routine NHS care slot. If patients are handed the study information at a clinic appointment and they wish to be screened for the study on the same day; this will only happen if they have had adequate time to consider the study (time to read the information and then to ask questions) and to complete informed consent.

Eligibility screening

All patients willing to be considered for the study will have a research appointment to precede their therapy appointment. In this appointment the clinician providing care will take a routine medical history and a routine physical examination to confirm clinical signs of symptomatic thumb base OA. The participant will also be asked to confirm they are available to attend therapy sessions. Where participants are not eligible for the study, or decline to consent, their age, their sex assigned at birth, as well as any reasons for ineligibility (if known) will be collected on an anonymised screening log.

FUNDED BY
NIHR | National Institute for Health and Care Research

Consent

At the research appointment the treating clinician or a delegated individual will discuss the study in more detail, confirm participants have had sufficient time to consider the study information, and provide further opportunities to ask questions. Participants interested in taking part will then be asked to give consent to participate. All participants must consent to be part of the cohort study. Participants will be asked to consent to the data collected being looked at by researchers and clinical trials unit staff from Keele University.

Participants will be asked if they are happy for us to contact them about other aspects of the study, and this will be used to contact some participants about the interview study (and if further funding and ethical approval is secured, to extend the follow up by adding a further follow-up questionnaire beyond six months). It is possible to opt out of interviews but still participate in the cohort. All collaborators taking informed consent will have undertaken Good Clinical Practice (GCP) training. Consent will be taken in two ways according to participant preference, either through a REDCap (Research Electronic Data Capture) generated form sent by email to the participants personal email, and the participant completes the form online with tick boxes to confirm agreement. Or a paper form where the participant signs the form to confirm consent.

At the research appointment, data will be collected after informed consent has been given. A baseline self-reported participant questionnaire will be used to collect patient-rated outcome measures and demographic information of ethnicity, educational level, time since onset of thumb pain, working status, thumb pain and work, and income (table 1). Study specific physical assessments will also be undertaken. The data collected includes measures for pain, function, quality of life and participation, and quality of care which will be collected at all time points, and prognostic factors that will be just collected at baseline (table 1 & 2).

Study assessments

Assessments for the study will take place in person, face to face at baseline, and online (or if not possible by postal questionnaire or phone call) at three and six months (table 1). The options of paper based, and online questionnaires allow participants to choose a preferred method which was requested by PPIE members. Having both options was also important as there is evidence to show that online questionnaires can limit the response from certain groups, making the research less accessible[53]. Phone call data collection will be used if required e.g., there is a need for interpreting services or for minimum data collection (MDC - where a maximum of three attempts will be made). The primary outcome measure is the Australian Canadian Hand Index (AUSCAN), which is recommended as a core outcome for studies of hand OA[54]. It is a patient-rated, disease-specific, and hand-specific questionnaire comprising of five items measuring hand pain (0-20), one item

FUNDED BY NIHR | National Institute for Health and Care Research

measuring stiffness (0-4), and nine measuring hand function (0-36). The total score ranges from 0-60 with higher scores indicating more pain, stiffness, or functional limitation. The AUSCAN is both reliable (intra-class correlation co-efficient: 0.85-0.9) and responsive (standardised response mean >-0.7) in patients with hand OA[55]. The AUSCAN has evidence of construct validity as an instrument for use in thumb OA[56, 57], while the relevance of pain as the primary symptom of concern, and of the AUSCAN to thumb OA, has been supported by PPIE review for this study. In addition, we will use a numerical rating scale (NRS) specific to thumb pain severity over the last week [40], to support comparisons with other studies in this area. The temporal features of pain is an important measure in chronic pain conditions[41], and thumb pain frequency is not a concept captured by the AUSCAN, this will be assessed using a Likert scale[58]. Pain self-efficacy will be assessed to judge the impact of education on beliefs about pain, and whether supported self-management gives the confidence to continue the important social and practical activities and work around the pain. This will be measured using the PSEQ[46], a reliable and valid measure of self-efficacy in chronic pain conditions.

Generic health status and quality of life measures will allow evaluation of general health outcomes, and comparisons with other health conditions. These will be measured using the EuroQol 5 Dimensions 5 Levels (EQ-5D-5L) index questionnaire[42]. Social participation and difficulty in daily life will be measured using the PROMIS short form [59]. A global rating of change (GROC) question is included, enabling calculation of the OARSI-OMERACT responder criteria, which also relies on (absolute and relative) changes in AUSCAN score[21]. The Osteoarthritis Quality Indicator (OA-QI) questionnaire will be used to assess patient-perceived quality of care [60].

Candidate prognostic factors for response to conservative management will be collected at baseline only. These factors have been identified from a systematic review of the prognosis for pain and function in hand and thumb base OA[61]. Additionally, some factors have been identified from treatment cohorts looking at response to treatment in thumb base OA[62] [63] details of all the assessments are in table 2. The prognostic factors fall into the following categories clinical signs, general health, psychological factors, and perceived symptom severity.

Table 1 Assessments at each study time point

Assessments	**Baseline**	**3 months**	**6 months**	**Measurement method**
AUSCAN	x	x	x	Participant self-report
Pain NRS	x	x	x	Participant self-report
Pain Frequency	x	x	x	Participant self-report

FUNDED BY
NIHR | National Institute for Health and Care Research

EQ-5D-5L	x	x	x	Participant self-report
OA-QI	x	x	x	Participant self-report
PROMIS SFv2 4a Participation	x	x	x	Participant self-report
PSEQ	x	x	x	Participant self-report
B-IPQ	x			Participant self-report
Grip strength	x			Clinician assessment
Number of painful joints	x			Clinician assessment
Confirmation of thumb OA & presence of co-existing hand conditions	x			Clinician report
Availability of radiographs	x			Clinician report
Demographic: DOB, sex assigned at birth, ethnicity, language*, work status, income, educational level, postcode, hand dominance.	x			Participant self-report
Health: age at onset of thumb pain, duration of OA thumb, side affected, previous therapy treatment, co-morbidities, BMI*, use of NSAIDs	x			Participant self-report
START psych subscale	x			Participant self-report
GROC		x	x	Participant self-report
Therapy adherence questionnaire		x	x	Clinician and Participant self-report
Number of therapy appointments attended		x		Clinician report
Information regarding additional treatments provided as part of stepped care.		x	X	Clinician and Participant self-report
Key: NRS - numerical rating scale, EQ-5D-5L - EuroQol 5 Dimensions 5 Levels Questionnaire health status and quality of life, OA-QI - Osteoarthritis (care) Quality Indicator, PROMIS SFv2 - Patient-Reported Outcomes Measurement Information System Short Form for participation in social roles and activities, PSEQ – pain self-efficacy questionnaire, DOB – date of birth, BMI – body mass				

FUNDED BY
NIHR | National Institute for Health and Care Research

index, NSAIDS – non steroidal anti-inflammatory medication, GROC – global rating of change question, B-IPQ – Brief Illness perception questionnaire.

*BMI, participants first language and whether an interpreter is needed, are self-report collected in clinician DCF (not baseline questionnaire).

