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Clement et al How surgical Trainee Research Collaboratives achieve success_supplementary materials Video 1.mp4

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How surgical Trainee Research Collaboratives achieve success: a mixed methods study to develop trainee engagement strategies

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Abstract

Objectives

This study aimed to understand the role of Surgical Trainee Research Collaboratives (TRCs) in conducting randomised controlled trials (RCTs) and identify strategies to enhance trainee engagement in trials.

Design

This is a mixed methods study. We used observation of TRC meetings, semi-structured interviews, and an online survey to explore trainees' motivations for engagement in trials and TRCs, including barriers and facilitators. Interviews were analysed thematically, alongside observation field notes. Survey responses were analysed using descriptive statistics. Strategies to enhance TRCs were developed at a workshop by 13 trial methodologists, surgical trainees, consultants, and research nurses.

Setting

This study was conducted within a secondary care setting in the UK.

Participants

The survey was sent to registered UK surgical trainees. TRC members and linked stakeholders across surgical specialities and UK regions were purposefully sampled for interviews.

Results

We observed 5 TRC meetings, conducted 32 semi-structured interviews and analysed 73 survey responses. TRCs can mobilise trainees thus gaining wider access to patients. Trainees engaged with TRCs to improve patient care, surgical evidence and to help progress their careers. Trainees valued the TRC infrastructure, research expertise and mentoring. Challenges for trainees included clinical and other priorities, limited time and confidence, and recognition, especially by authorship. Key TRC strategies were consultant support, initial simple rapid studies, transparency of involvement and recognition for trainees (including authorship policies) and working with Clinical Trials Units (CTUs) and research nurses. A 6-minute digital story on YouTube disseminated these strategies.

Conclusion

Trainee surgeons are mostly motivated to engage with trials and TRCs. Trainee engagement in TRCs can be enhanced through building relationships with key stakeholders, maximising multi-disciplinary working and offering training and career development opportunities.

Strengths and limitations of this study

- The mixed methods approach and triangulation of data from surveys, interviews and observations that included multi-stakeholder perspectives enabled an in-depth and comprehensive understanding of TRC research.
- A range of surgical specialities and TRCs across geographical areas increased the potential generalisability of findings.
- The survey uniquely included the views of trainees not engaged in TRCs that allowed broader insight into what influences trainee engagement in trials research.
- We only interviewed trainees involved in TRCs.
- The study only focussed on surgical TRCs.

Introduction

Trainee Research Collaboratives are a supportive infrastructure established by surgical trainees collaborating on multi-centre research with advice and mentoring from senior surgeons, trial methodologists and CTUs. The Royal College of Surgeons of England (RCS) and the UK National Institute of Health Research (NIHR) also established Surgical Trials Centres and Surgical Speciality Leads to increase surgical research, led by Professor Dion Morton (1). The West Midlands Research Collaborative (WMRC) was the first TRC (2) and 24 regional and national speciality surgical TRCs were formed subsequently (2, 3), including GlobalSurg internationally (4). TRCs have conducted multi-centre studies ranging from clinical audits and observational studies to RCTs such as ROSSINI (5, 6). The National Institute for Health Research (NIHR) launched an Associate Principal Investigator (API) scheme in 2019 which built on the TRC experiences and aims to encourage trainee clinicians to engage in research with recognition given for activity and training (7). In 2020 the API scheme was utilised in the COVID-19 RECOVERY trial and thereafter was expanded to all NIHR portfolio studies – underlining its success. Understanding why this scheme has been so well received and beneficial will give insights into how to maintain and develop it further. This paper, therefore, aimed to identify reasons for successful trial conduct by surgical TRCs and to develop strategies to increase clinician engagement in trials.

Methods

This study included non-participant observation of TRC meetings, semi-structured interviews, and a survey to gain an in-depth understanding of trainee engagement in research and TRCs. A stakeholder workshop utilised these findings to devise strategies for TRCs to enhance clinician engagement in trials which were disseminated in a digital animated story.

Observations and semi-structured interviews

Sample and setting

Initially, we conducted a review of TRC webpages and with co-applicants identified a range of TRCs, the types and frequency of TRC meetings and key members. A request to observe meetings was sent to the meeting organiser and TRC Chair by a study researcher (CC/KC). TRC meetings were sampled opportunistically focused on TRCs, trials or training meetings between March-December 2017. Due to timing and participant confidentiality issues, no trainee-led Trial Management Group meetings were observed.

Interviewees were purposively sampled to ensure participants across clinical specialities and geographical locations, trainee and consultant surgeons, research nurses and trial methodologists with experience of TRC research were included. Of 70 people who were invited (two declined and 36 did not reply) 19 were interviewed in person and 13 by telephone (May 2017 to January 2018) for between 20 and 59 minutes (mean 37 minutes) until information power (adequate quality and depth of information) was reached (8).

Data collection

Observational and interview data were collected in parallel by experienced qualitative researchers in health research (CC and KC). Observations were non-participant (i.e., researcher not involved) although researchers were known to some meeting attendees and interviewees prior to data collection. Detailed field notes were taken during TRC meetings guided by an observation topic schedule (Supplementary materials 1) based on the research questions (9). Interviews were audio-recorded with permission and transcribed verbatim using a professional transcription service. Interviews were guided by a flexible topic guide (Supplementary materials 2) which enabled a focus on the research questions and participants to introduce topics.

Qualitative analysis

Interview transcripts and field notes were analysed using thematic analysis (10). Analysis began shortly after data collection started with early insights utilised in subsequent data collection. The main study researcher (CC) analysed all transcripts and field notes and the second researcher (KC) analysed nine transcripts. A hybrid approach using both deductive coding based on study aims and inductive coding to allow for theme development was used to create an initial coding framework based on the nine double-coded transcripts (11). The framework was agreed by the study team (CC, KC and JAL) and applied to remaining data. Triangulation addressed differences and similarities within themes across interviews and meeting observations for disconfirming and confirming instances. Data management and coding were facilitated using NVIVO 10 software (12).

Survey and analysis

An email invitation for the online survey was sent to trainees from all surgical specialities via administrators at the 18 Local Education Training Boards (LETB) in England and Deaneries in Scotland, Wales and Northern Ireland and advertised on social media in 2017. The anonymous survey asked about attitudes to, and involvement in, surgical research and collected basic demographic information (Supplementary materials 3). Survey data were collected using Bristol Online Surveys (https://onlinesurveys.ac.uk/). Participants could enter a prize draw for a £50 voucher. Responses were analysed using descriptive statistics in STATA statistical software. Responses to open-ended survey questions were transferred into Microsoft Excel and two researchers (KC and NH) independently coded each response thematically then agreed the final themes to be integrated with the observation and interview data.

Stakeholder workshop and digital story

Thirty-seven expert stakeholders were invited to a workshop in 2018, of whom 13 attended: two consultant surgeons, four trainee surgeons, four trial methodologists, two research nurses, one Chief Operating Officer for an NIHR Clinical Research Network, plus the study chief investigator (JAL) and researchers (CC & KC). Findings from the interviews, observations and survey were developed into key statements and these experts ranked the most useful strategies for TRCs and trainee development. Subsequently, a digital story outlining key strategies for enhancing trainee engagement in trials was produced using an Integrated Participant Digital Storytelling Technique (IPDS). IPDS utilises digital storytelling techniques and participant data to combine stories from personal experiences with multi-media tools to communicate evidence in an approachable and engaging manner.

Results

TRC meeting observation and interview participants

We observed five TRC meetings at different geographical locations, four were approximately two hours in the evening, and a one-day national TRC meeting with plenary sessions and breakout workshops. Interviews included trainees from 9 of the 14 LETBs and five clinical specialities (characteristics in Table 1) and half of the consultant and trainee surgeons had been involved in RCTs (n = 16, 50%).