Table 2: Details of (Potential) Prognostic Factor Assessments

Concept	Measurement method	Detail
Perceived symptom severity		
Hand Pain	Australian Canadian Hand Index (AUSCAN) Participant self-report	Pain subscale – 5 items about the severity of pain at rest and with function in the last 48 hours.
Hand Function	AUSCAN Participant self-report	Function subscale – 9 items about the extent of difficulty with different tasks.
Psychological factors		
Mood and perception of condition	STarT back psychological subscale[62] Participant self-report	5 items asking about their perception of the condition and the pain.
Illness perceptions	Illness perceptions questionnaire (brief IPQ)[64, 65] Participant self-report	8 items on illness perception relating to consequences, timeline, personal control, treatment control, identity, concern (emotional), Illness comprehensibility and Emotions.
General Health		
Age & age at onset	Single item questions Participant self-report	Date of Birth and How long have you had your thumb pain? Less than a year, 1-2 years, 3-4 years, more than 4 years.
Co-morbidities including high BMI	Single-item questions Participant self-report	Have you been given a diagnosis by a health professional of any of the following? knee OA, heart or cardiovascular disease, diabetes (Y/N).

FUNDED BY NIHR | National Institute for Health and Care Research

		Self-reported height and weight.
Use of NSAIDs	Completed as part of OA-QI Participant self-report	Single question in OA-QI If you use anti-inflammatory medications have you been given warnings about the side effects? (Y/N/Not Applicable).
Clinical signs		
Number of painful joints in the hand (disease activity)	Hand diagram – participant and clinician identify and count the number of painful joints.	Mark the circles over the joints (with an x) to indicate which joints have been painful on most days of the past month. Please count how many joints are painful.
Hand grip strength	GripAble Dynamometer (kg)	The maximum value of the mean of three right and three left hand measurements.
Additional Factors to consider		
Co-existing hand conditions	Routine clinical assessment	From your clinical assessment does this participant have a symptomatic co-existing hand condition? If yes please indicate which condition(s): Carpal tunnel syndrome, De Quervain's syndrome, Trigger digits, OA wrist (excluding STTJOA considered part of thumb OA), (Y/N). Other, please specify.

FUNDED BY
NIHR | National Institute for Health and Care Research

Follow-up assessments

At three and six months, questionnaires will be sent to participants by email or post according to participant stated preference. These questionnaires will collect outcome data on hand pain and function, global rating of change, quality of life, quality of care and adherence to treatment.

If participants do not respond to the questionnaire, a further one will be sent after two weeks, if after a further 2 weeks there is still no response, contact will be made by phone by a member of the research team (where the participant has previously provided consent for telephone contact). In this call the participant will be asked if they are happy to complete minimum data collection (MDC), by telephone (or post/email if preferred). MDC comprises 15 questions: The AUSCAN pain and function score and a global rating of change.

If contact cannot be made (maximum three attempts over 2 weeks during working hours (9am to 5pm) on weekdays), an MDC form will be sent by post. There will be no further attempts to collect data at this time point. Participants can withdraw from the study (data previously collected will remain in the study database and be used for de-identified analysis) at any time point including when contact is made by telephone.

Those who participate in the study and return either a paper or online questionnaire at 6 months will be included in a prize draw for the opportunity to win one of eight £25 prizes (e.g. Love2Shop voucher).

Patient involvement has highlighted the importance of longer-term outcomes in this chronic condition. If further funding can be gained, the study team would seek permission to contact participants and determine longer-term outcomes (for change in pain, hand function, participation, pain self-efficacy and quality of life). In the consent forms there will be a section on consent to further contact which would be used for this purpose.

Qualitative Research – Linked Study

The aim of the interview study and focus group is to evaluate the participant experiences of care and identify what factors participants and therapists feel contribute to the outcome of a supported self-management package of care.

1.14.1 Participants

Cohort study participants with thumb base OA who consented to further contact are eligible for the interview study. Occupational and physiotherapists from all sites who have taken part in delivering care to participants for the study are eligible to take part in the focus groups.

FUNDED BY
NIHR | National Institute for Health and Care Research

2.14.1 Recruitment

Participants from the cohort study who consented to further contact will be purposively selected to take part in a 1:1 semi-structured interview. They will be chosen to represent a range of characteristics considered important from the engagement work e.g., sex, age, perceived severity of problem, response to treatment, a variety of experience of care (e.g., prescribed a hand splint, attended group education) language, and sociodemographic status. Participants will be interviewed 4-6 months after their baseline appointments, so that they have experienced care and will have a sense of their response to the treatment provided.

All therapists at each site who have been responsible for delivering the care will receive study information and consent forms by email about taking part in focus groups.

3.14.1 Informed consent

Participants who consented to further contact and were purposively sampled and selected for the interview study will be sent a letter of invitation, participant information about the interview study and a consent form. Similarly, all therapists who have been involved in providing treatment for participants will be sent, via the PI at that site, a letter of invitation, participant information about the focus group study and a consent form. Participants and therapists will have the option of responding by a reply slip/ email, asking them to inform the researcher if they are willing to participate. A reminder will be sent out if there is no response after two weeks. Those who are willing to participate will be contacted and scheduled an interview or focus group and informed consent will be completed by phone. As well as returning a consent form, (paper form or online REDCap version) both interviewees and focus group attendees, will also be asked to provide additional verbal recorded consent prior to the start of the interview or focus group. Focus group participants will also be asked to complete a short survey with seven questions, aiming to describe sociodemographic characteristics of the focus group participants, and support equality, diversity and inclusion impact assessment (see TOPS Data Collection Focus Group Form v.1).

4.14.1 Methods: Interview study

Semi structured interviews (1:1) will be used to explore and describe participants' experience of care, these will last approximately one hour. A topic guide for the interviews has been created based on the objectives of the study, a review of the literature and the Theoretical Domains Framework (TDF)[55]. TDF amalgamates theories and constructs related to behaviour change and implementation issues into 14 domains. The topic guide draws on these domains to explore perceptions relating to response to treatment, as well as facilitators and barriers to supportive self-management. The topic guide has been reviewed and amended by our PPIE group and will be refined during data collection

FUNDED BY NIHR | National Institute for Health and Care Research

to allow any emerging issues to be explored. The interviews will be conducted by phone, video call, or face to face according to participant preference, and will be undertaken by a researcher with qualitative research training.

5.14.1 Methods: Focus group study

A therapist focus group will explore and generate discussion on the factors that influence the response to treatment of those with thumb base OA. The focus group will last approximately two hours and will use a topic guide that has been developed as described above. The focus group will take place face to face or by video meeting and will be conducted by two researchers with qualitative research training.

Withdrawal criteria

A participant can withdraw from the study at any point. If a participant withdraws consent from the study, their existing data up to the date of withdrawal will remain on file and will be included in the final study analysis.

End of study

The end of the study is defined as the point at which data collection is complete and the study database is locked. All Case Report Forms (CRFs), audio files and transcripts will have been received by the data management team at Keele CTU and any data queries will have been resolved. The (Chief Investigator) CI will notify the Research Ethics Committee (REC) of the end of the study within 90 days of study completion.

Stakeholder involvement and PPIE workshop

The final objective of this study is to generate recommendations to improve care. To support this, it is planned to hold a stakeholder workshop to disseminate the results, presenting the key results for the experience and the outcomes of care, and the nature and the strength of factors influencing the outcome of treatment. Including presenting the results of the quantitative and qualitative data triangulation. If appropriate, discussion will then be guided toward identifying the implications of the results on clinical care, and towards suggestions for improving supported self-management, and ideas for future research.