Table 1 Interview and survey participant characteristics

Participant characteristics	Interview participants (n=32)	Survey respondents (n=73)
Role		
Consultant Surgeon	5 (15.6%)	-
Clinical Trial Unit methodologist	7 (21.9%)	-
Research Nurse	3 (9.4%)	-
Trainee Surgeon	17 (53.1%)	73 (100%)
Gender		
Female	15 (46.9%)	29 (60.3%)
Male	17 (53.1%)	44 (39.7%)
Trainee surgeon grade	(n = 17)	
CT1/CT2	2 (11.8%)	22 (30.5%)
ST3/4/5	4 (23.5%)	22 (30.5%)
ST6/7/8	11 (50.0%)	24 (32.9%)
Trust Grade	-	2 (2.7%)
Other	-	3 (4.1%)
Surgical speciality	(n = 22)	
Cardiothoracic	0	1 (1.4%)
Colorectal	3 (13.7%)	0
Gastroenterology	1 (4.5%)	0
General Surgery	7 (31.9%)	30 (41.1%)
Neurosurgery	1 (4.5%)	3 (4.1%)
Oral and Maxillofacial	0	1 (1.4%)
Otolaryngology	0	2 (2.7%)
Oncoplastic	2 (9.2%)	0
Paediatric	1 (4.5%)	2 (2.7%)
Plastic	1 (4.5%)	3 (4.1%)
Transplantation	1 (4.5%)	0
Trauma and Orthopaedic	1 (4.5%)	18 (24.7%)
Urology	0	6 (8.2%)
Upper gastro-intestinal	3 (13.7%)	0
Vascular	1 (4.5%)	5 (6.8%)
Undecided	0	2 (2.7%)

Clinician regions[1]		
Eastern	2 (9.1%)	3 (4.1%)
London	2 (9.1%)	3 (4.1%)
Mersey	0	3 (4.1%)
Northern	1 (4.5%)	1 (1.4%)
Northern Ireland	1 (4.5%)	0
Northwest	1 (4.5%)	12 (16.4%)
Oxford	4 (18.2%)	0
Scotland	0	21 (28.8%)
Southwestern	4 (18.2%)	11 (15.1%)
Wales	2 (9.1%)	1 (1.4%)
West Midlands	5 (22.8%)	13 (17.8%)
Wessex	0	23 (2.7%)
Yorkshire	0	3 (4.1%)

Trainee survey participants

Seventy-three participants completed the survey from 11 LETBs and 10 clinical specialities (Table 1 for respondent characteristics). Of these trainees, 36 (49%) were currently involved in TRC research, 7 had previously been involved (10%) and 30 had never been involved (41%). In total, 37 trainees (51%) were undergoing or had completed formal research training and 12 reported being a current or former Academic Trainee (16%).

Thematic findings

Three main themes were developed which are mapped in Figure 1, i) motivations for engagement in trainee collaborative research, ii) challenges to that engagement and, iii) facilitating and optimising trainee collaborative research.

Motivations for engagement in trainee collaborative research

Trainees, consultants, and researchers recognised that TRCs provided momentum to trial conduct, contributed to higher quality study designs which produced greater impact on clinical practice and so motivated their involvement. Interviewees spoke of the *"power" (P02, trainee, interview)* of TRCs to deliver large studies relatively quickly by mobilising a cohort of trainees who facilitated access to, and recruited, patients and collected and reported data. It was also thought that trainees who engaged with TRCs would develop into research-active consultants (Table 2).

Table 2 Interviewee quotes for motivations for engagement in trainee collaborative research and challenges to that engagement

Benefits of trainee collaborative research
Higher quality trials and greater impact *"Hopefully, the attitude's changing from you can be a one-man band in your hospital and perform a small study that may not…have all that much influence…to do things in larger networks and nationally having a greater power…greater significance, better for patients." (P06, trainee, interview)*
Ability to deliver trials *"We're able to turn over larger multi-centre studies quite quickly…that study…recruited 900 patients in a 12-week period over a national recruitment drive of about 50 sites." (P02, trainee, interview)* *"When we were trying to roll the study out, we were conscious that we needed the help of the registrars [trainees] all over [region] and the [collaborative] was a great forum to access that." (P29, research nurse, interview)* *"Trainees are pretty important in the way we deliver the trials. Nearly all of our patients are recruited in a very quick turnaround. A lot of it is out of hours...and the only people there are the surgical team [trainees]…a patient that comes in that's eligible and they will recruit them and randomise them…we really rely on the registrars [trainees]... You'd have quite substantial, well double the amount of staff that we do now." (P11 consultant, interview)*
Investment in future research *"Some of them [trainees] become research-active consultants and take their role to champion research in their unit...actually that's very valuable...the whole point of collaborative research is that we want to prepare trainees to be research active clinicians." (P07, trainee, interview)* *"They [TRCs] also give the next generation of academic's real experience of the difficulties and politics involved in running research projects." (P16, trainee, survey)*
Trainee motivations to engage with collaborative research
Personal motivations *"I think the initial carrot is always going to be the line on the CV that they become a named author, they get a publication or a presentation out of it and I think that is definitely what brings them in to the room." (P05, trainee, interview)*
Interest in research *"There was … that [training requirement] when I first got involved…didn't really know much about research. As I got involved, I actually found it enjoyable." (P02, trainee, interview)*
Altruistic motivations *"Best opportunity as a trainee to contribute to meaningful research that has the potential to improve patient care." (P5, trainee, survey)*
Gaining knowledge and skills *"They [trainees] understand that participation will develop skills for them not just understanding how to do research, but…transferable skills – communications skills, how you talk to patients, colleagues…leadership skills, and so on." (P07, trainee, interview)*

Challenges in engagement with trainee collaborative research
Awareness and opportunity *"Never been informed of the existence of a trainee research collaborative." (P29, trainee, survey)* **Time restraints** *"The time is a big constraint…there's so many other demands on your time as a surgical junior. It's the wards want you, theatre…nurses, clinic…assessments as part of your training…to leave time for research…it all gets a bit squeezed…shifted to the bottom of the pile." (P06, trainee, interview)* **Perceptions of poor quality** *"Research should be led by people with the sufficient time and training to do so and who are paid from this role." (P65, trainee, survey).* *"Some people… would say that it's a risk in terms of poor quality data… if you involve a hundred people at a site rather than three, there's an understandable concern that you will have a lower quality trial." (P08, Consultant, interview)* **Lack of recognition and transparency in roles** *"At the end of the day really are one or two people who put a lot of time and effort in who are actually going to benefit from this…there can be some cynicism that although it states collaborative, the person whose name is at the front or at the back of the authorship is really the one that you're doing it for." (P24, trainee, interview)* **Confidence and integration** *"When you have a group of people who are well established and you're the new person coming in…sometimes it's hard to break into the ranks of that." (P23, trainee, interview)*

In the survey, trainees engaged in collaborative research because of i) an interest in surgical research (n=43, 59%), ii) publications (n=39, 53%) and iii) improving patient care (n=37, 51%) (Table 3). Some interviewees thought that their interest in publications was *"purely selfish" (P19, consultant, interview)* to further careers, or meet training requirements so a *"line in your CV" (P06, consultant, interview).* In contrast (and in the survey) many interviewed trainees had a genuine interest and enjoyed research and took up research training positions whilst others initially engaged in research to meet training requirements but came to enjoy it (Table 1). Contributing to the advancement of their field and meaningful research for patient benefit were also important to interviewed trainees. Trainees welcomed the opportunity to generate study ideas and receive training to build their skills and confidence (Table 1) as was observed during TRC meeting presentations by a Clinical Trials Unit (CTU) member on trial methodology and Good Clinical Practice by a Clinical Research Network representative.

Table 3 Survey reasons for trainee involvement in or declining surgical collaborative research

Reason	Number of respondents (N = 73)
Involvement in surgical collaborative research	
Interest in surgical research	43 (58.9%)
Increase publications	39 (53.4%)
Improve patient care	37 (50.7%)
Satisfy ARCP* requirements	22 (30.1%)
Mentoring	21 (28.8%)
Education about research and governance	17 (23.3%)
Encouraged by Programme Director	1 (1.4%)
Declining involvement in surgical collaborative research	
Insufficient time	13 (13.4%)
Timing of meetings	7 (7.2%)
Issues with authorship of collaborative research	7 (7.2%)
Not recognised at Certificate of Completion of Training	6 (6.2%)
Projects not of interest	6 (6.2%)
Too junior to be part of the collaborative	5 (5.2%)
No surgical research collaboration in my region	4 (4.1%)
Other	4 (4.1%)
Not feel welcome at the collaborative	3 (3.1%)
Not interested in collaborative research	2 (2.1%)
Location of the meeting is too far away	1 (1%)
N/A as not involved in TRCs	39 (40.2%)