Clinicians (therapists, GPs, surgeons – who have a particular clinical or research interest in thumb base or hand OA) from the CI's existing networks in the UK will be invited to attend using e-bulletin advertisements and direct e-mail invitations (British Association of Hand Therapists, British Society for Surgery of the Hand OA thumb guidelines group, Local GP practices). Patients from the TOPS

FUNDED BY NIHR | National Institute for Health and Care Research

study patients' advisory group, who are familiar with group meetings and the study, and it's aims will be invited to attend. Participation will be voluntary, as this is a dissemination and discussion event, rather than research that generates data for analysis, there will be no anticipated requirement for formal informed consent. A record of the key points of the discussions and the ideas for improving care and future research will be taken, with no identifiable information included in the summary produced.

The detailed plan for this workshop and methods used to facilitate the group discussions and develop recommendations will be written up and agreed prior to inviting participants.

15 STATISTICS AND DATA ANALYSIS

Quantitative analysis

Summary of baseline data and flow of patients

The full statistical analysis plan will be written, and agreed prior to analysis, hence only an outline of the analysis is described below. The presentation of data and reporting will be informed by the Strobe statement[66]. The numbers of those examined for eligibility and those included and those completing follow up will be presented with a flow chart. The reasons for non-participation or withdrawal will be presented. Key socio-demographic and health data will be presented and compared between those who do and do not complete the three and six-month follow up. Descriptive statistics will be used for this analysis (frequencies and percentages for categorical data, means and standard deviations for numerical data).

Outcome analysis – descriptive statistics

Descriptive statistics, including 95% confidence intervals where relevant, will be used to estimate:

- Overall outcomes of care at three and six months - the change from baseline in pain, function, participation, pain self-efficacy and health related quality of life; and the proportions classed as responders at each time point.
- The proportions who required additional treatments and what care was provided will be described.
- Summarised scores for perceived quality of care (OA-QI).

FUNDED BY NIHR | National Institute for Health and Care Research

Outcome analysis

Linear regression for continuous outcomes will be used to explore the association of selected prognostic factors with outcome (pain and function); logistic regression for binary outcome (OMERACT-OARSI responders). Crude (unadjusted) estimates will be calculated as well as estimates of the strength of associations adjusted for relevant covariates (e.g., age, gender, socioeconomic status, presence of comorbidities, baseline value of the outcome). Results from the interview study will inform the order of prognostic factors to be included in the analysis of the relationship between candidate prognostic factors and outcomes. Model fit will be explored using statistics such as R-squared or C-statistic to estimate predictive value, i.e., how well the prognostic factor can explain variability in outcome over and above demographic variables and baseline pain/function.

Sample size calculation

A total of 150 participants will be recruited and, with an anticipated maximum loss to follow-up of 30%, 105 participants would be retained at 6-months. This sample size will enable the proportion of participants meeting the OMERACT-OARSI responder criteria at 6-months to be estimated with a confidence width of 20% (the difference between the lower and upper bound of a 95% confidence interval). The sample size is derived using the Exact (Clopper-Pearson) method. This calculation assumes that the proportion of participants meeting the OMERACT – OARSI responder criteria is 50% (a worse-case scenario for a sample size calculation) but is also reasonable given that 33% - 44% of participants met these criteria in a trial at 3-months where stepped care was not part of the treatment package [17]. Additionally for the secondary objective of investigating the association of prognostic factors with pain and function outcomes. The sample size calculated above (n=105) allows a difference of 0.05 or more in model R2 to be detected at 80% power and 5% significance in a multiple regression to predict our outcomes of interest e.g., (AUSCAN pain or function) when comparing a model with, and without a single predictor of interest. This assumes an R2 value of 0.3 for the model without the predictor of interest and translates to an effect size (f2) of 0.077 (=0.05/0.65). An R2 value of 0.3 is feasible as, it has been achieved in another study predicting outcome in hand therapy [59]. The sample size calculations were completed using PASS 2020 software [60].

Planned recruitment rate.

It is planned to recruit participants from four study sites that each receive 15-20 referrals per month. From recruitment to a previous study at two of these sites it is estimated that at least 3 participants monthly will consent to the study. With a 14-month recruitment period, a total sample size of 150

FUNDED BY
NIHR | National Institute for Health and Care Research

consenting participants is considered feasible within the fellowship (4 x 3 x 14 = a minimum pool of 168 participants).

Procedure(s) to account for missing or spurious data

The amount of missing data, and the reasons for non-response where given, will be reported. Primary analyses will be based on multiple imputation by chained equations to impute missing data. As a sensitivity analysis, analyses of the primary outcome (AUSCAN) will be re-analysed using only the complete data for comparison [69].

Qualitative analysis – linked study

Data management and analysis of linked study

The interviews and focus group will be audio-recorded, and field notes will be made following each interview and focus group. Transcriptions will be made ad verbatim; all identifiable information will be redacted. The transcripts will be proofread against the audio-recordings and the notes, and then entered into NVivo data management software.

Thematic data analysis will be undertaken using a framework method [56]. The data will be coded within a preliminary pre-defined thematic framework based on the TDF. Two researchers (VJ & CW) will independently code a subsample of transcripts, meet to discuss overlap and divergence and to refine the framework. They will then independently code a minimum of 5% and discuss overlap and refine the framework until a satisfactory consensus between coders has been achieved, anticipating 10-25% will be dual coded [57]. VJ will then continue to code the remaining transcripts meeting with CW regularly to discuss coding decisions. The patients and therapists involved will be invited to inspect the outcomes of the analysis. Additionally key socio-demographic data will be presented in tabular form to describe the sample selected.

Sample size for linked study

For the interview study, it is estimated that up to 20 participants will be needed. Sample size in qualitative research is difficult to estimate in advance [58] but will be determined in this study by achieving representation of the selection criteria chosen for purposive sampling, and finding similar themes and meaning arising from interviews, with limited new perspectives (or data saturation).

For the focus group it is estimated that 6-10 therapists will be required, to achieve a range of factors in purposive sampling, and be realistic based on having several staff involved in delivering the study

at each of the four sites [56]. Purposive sampling will select therapists from different sites, and a range of job grades in the NHS.

Triangulation of data

A detailed plan for triangulation and integration of the qualitative and quantitative data sets will be written and agreed prior to all data analysis. The findings from the cohort study quantitative data and the qualitative study will be brought together by listing the key findings from each component of the study to create a convergence coding matrix[67]. The findings will be assessed by the research team (together with patient collaborators) to explore where they agree (convergence), offer complementary information on the same issue complementarity), appear to contradict (dissonance), or where a finding only emerges in one data type (silence)[68]. TDF domains support the generation of recommendations for patient care. For example, if patients believe that self-management will not help them (TDF domain: beliefs about consequences) then this would point to more patient education on the potential impact of self-management may be required. The results of this aspect of analysis will form an important part of the study results to be presented at the stakeholder involvement and PPIE workshop.

16 DATA HANDLING

Data collection tools and source document identification

Online/postal self-report questionnaires, clinical data collected on study specific CRFs, audio recordings (of interviews and a focus group) will form the basis of the data collection. A dedicated study database will be developed using REDCap this will be managed by the principal investigator (with support from a Senior Application Developer and a Biostatistician). REDCap is housed on Amazon Web Services (AWS) infrastructure which is managed and maintained by Keele University and will be the final repository for the data collection.