Challenges in engagement with trainee collaborative research

Some interviewees and survey respondents reported a perception that trainee collaborative research is of poor quality as trainees have insufficient skills or time to conduct research. This appeared to discourage some trainees and collaborators and was also discussed at observed TRC meetings. Concerns were also raised about competing priorities and a lack of time for research and *"trainee fatigue" (P09, trainee, interview).* Trainees were also hesitant about engaging with TRCs if they did not receive appropriate recognition for their contributions. Confidence and integration into a trainee collaborative were sometimes challenging as several survey participants were unaware of how to get involved in TRCs or had limited opportunities e.g., evening meetings due to childcare provision (P31, trainee, survey) (observed TRC meetings were in the evening, Table 1). Some trainees also found it difficult if TRCs had a predominantly male membership so seen as a *"boys club" (P13, trainee, interview)* (Table 1) and we also observed that junior trainees (or those moving from a different Deanery) tended to sit at the back of TRC meetings and made fewer contributions.

Strategies for facilitating and optimising trainee collaborative research

Trainee engagement and collaborative research were optimised with support from consultants, CTUs, research nurses and by having transparency over roles and authorship. Additional facilitators were study designs that the TRCs could enact easily, training and career progression opportunities.

The role of TRCs

TRCs played an important role in providing a supportive infrastructure for collaborative research and in *"bringing together the pieces of the puzzle" (P19, consultant, interview)* through mentorship from individuals with knowledge and experience in trials. In one observed TRC meeting trainees gravitated to discussion groups led by more senior members of the TRC. Trainees also presented study ideas or had a sandpit-type session with senior academics and surgeons and some trainees providing constructive feedback. TRCs were also seen to facilitate networking and collaboration and trainees could get involved at the level and time appropriate to their circumstances (Table 4).

Consultant surgeon support for TRCs

Consultant surgeon involvement and support was critical to establishing and maintaining TRCs and clinical trials, providing consistency for trial oversight and regulatory bodies and encouraging trial completion. Interviewees recommended seeking consultants to collaborate with, including at TRC meetings (also seen in observed meetings) (Table 4).

CTU and research nurse support for TRCs

TRCs fostered communication between trainees, CTU staff and research nurses. CTUs provided important methodological and statistical support to trainees but also benefitted from the TRC-led trials in a symbiotic relationship. Research nurses helped co-ordinate trial recruitment and held knowledge about studies which could benefit trainees although they described how it was difficult initially working with multiple trainees on a trial as a new working practice. Nurses also felt it was important for early engagement by trainees and to develop good communication between all those involved which was helped by technology (Table 4).

Transparency in roles and authorship

The importance of being clear and realistic with trainees throughout a study in a 'terms of engagement' and authorship agreements agreed by all parties was highlighted by many interviewees

(Table 4). Collaborative authorship models used by some TRCs recognised specific inputs and activities for group authorship which was supported by 49% (n=36) of surveyed trainees. However, 47% (n=34) of trainees surveyed stated co-authors should be individually named and in the observed meetings some trainees thought that collaborate authorship prevented first author publication requirements for the UK General Medical Council Certificate of Completion of Training (CCT).

Achievable study designs

Interviewees recommended that new TRCs commence with audits or feasibility/pilot studies to build skills and confidence as RCTs were regarded as daunting due to their duration, complexity, skills required and funding requirements. It was also helpful to identify specific aspects for trainees to contribute to obtain outputs (Table 4).

Training and career progression

Interviewees felt that greater recognition of research activity was needed in their career pathway and greater emphasis on research training in the surgical curriculum. Survey respondents also thought TRCs should be part of surgical training (94.5%, n=69) but research should not be compulsory. Having trainees co-lead studies with more senior colleagues also allowed trainees to build confidence and skills and addressed funder requirements for a 'consistent', consultant on grant applications (Table 4).

Table 4 Interviewee quotes for facilitating and optimising trainee collaborative research

TRCs facilitation of collaborative research and consultant support
Mentorship *"Medical students coming, they can see that senior registrars want to make contributions and hopefully inspire people or guide them in the path…there's an educational, a mentorship element." (P04, trainee, interview)* ***Consultant support*** *"…our role with them is an apprenticeship in trials…they are actually gaining the exposure to working with an expert team, which is really valuable and unique." (P11, consultant, interview)* *"The consultants are there for mentorship but also because we need consistency within the site…because trainees move around the region." (P02, trainee, interview)* **Widening access and providing choice** *"There are a few people that like to get involved in different aspects of the research pathway…part of the attractiveness of it [TRC involvement] is that you can be as much or as little invested in it as you like." (P12, trainee, interview)*

TRCs engaging with CTU and research nurses

CTUs

"A person who will be based within the [CTU], whose remit will be to spend their entire time working with trainees…on an idea that we have said it's worth taking forward and they will help them deliver the first steps of it." (P28, methodologist, interview)

"[methodologist] has been supporting us …we are trying to build that link…he came along to our meetings…you can't do these things out of thin air; you need to link in with people who have expertise, and the trials unit is great for that." (P06, trainee, interview)

Research nurses

"Tap into your research nurse. Because the research nurses are the ones with all the protocols, all the paperwork, they've probably got more time to discuss the studies with you than the consultants." (P29, research nurse, interview)

"We'd never done anything like this before…it's not bad, it's just the enormity of the challenge… previously… there's one or two doctors that you liaise with…it's a very clear linear pathway as to who's your point of contact, and who's recruiting the patients…then…there is this new idea of getting as many trainees involved in research, and …a whole new strategy that we had to come up with." (P32, research nurse, interview)

"We managed to set up a WhatsApp group…liaising on a daily basis making sure that you connected with the surgical trainee that was on that day, what they had and hadn't done, who were the eligible patients?" (P32, research nurse, interview)

Transparency in roles and authorship

Clarity and transparency in roles and responsibilities

"For trainee involvement to work well there has to be a clear objective task for them to do…for a specific award had to be clearly defined." (P26, methodologist, interview)

"In the [CTU] we've got a policy that if somebody moves on, they do not lose their intellectual property rights…we expect you to respond to requests and…a system like…the International Committee of Medical Journal Editors as to who is eligible to be an author." (P21, methodologist, interview)

Collaborative authorship

"The research collaborative is offering something different…we have a corporate authorship policy whereby this single authorship for anything that comes from the groups and then within…will be broken down into different groups…writing groups, steering group, data analysis, local leads, collaborators." (P12, trainee, interview)

"I think there's a perception that it's more useful, more important to have your own first-author paper." (P07, trainee, interview)

"It [corporate authorship] doesn't in any way recognise the disproportionate or the varying effort that different trainees make… we ended up with…sixty-five authors…it's promoting a lot of the worst practice that happens with medical authorship in my opinion." (P26, methodologist, interview)

Achievable study designs

"Don't start with a trial, because it takes a long time, you need a grant, stats, a protocol and ethics, and those are the hardest things to do…Start with a simple, collaborative prospective

snapshot audit or cohort study…a quick win, then set up some bigger stuff, like trials." (P08, consultant, interview)

"I think another thing is running simpler studies…entry step, so that they can see, well this is what collaborative studies are about…and maybe they'll be excited and inspired to then take part in an RCT." (P07, trainee, interview)

Training and career progression

"We've moved towards changing some of our CCT requirements from…you have to produce three papers…that actually nobody seems to really care what the quality is and what the content is it's just sort of a box ticking exercise. There's a move from that to having recruited a certain number of patients…I think that if you were to make it a requirement that would shift the culture and the way people think about these things." (P06, trainee, interview)

"I think you need to understand the methodology more, so I absolutely think there is a place in the curriculum. I think if you're going to shift critical mass of understanding about research, that's one of the only ways it's going to happen." (P05, trainee, interview)
"They have set up what they call a co-PI network, so they've got the PIs…the experienced [clinician] and they've all identified a junior colleague who is working with them." (P20, methodologist, interview)

TRC engagement strategies and dissemination

The expert workshop prioritised five strategies for enhancing TRCs (Table 5). These strategies were converted into a 6-minute animated digital story on YouTube (https://www.youtube.com/watch?v=vbITEHMjQfU) with 373 views (Supplementary material – video 1). A presentation at the National TRC meeting in 2019 received positive feedback including 232 twitter impressions and was subsequently uploaded to four national and international TRC websites.