Potential participants are screened by clinicians for eligibility using study specific CRFs. For those not consenting, or ineligible to participate in the study, data will be collected on age, gender, and reason for exclusion (if known). Sites will be given the option of uploading data directly into a database. Data collection, storage and study processes will be managed using Research Electronic Data Capture (REDCap). REDCap is a secure web application for building and managing research databases and online and offline data capture. All potential participants who are assessed for eligibility, and all eligible participants who have completed the consent form will be entered onto the REDCap study database and allocated a unique participant study ID so that only anonymised data are used for

analysis. The unique study numbers will be generated from the study database and allocated to each patient before sending a baseline questionnaire. The number will be made up of site ID followed by a sequence of unique numbers. The study number will be for use on CRFs, other study documents and the electronic database. If a site cannot access REDCap then they will have sets of study paperwork (DCFs and ICFs and questionnaires) with predefined ID numbers printed on them. They can collect data on these and send them to Keele CTU where the data will be entered into REDCap generating a new ID number that includes the paper ID number.

All data used for analysis will be de-identified on a separate database and linkage will only take place via the participant's unique ID number. Names and contact details will be deleted after the data collection phase is completed. Paper-based questionnaires and data collection forms will be sent to the Keele CTU administration team in pre-paid envelopes provided to participants and therapists. Paper-based questionnaires and forms will be date stamped on receipt at Keele CTU. Questionnaires will then be logged as returned on a management database, and the participant's responses entered into the study database on REDCap.

Data handling and record keeping

Questionnaires will include the participant's Study ID plus date of birth and initials to confirm the correct participant's study ID has been provided. Study data, including relevant information from participating patient therapy records, will be recorded on CRFs by clinicians or local research staff who are taking part in the study and will be trained in accordance with the protocol on completing CRFs. Data extracted from therapy records will be linked to the participant's Study ID and to study data attributed to each participant. The study site is responsible for redacting all other personal identifiable data prior to CRFs and any other reports being sent to Keele CTU, where appropriate. Following receipt, Keele CTU will contact the site to resolve any missing or discrepant data queries relating to clinical data in accordance with Keele CTU procedures.

Dictaphone audio recordings will be used to record interviews with participants and the focus group meeting. These will be removed from the Dictaphone at the earliest opportunity. The files will be transferred to a secure drive on the university server, immediately after recording, and deleted from the Dictaphone. Video call interviews also recorded by Dictaphone and treated in the same way.

Recordings will be transcribed via Sponsor approved transcription services only. The transfer of recordings to external transcription services will adhere to the secure transfer of recordings/transcripts procedure specified by the Sponsor. A confidentiality agreement will be put in place to cover this arrangement with the service provider.

FUNDED BY
NIHR | National Institute for Health and Care Research

Access to the final study dataset & archiving

At the end of the study, archiving of essential study documents at the sites and Keele CTU will be authorised by the sponsor following submission of end of study reports which will be for a minimum of 5 years after the end of the study (5 years as per sponsor request). Destruction of essential documents requires authorisation from the Sponsor.
A record of consent will be held in the local investigator site file. All other data will be held by Keele CTU and will be archived in the designated Keele CTU storage facility, until destruction as outlined in the QMS.

Data sharing agreements

Any subsequent requests for access to the data from anyone outside of Keele CTU (e.g., collaboration, joint publication, data sharing requests from publishers) will follow Keele University's QMS.
The anonymised datasets of quantitative data generated during and/or analysed during the current study will be available to request from medicine.datasharing@keele.ac.uk. A data request form must be completed outlining the data requested, the reason for obtaining this data (research question / objective), the timing for when the data is required to be available (start date/end date). The Data Custodian and Academic Proposals (DCAP) committee at Keele will only give approval if the data requested is appropriately suited to answer the research question/objective and that the request fits with the original ethical approval and participant consent and adheres to funder and legal restrictions. Only anonymous data will be available for request in aggregated format or at the level of the individual participant.

17 MONITORING & AUDIT

The Investigators will ensure that source documents and other documentation for this study are made available to study monitors, the REC or regulatory authority inspectors. Authorised representatives of the Sponsor may visit the participating sites to conduct audits/ inspections.

Sponsor

UHDB as the sponsor is responsible for initiation, operationalisation, and financial management of the study. These functions are devolved to the CI and to Keele CTU as will be detailed in the Delegation of Responsibilities agreement, as follows:

FUNDED BY
NIHR | National Institute for Health and Care Research

Chief Investigator (CI)

The Study Sponsor, UHDB delegates the management of the study to the CI (VJ). The CI has overall responsibility for the scientific quality and delivery of the study. The CI will also be responsible for safety reporting and escalation of reportable adverse events.

Keele University

Keele University, the Host Organisation for research delivery, will provide the CI with access to its HSCR Quality Management System. Supervision support will also be provided by Keele University.

Keele CTU

Keele CTU will support and advise the CI on set-up and monitoring of study conduct, in accordance with Keele University's HSCR QMS. The CI with support and advice from Keele CTU, will manage the day-to-day running of the study including study management, database administrative functions, data management, safety reporting and all statistical analyses. Regular monitoring of study recruitment will be performed and CRFs will be monitored, against the study protocol for compliance.

NIHR Clinical Research Networks (CRNs)

NIHR CRNs will co-ordinate CRN support across the sites and will provide funding or staff resource to secure the additional clinical time associated with service support to embed the study into the sites to allow identification of potentially eligible participants.

Study Management Group (SMG)

The SMG, convened by the CI, will comprise members of the research team, Keele CTU and a PAG representative, and will have overall responsibility for the clinical set-up, promotion, ongoing management, and monitoring of the study, and for analysis and interpretation of results. The CI (VJ) will chair the SMG to oversee; obtaining regulatory approvals from the Health Research Authority (HRA) and general practices; monitoring and managing funding; CRF development; protocol delivery; monitoring of recruitment, intervention delivery and follow-up procedures; data collection and database development; completion of regulatory reporting requirements; reporting of unexpected events to the REC and Sponsor; and completing funder reporting requirements. The SMG will meet on a regular basis throughout the study.

FUNDED BY
NIHR | National Institute for Health and Care Research

Monitoring arrangements

Monitoring will be conducted according to a Study Monitoring Plan developed by the SMG based on the study risk assessment and in accordance with Keele HSCR QMS. Monitoring will also be undertaken by the approving Research Ethics Committee (REC) in the format of annual progress reports, and the funder in the format of progress reports as required by the NIHR Clinician Scientist funding stream.

Study monitoring will be carried out in accordance with a Study Monitoring Plan and Keele HSCR QMS which lays out the procedures for monitoring consent forms, data collection, case report forms (from the clinical assessments), protocol compliance and data management and entry procedures.

Study data will be monitored for quality and completeness. Where 20% or more of items from the primary outcome (AUSCAN) is missing in the baseline or follow-up questionnaires those participants who have provided a current telephone number will be contacted to complete the questions over the phone.

Safety reporting

The treatment being delivered is usual NHS care and is anticipated to be low risk, therefore related adverse events, should any occur, are likely to be uncommon and generally minor. Occupational therapists and Physiotherapists will be asked to report unexpected events they become aware of during the study. Reporting procedures will be made clear during the training and will be contained in site files for all those involved in the study.

Should an Adverse Event (AE) occur the Keele University HSCR QMS relating to the reporting of such events will be adhered to.

FUNDED BY
NIHR | National Institute for Health and Care Research

1.1.17.1 Study timeline

Project Year	Year 1				Year 2				Year 3			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Set up												
Develop essential documentation												
REC Approvals												
Site initiation												
Recruitment												
Baseline data collection												
Qualitative data collection & analysis												
Follow up												
3-month												
6-month												
Close sites, data analysis, triangulation												
Stakeholder dissemination meeting												

FUNDED BY
NIHR | National Institute for Health and Care Research

18 ETHICAL AND REGULATORY CONSIDERATIONS

Research Ethics Committee (REC) review & reports

The study will be submitted to and approved by the HRA (which includes REC) to gain the appropriate NHS Permissions prior to recruiting participants into the study. Application for regulatory approvals will include: the final protocol; PISs, consent forms and all other relevant study documentation required.

Following receipt of a favourable opinion from the REC, and issue for HRA approvals, the HRA and where required REC, will be informed of any substantial changes to the management of the study. Routine reporting will take place in line with regulatory reporting requirements.

All regulatory correspondence will be retained in the Study Master File (SMF) and where necessary, Study Site Files.

The CI will be responsible for producing regulatory reports as required, and will:

- Provide annual REC reports;
- Notify the REC of the end of the study;
- Notify the REC if the study is ended prematurely, including the reasons for the premature termination and;
- Submit a final report with the results, including any publications/abstracts, to the REC within one year after the end of the study.

Before any site can enrol a patient into the study confirmation of capacity must be sought from the site's research and development (R&D) department. In addition, for any amendment that will potentially affect the site's permission, the research team must confirm with the site's R&D department that permission is ongoing.

Amendments

If changes to the study are required these must be discussed with the Sponsor, who is responsible for deciding if an amendment is required and if it should be deemed substantial or non-substantial. Substantial amendments will be submitted to the relevant regulatory bodies (REC, HRA) for review and approval. The amendments will only be implemented after approval and a favourable opinion has been obtained. Non-substantial amendments will be submitted to the HRA for their approval/ acknowledgment. Amendments will not be implemented until all relevant approvals are in place. The detailed protocol will be updated in response to approved amendments, as required.

FUNDED BY
NIHR | National Institute for Health and Care Research

Protocol compliance

The Study Management Group will monitor protocol compliance of recruitment, treatment, and follow-up procedures during conduct of this study, and this will be discussed at monthly SMG meetings.
Deviations which are found to frequently recur are not acceptable and will require consideration from the CI, sponsor, and agreement from the study management as to whether they are to be classified as a serious breach. Appropriate corrective and preventative actions will be taken by the research team with the CI being responsible for these with agreement from the SMG.

Technical deviations from protocol that do not result in harm to the study participants, do not compromise data integrity or significantly affect the scientific value of the reported results of the study will be documented and again appropriate corrective and preventative actions will be taken by the research team with the CI being responsible for these with agreement from the SMG.

Notification of serious breaches to GCP and/or the protocol

A "serious breach" is defined as a breach of the protocol or of the conditions or principles of Good Clinical Practice (GCP) which is likely to affect to a significant degree the safety or physical or mental integrity of the study subjects, or the scientific value of the research. The Sponsor will be notified immediately of any case where the above definition applies during the study conduct phase. The sponsor will notify the REC in writing of any serious breach of:
a. the conditions and principles of GCP in connection with that study; or
b. the protocol relating to that study, within 7 days of becoming aware of that breach.

Peer review

This study has obtained independent peer review, prior to award of funding, by NIHR. Further review has been undertaken within Keele CTU to ensure additional quality checks and compliance with the HSCR QMS.

Public and patient involvement

A group of patients with thumb base OA was convened from Keele's Research User Group (RUG), and those who had attended the Pulvertaft Hand Unit for therapy. This patient advisory group (PAG) supported the development of the TOPs research study and the NIHR funding application. The group met prior to funding, helping to define the research questions, and influencing research design.

FUNDED BY
NIHR | National Institute for Health and Care Research

The PAG group showed strong support for the aims of this proposal and challenged the researchers to broaden their goals. Patients reported that the quality of care is important, but care is not just about achieving improvements in pain and function, as this varies with the course of the disease. It is also important to measure the change in mental wellbeing, quality of life and social participation that a supported self-management programme can provide.

PAG group input has led to the addition of participation and quality of life outcomes, and the use of qualitative research to explore the experience of care and what influences the outcome of treatment. Patients stressed that changes in habits and hand use are required to settle symptoms, and that the benefits of exercise emerge slowly. They therefore suggest that "at least" 6-month outcomes are important to them, and this is why further funding will be sought to extend follow-up if it is feasible to do so. Patients support the approach of including a broad group of participants with co-existing hand or health conditions, as well as those who previously received treatment, as people do return for care. These groups have been unrepresented in previous studies.

This study will strive to meet NIHR priorities of equality, diversity, and inclusion, and reach those who are underserved by previous research. Data will be collected to identify differences in age and sex between those who consent and those who decline the study. Data will also be collected on ethnicity, language, and education to understand the spread of participation in the study. Funds have been requested for interpreting and translation services. Data collection online and by post will be adapted for phone according to individual circumstances. Patients expressed dissatisfaction that their thumb base OA was underestimated in its severity and its impact on life, and therefore access to treatment was variable. They expressed a desire for a basic level of care for all. This study will seek to understand the pathway and experience of this basic level of care, in order to optimise care, and post-doctoral work will seek to work with primary care to improve access to care and investigate enhanced care interventions.

Members of the PAG have subsequently been invited to support the planning and delivery of the TOPs research study. The PAG have and will continue to meet face-to-face or remotely at specified times over the course of the study. PAG have reviewed all the patient facing documentation, particularly ensuring clear explanations were given e.g., about the importance of exercise to encourage motivation. PAG have also contributed to choosing the optimum measures for participation and adherence to treatment and have reviewed and contributed to the interview topic guide. Future meetings will: test the online data collection system; support the development of a study website; devise updates for participants; advise on any issues with retention of participants; support the research team's integration of the qualitative and quantitative data; support the planning of and participate in the stakeholder meetings and the dissemination work. Ken Clamp PAG member is also part of the study management group (SMG).

FUNDED BY
NIHR | National Institute for Health and Care Research

Data protection and patient confidentiality

Each participant is allocated a unique study identification (ID) number, so that only anonymised data are used for analysis. At the end of the study, database anonymisation and locking will be carried out in accordance with Keele HSCR QMS. Transcriptions from interviews and focus group will be checked for accuracy against the audio/ video recording. Transcripts will be fully anonymised (names of people or places removed, labelled with unique study ID numbers).

Keele CTU has robust data security systems and procedures in place, which are regularly reviewed, and which achieve the legal obligations set by the Data Protection Act (2018) and the General Data Protection Regulation (GDPR) and follow GMC Caldicott Guardian and British Computer Society standards and guidelines. Information about Keele University's Privacy Notice will be included in the Patient Information Leaflet.

All identifiable participant data will be housed on Amazon Web Services (AWS) infrastructure which is managed and maintained by Keele University and will be the final repository for the data collection. This is a secure virtual network requiring two factor authentication (2FA) to access the data stored within. Permissions are applied to users within the network to restrict access to study data as required. Only authorised members of staff will have access to the study data. All hard copy information will be stored securely in locked cabinets in accordance with Keele HSCR QMS. Data used for analysis will be kept separate from consent forms containing participant identifiable information.

All confidentiality arrangements adhere to relevant regulations and guidelines and the CI (Data Custodian) and study team have responsibility to ensure the integrity of the data and that all confidentiality procedures are followed.

Financial and Other Competing Interests for the Chief Investigator, Principal Investigators at Each Site and Committee Members for the Overall Study Management.

The CI, site PIs and SMG members have no financial or other competing interests to declare.

Indemnity

As UHDB is acting as the research Sponsor for this study, NHS indemnity applies. NHS indemnity provides cover for legal liabilities where the NHS has a duty of care. Non-negligent harm is not covered by the NHS indemnity scheme. UHDB, therefore, cannot agree in advance to pay compensation in these circumstances. In exceptional circumstances an ex-gratia payment may be offered.

FUNDED BY
NIHR | National Institute for Health and Care Research

19 DISSEMINATION POLICY

Dissemination

On completion of the study the data will be analysed, and a final study report prepared. This report will be included in the annual report submitted to NIHR in accordance with the conditions of the grant award. All publications, presentations, correspondence, and advertisements arising or related to the grant will acknowledge NIHR as the study's funding source (quoting the grant reference number).

This proposed work will provide data on the outcomes, experience, and quality of NHS care for the presenting population, and with a longer follow-up than is currently known. The results of this study will be shared with therapists, hand surgeons, primary and secondary care clinicians, health service commissioners, and researchers. Initially, this will be achieved through a dissemination event with stakeholders. At this event, the results will be presented and discussed, and attendees will be guided to discuss the implications of the results, and if appropriate agree on recommendations for practice. The results will also be disseminated more broadly through hand therapy and surgery networks, the use of social media, a study website, primary care, and commissioning networks. Patients with OA thumb and participants will be informed using a website (to be developed) and participant/clinician newsletters. The PAG will be asked to support the preparation of dissemination materials and methods chosen and have been appropriately costed into the funding proposal.

This work will be submitted as fulfilment for a doctoral award and for publication (in peer reviewed journals) and presentations at scientific conferences. The results on the outcomes of the experience of care, and the prognostic factors which may influence the outcome of care will inform future trials to investigate enhanced care interventions. The following topics for scientific papers are planned: protocol, the main study results (the population treated, the treatment delivered over 6 months, the outcomes), the experience and quality of care and recommendations, and finally, the prognostic factors and recommendations for care. Keele's Impact Accelerator Unit has a track record of international implementation of OA management programmes through the Joint Effort Initiative implementation subgroup of the OARSI, where my thesis on this study will be integrated.

Intellectual property

The development of intellectual property is not expected from this project but would be managed by Keele University in liaison with the Sponsor if appropriate.

FUNDED BY
NIHR | National Institute for Health and Care Research

Authorship eligibility guidelines and any intended use of professional writers

Authorship for the final report of this study will be the TOPS study team, protocol contributors and individuals involved in study management. Authorship on any publication resulting from the work described in this protocol will follow the criteria of The International Committee of Medical Journal Editors which has defined authorship criteria for manuscripts submitted for publication. There is no intention to use professional writers.

FUNDED BY
NIHR | National Institute for Health and Care Research

20 REFERENCES

1. ARUK. *Osteoarthritis in General Practice.* 2013. Chesterfield UK:.
2. Safiri S, Kolahi AA, Smith E, et al. Global, regional and national burden of osteoarthritis 1990-2017: a systematic analysis of the Global Burden of Disease Study 2017. *Annals of the Rheumatic Diseases* 2020; 79: 819-828.. DOI: 10.1136/annrheumdis-2019-216515.
3. DiBonaventura Md, Gupta S, McDonald M, et al. Evaluating the health and economic impact of osteoarthritis pain in the workforce: results from the National Health and Wellness Survey. *BMC Musculoskeletal Disorders* 2011; 12: 83-83. DOI: 10.1186/1471-2474-12-83.
4. Litwic A, Edwards MH, Dennison EM, et al. Epidemiology and burden of osteoarthritis. *British Medical Bulletin* 2013; 105: 185-199. DOI: 10.1093/bmb/lds038.
5. Datta Gupta N and Larsen M. The impact of health on individual retirement plans: self-reported versus diagnostic measures. *Health economics* 2010; 19: 792-813. DOI: https://dx.doi.org/10.1002/hec.1523.
6. Peat G, Rathod-Mistry T, Paskins Z, et al. Relative prevalence and distribution of knee, hand and foot symptomatic osteoarthritis subtypes in an English population. *Musculoskeletal Care* 2020; 18: 219-224. Article. DOI: 10.1002/msc.1457.
7. Hill S, Dziedzic KS and Nio Ong B. Patients' perceptions of the treatment and management of hand osteoarthritis: a focus group enquiry. *Disability and rehabilitation* 2011; 33: 1866-1872. DOI: https://dx.doi.org/10.3109/09638288.2010.550381.
8. Haugen IK, Englund M, Aliabadi P, et al. Prevalence, incidence and progression of hand osteoarthritis in the general population: the Framingham Osteoarthritis Study. *Annals of the Rheumatic Diseases* 2011; 70: 1581-1586. Article. DOI: 10.1136/ard.2011.150078.
9. Marshall M, Peat G, Nicholls E, et al. Subsets of symptomatic hand osteoarthritis in community-dwelling older adults in the United Kingdom: prevalence, inter-relationships, risk factor profiles and clinical characteristics at baseline and 3-years. *Osteoarthritis and Cartilage* 2013; 21: 1674-1684. DOI: 10.1016/j.joca.2013.08.004.
10. Goislard de Monsabert B, Vigouroux L, Bendahan D, et al. Quantification of finger joint loadings using musculoskeletal modelling clarifies mechanical risk factors of hand osteoarthritis. *Medical Engineering & Physics* 2014; 36: 177-184. DOI: https://dx.doi.org/10.1016/j.medengphy.2013.10.007.
11. Kloppenburg M, van Beest S and Kroon FPB. Thumb base osteoarthritis: A hand osteoarthritis subset requiring a distinct approach. *Best Practice & Research Clinical Rheumatology* 2017; 31: 649-660. DOI: 10.1016/j.berh.2018.08.007.
12. NICE. Osteoarthritis: Assessment and Management, (2022, accessed April 2022).
13. Kloppenburg M, Kroon FP, Blanco FJ, et al. 2018 update of the EULAR recommendations for the management of hand osteoarthritis. *Annals of the Rheumatic Diseases* 2018. DOI: 10.1136/annrheumdis-2018-213826.
14. Gravas EMH, Tveter AT, Nossum R, et al. Non-pharmacological treatment gap preceding surgical consultation in thumb carpometacarpal osteoarthritis - a cross-sectional study. *BMC Musculoskeletal Disorders* 2019; 20: 180. DOI: https://dx.doi.org/10.1186/s12891-019-2567-3.
15. Parker S, Riley N, Dean B, et al. Management of osteoarthritis at the base of the thumb. *The Bone & Joint Journal* 2020; 102-B: 600-605. DOI: 10.1302/0301-620x.102b5.bjj-2019-1464.r2.
16. Kjeken I, Darre S, Smedslund G, et al. Effect of assistive technology in hand osteoarthritis: a randomised controlled trial. *Annals of the Rheumatic Diseases* 2011; 70: 1447-1452. DOI: https://dx.doi.org/10.1136/ard.2010.148668.

FUNDED BY NIHR | National Institute for Health and Care Research

17. Poole JU and Pellegrini Jr VD. Arthritis of the thumb basal joint complex. *Journal of Hand Therapy* 2000; 13: 91-107. DOI: http://dx.doi.org/10.1016/S0894-1130(00)80034-4.
18. Adams J, Barratt P, Arden NK, et al. The OA thumb therapy trial: A three arm multi-centre randomised controlled trial of the clinical effectiveness and efficacy of splints for symptomatic thumb base OA. *Rheumatology (United Kingdom)* 2020; 59.
19. Ahern M, Skyllas J, Wajon A, et al. The effectiveness of physical therapies for patients with base of thumb osteoarthritis: Systematic review and meta-analysis. *Musculoskeletal Science and Practice* 2018; 35: 46-54. DOI: https://doi.org/10.1016/j.msksp.2018.02.005.
20. Dziedzic K, Nicholls E, Hill S, et al. Self-management approaches for osteoarthritis in the hand: a 2×2 factorial randomised trial. *Annals of the Rheumatic Diseases* 2015; 74: 108-118. DOI: 10.1136/annrheumdis-2013-203938.
21. Pham T, van der Heijde D, Altman RD, et al. OMERACT-OARSI initiative: Osteoarthritis Research Society International set of responder criteria for osteoarthritis clinical trials revisited. *Osteoarthritis Cartilage* 2004; 12: 389-399. DOI: 10.1016/j.joca.2004.02.001.
22. Dziedzic K, Nicholls E, Myers H, et al. The impact of non-inflammatory musculoskeletal hand conditions in a community-dwelling population of older adults. *Rheumatology* 2007; 46: i20.
23. Tsehaie J, Porsius JT, Rizopoulos D, et al. Response to Conservative Treatment for Thumb Carpometacarpal Osteoarthritis Is Associated With Conversion to Surgery: A Prospective Cohort Study. *Physical Therapy* 2019; 99: 570-576. DOI: https://dx.doi.org/10.1093/ptj/pzz009.
24. Stubbs B, Aluko Y, Myint PK, et al. Prevalence of depressive symptoms and anxiety in osteoarthritis: a systematic review and meta-analysis. *Age and Ageing* 2016; 45: 228-235. DOI: 10.1093/ageing/afw001.
25. Bűhler M, Chapple CM, Stebbings S, et al. Impact of thumb carpometacarpal osteoarthritis: a pragmatic qualitative study. *Arthritis Care Research (Hoboken)* 2019. DOI: 10.1002/acr.24124.
26. Grüschke JS, Reinders-Messelink HA, van der Vegt AE, et al. User perspectives on orthoses for thumb carpometacarpal osteoarthritis. *Journal of Hand Therapy* 2019; 32: 435-443. DOI: 10.1016/j.jht.2018.04.006.
27. Martel-Pelletier J, Barr AJ, Cicuttini FM, et al. Osteoarthritis. *Nature Reviews Disease Primers* 2016; 2: 16072. DOI: 10.1038/nrdp.2016.72.
28. Gehrmann SV, Tang J, Li ZM, et al. Motion Deficit of the Thumb in CMC Joint Arthritis. *Journal of Hand Surgery* 2010; 35: 1449-1453. DOI: 10.1016/j.jhsa.2010.05.026.
29. Villafane J and Valdes K. Combined thumb abduction and index finger extension strength: A comparison of older adults with and without thumb carpometacarpal osteoarthritis. *Journal of Manipulative and Physiological Therapeutics* 2013; 36: 238-244.
30. Haugen IK, Slatkowsky-Christensen B, Bøyesen P, et al. Cross-sectional and longitudinal associations between radiographic features and measures of pain and physical function in hand osteoarthritis. *Osteoarthritis and Cartilage* 2013; 21: 1191-1198. DOI: 10.1016/j.joca.2013.04.004.
31. Trouvin A-P and Perrot S. Pain in osteoarthritis. Implications for optimal management. *Joint Spine* 2018; 85: 429-434. DOI: https://dx.doi.org/10.1016/j.jbspin.2017.08.002.
32. Hurley MV, Walsh NE, Mitchell HL, et al. Clinical effectiveness of a rehabilitation program integrating exercise, self-management, and active coping strategies for chronic knee pain: a cluster randomized trial. *Arthritis & Rheumatology* 2007; 57: 1211-1219. DOI: 10.1002/art.22995.
33. Hill JC, Whitehurst DGT, Lewis M, et al. Comparison of stratified primary care management for low back pain with current best practice (STarT Back): a randomised controlled trial. *The Lancet* 2011; 378: 1560-1571. DOI: 10.1016/S0140-6736(11)60937-9.
34. Arden N, Richette P, Cooper C, et al. Can We Identify Patients with High Risk of Osteoarthritis Progression Who Will Respond to Treatment? A Focus on Biomarkers and Frailty. *Drugs & Aging* 2015; 32: 525-535. DOI: 10.1007/s40266-015-0276-7.

FUNDED BY
NIHR | National Institute for Health and Care Research

35. Foster NE, Hill JC, O'Sullivan P, et al. Stratified models of care. *Best Practice & Research Clinical Rheumatology* 2013; 27: 649-661. DOI: 10.1016/j.berh.2013.10.005.
36. Yardley L, Morrison L, Bradbury K, et al. The Person-Based Approach to Intervention Development: Application to Digital Health-Related Behavior Change Interventions. *Journal of Medical Internet Research* 2015; 17. DOI: 10.2196/jmir.4055.
37. Gelberman RH, Boone S, Osei DA, et al. Trapeziometacarpal Arthritis: A Prospective Clinical Evaluation of the Thumb Adduction and Extension Provocative Tests. Journal of *Hand Surgery (American version)* 2015; 40: 1285-1291. DOI: 10.1016/j.jhsa.2015.04.012.
38. Normand M, Tang TS, Brismée J-M, et al. Clinical evaluation of thumb base osteoarthritis: A scoping review. *Hand Therapy* 2021; 26: 63-78. DOI: 10.1177/17589983211002560.
39. Bellamy N, Campbell J, Haraoui B, et al. Clinimetric properties of the AUSCAN Osteoarthritis Hand Index: an evaluation of reliability, validity and responsiveness. *Osteoarthritis and Cartilage* 2002; 10: 863-869.
40. Breivik H. Patients' subjective acute pain rating scales (VAS, NRS) are fine; more elaborate evaluations needed for chronic pain, especially in the elderly and demented patients. *Scandinavian Journal of Pain* 2017; 15: 73-74. DOI: 10.1016/j.sjpain.2017.0.1.001
41. Fillingim RB, Loeser JD, Baron R, et al. Assessment of Chronic Pain: Domains, Methods, and Mechanisms. The *Journal of Pain* 2016; 17: T10-20. DOI: 10.1016/j.jpain.2015.08.010.
42. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Life* 2011; 20: 1727-1736.. DOI: 10.1007/s11136-011-9903-x.
43. Bartlett SJ, Orbai A-M, Duncan T, et al. Reliability and Validity of Selected PROMIS Measures in People with Rheumatoid Arthritis. *PLOS ONE* 2015; 10: e0138543. DOI: 10.1371/journal.pone.0138543.
44. Nicholas MK, McGuire BE and Asghari A. A 2-Item Short Form of the Pain Self-Efficacy Questionnaire: Development and Psychometric Evaluation of PSEQ-2. *The Journal of Pain* 2015; 16: 153-163. DOI: 10.1016/j.jpain.2014.11.002.
45. Cella D, Riley W, Stone A, et al. The Patient-Reported Outcomes Measurement Information System (PROMIS) developed and tested its first wave of adult self-reported health outcome item banks: 2005–2008. *Journal of Clinical Epidemiology* 2010; 63: 1179-1194. DOI: 10.1016/j.jclinepi.2010.04.011.
46. Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. *European Journal of Pain* 2007; 11: 153-163. DOI: 10.1016/j.ejpain.2005.12.008.
47. Østerås N, Garratt A, Grotle M, et al. Patient-reported quality of care for osteoarthritis: development and testing of the osteoarthritis quality indicator questionnaire. *Arthritis Care Research (Hoboken)* 2013; 65: 1043-1051. DOI: 10.1002/acr.21976.
48. Macdermid J. Therapy Adherence Assessment. In: Jansen V, (ed.). Table of questions asked to obtain a measure of adherence with therapy from a patient perspective and judged adherence from a therapist perspective. ed. unpublished 2018, p. 1.
49. Adams J, Barratt P, Arden NK, et al. The Osteoarthritis Thumb Therapy (OTTER) II Trial: a study protocol for a three-arm multi-centre randomised placebo controlled trial of the clinical effectiveness and efficacy and cost-effectiveness of splints for symptomatic thumb base osteoarthritis. *British Medical Journal open* 2019; 9: e028342.
50. Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. *British Medical Journal* 2014; 7: 1687. DOI: doi: 10. 1136/bmj. g1687.
51. Meireles SM, Jones A and Natour J. Orthosis for rhizarthrosis: A systematic review and meta-analysis. *Seminars in Arthritis and Rheumatism* 2019; 48: 778-790.
52. J.C.MacDermid. Optimizing Outcomes: Concepts of Patient Preference, Health Literacy, and Adherence to Treatment. In: T.M. Skirven ALO, J. M. Fedorczyk, P.C. Amadio, S. B. Feldscher, E. K.

FUNDED BY
NIHR | National Institute for Health and Care Research

Shin. (ed) *Rehabilitation of the Hand & Upper Extremity*. 7th ed. 1600 John F. Kennedy Blvd, Ste 1800, Philadelphia, PA 19103-2899: Elsevier, 2021, pp.1470-1477.
53. Pham TM, Abel GA, Gomez-Cano M, et al. Predictors of Postal or Online Response Mode and Associations With Patient Experience and Satisfaction in the English Cancer Patient Experience Survey. *Journal of medical Internet research* 2019; 21: e11855-e11855. DOI: 10.2196/11855.
54. Kroon FPB, van der Heijde D, Maxwell LJ, et al. Core outcome measurement instrument selection for physical function in hand osteoarthritis using the OMERACT Filter 2.1 process. *Seminars in Arthritis and Rheumatism* 2021. DOI: https://doi.org/10.1016/j.semarthrit.2021.08.014.
55. Bellamy N, Campbell J, Haraoui B, et al. Dimensionality and clinical importance of pain and disability in hand osteoarthritis: Development of the Australian/Canadian (AUSCAN) Osteoarthritis Hand Index. *Osteoarthritis and Cartilage* 2002; 10: 855-862.
56. MacDermid JC, Wessel J, Humphrey R, et al. Validity of self-report measures of pain and disability for persons who have undergone arthroplasty for osteoarthritis of the carpometacarpal joint of the hand. *Osteoarthritis and Cartilage* 2007; 15: 524-530. DOI: http://dx.doi.org/10.1016/j.joca.2006.10.018.
57. McQuillan TJ, Vora MM, Kenney DE, et al. The AUSCAN and PRWHE Demonstrate Comparable Internal Consistency and Validity in Patients With Early Thumb Carpometacarpal Osteoarthritis. *Hand (New York, NY)* 2018; 13: 652-658. DOI: https://dx.doi.org/10.1177/1558944717729217.
58. Breivik H, Borchgrevink PC, Allen SM, et al. Assessment of pain. *Br J Anaesth* 2008; 101: 17-24. DOI: 10.1093/bja/aen103.
59. Wilkie R, Peat G, Thomas E, et al. The Keele Assessment of Participation: a new instrument to measure participation restriction in population studies. Combined qualitative and quantitative examination of its psychometric properties. *Quality of Life Research* 2005; 14: 1889-1899. DOI: 10.1007/s11136-005-4325-2.
60. Østerås N, Tveter AT, Garratt AM, et al. Measurement properties for the revised patient-reported OsteoArthritis Quality Indicator questionnaire. *Osteoarthritis and Cartilage* 2018; 26: 1300-1310. DOI: 10.1016/j.joca.2018.06.007.
61. V J, M M, E N, et al. The Prognosis for Pain & Function in People with Hand and Thumb Base Osteoarthritis: a Systematic Review *International Hand Surgery& Therapy Conference 2022*. Excel Centre, London: Journal of Hand Surgery 2022, p. S308-309.
62. Larson D, Nunney I, Champion R, et al. Brief psychological screening for trapeziectomy: Identifying patients at high risk of a poor functional outcome. *Hand Therapy* 2022: 17589983221120839. DOI: 10.1177/17589983221120839.
63. Wouters RM, Vranceanu A-M, Slijper HP, et al. Patients With Thumb-base Osteoarthritis Scheduled for Surgery Have More Symptoms, Worse Psychological Profile, and Higher Expectations Than Nonsurgical Counterparts: A Large Cohort Analysis. *Clinical Orthopaedics and Related Research®* 2019; Publish Ahead of Print. DOI: 10.1097/corr.0000000000000897.
64. Moss-Morris R, Weinman J, Petrie K, et al. The Revised Illness Perception Questionnaire (IPQ-R). *Psychology & Health* 2002; 17: 1-16. DOI: 10.1080/08870440290001494.
65. Damman W, Liu R, Kaptein AA, et al. Illness perceptions and their association with 2 year functional status and change in patients with hand osteoarthritis. *Rheumatology (Oxford, England)* 2018; 57: 2190-2199. DOI: https://dx.doi.org/10.1093/rheumatology/key231.
66. Vandenbroucke JP, von Elm E, Altman DG, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. *PLoS Medicine* 2007; 4: e297. DOI: 10.1371/journal.pmed.0040297.
67. O'Cathain A, Murphy E and Nicholl J. Three techniques for integrating data in mixed methods studies. British Medical Journal 2010; 341: c4587. DOI: 10.1136/bmj.c4587.

FUNDED BY
NIHR | National Institute for Health and Care Research

68. Farmer T, Robinson K, Elliott SJ, et al. Developing and Implementing a Triangulation Protocol for Qualitative Health Research. *Qualitative Health Research* 2006; 16: 377-394. DOI: 10.1177/1049732305285708.
69. White IR, Royston P and Wood AM. Multiple imputation using chained equations: Issues and guidance for practice. *Statistic in Medicine* 2011; 30: 377-399. DOI: 10.1002/sim.4067.

FUNDED BY
NIHR | National Institute for Health and Care Research