Table 5 Top five strategies for enhancing TRC engagement

Strategy	Strategy	Examples of how strategy can be achieved
1	Create opportunities for trainees to generate study ideas and complete trial methodology training.	- Having trainees get involved in trial development alongside more experienced colleagues. - Trainees taking formal methodology courses and undertaking on the job training.
2	Promote trainee and collaborative engagement by having achievable study designs with quick wins.	- Getting involved in simpler studies like audits and feasibility studies can help build research skills and confidence. - Provide flexibility for trainees to be involved in different research aspects that suit their needs and circumstances.

3	Seek out the support of a consultant champion to provide consistency for a trial and mentorship to trainees.	- Have consultants involved in a trial to provide advice and guidance to trainees. - Having senior expertise can increase perceived credibility of a study to funding and oversight bodies. - Provide consultants with summaries of what is expected of them (e.g., agreeing to their patients being recruited) and what the trainee will be responsible for doing (e.g., data collection and follow up). - Have consultants attend monthly trainee collaborative meetings to provide feedback and expertise.
4	Be transparent about what is expected from all those involved in the trial and clarify roles, responsibilities and working practices early on.	- Ensure the work of trainees is recognised. - Terms of engagement can help define expectations for all those involved from the outset. - Creating a transparent authorship policy makes it clear up front how everyone will be credited for both trainees and collaborators such as universities and clinical trials units. - Consider having a corporate authorship model which can ensure everyone is acknowledged when a large group are involved.
5	Engage with and have better communication with collaborators such as Clinical Trials Units and Clinical Research Networks.	- Clinical trials units can provide expertise clinicians do not have (e.g., statistical support, data management and trial oversight). - Have a key person from the trials unit to work with, provide guidance and help develop the trial. - Build good relationships with research nurses. They will have trial protocols and paperwork and have more time to discuss the trial with trainees.

Discussion

Interviewees thought that surgical TRCs were generally successful in engaging trainees in research. However, we identified barriers and issues for trainees engaging in TRCs including clinical and other competing priorities (e.g., childcare), concerns about research quality, and wanting recognition for their inputs, most notably authorship. Trainees wished to increase surgical evidence and improve patient care; advance their careers and receive training and we utilised these motivations in developing strategies for enhancing engagement in TRCs. TRC strategies included gaining consultant and CTU support, creating opportunities for mentoring of trainees and to design studies, promoting the TRC with a rapid simple study and transparency about involvement and recognition, including authorship. These principles are valuable insights for TRCs as they are now being expanded into all clinical areas by the NIHR through their API scheme.

The establishment of TRCs, their structure and conduct of trainee-led studies have been described for several clinical specialities (13), (14) (15), including some of the strategies developed in this research e.g. a consultant champion (5). Consultant support was also highlighted in a recent study of a trainee-led clinical trial involved with the NIHR API scheme (16). Some TRC-led publications also advocated starting with a simple study design to give rapid recruitment and outcomes (14) since trainee and consultant support can be variable until they are convinced of the merits of TRCs (14, 15). Providing opportunities for trainees to generate study ideas and take on leadership roles e.g., as Co-PI in TRC-led studies had not been highlighted previously to engage trainees. The interests of trainees in progressing their careers were also highlighted clearly in this study and although regarded by some as "selfish" this benefitted the TRCs and potentially research more broadly. Identifying committed trainees was a WMRC principle (5) but we showed that time and competing priorities are significant barriers, possibly reflecting increased trainee workloads since the formation of the WMRC. If TRCs can offer different options and levels of activity this could potentially increase trainee engagement.

The expectation of trainees for transparency around their involvement in a TRC and recognition of their inputs has been raised by several TRCs (5, 14) and in an analysis of TRC-led publications (17). Some TRCs have collaborative authorship policies to acknowledge trainee inputs (5, 13). Although our study found some support for this model, others preferred "headline" named authors, in part through concerns about publication requirements for the CCT. A consensus group has subsequently defined which TRC roles qualify for "significant authorship" for journal and CCT requirements (18) although acknowledging that named authorship for a TRC writing group could be appropriate. The National Research Collaborative (a TRC umbrella organisation) is also campaigning for recognition of collaborative research in training pathways (19).

Advice and support from methodologists and CTUs in designing and conducting TRC studies was a key strategy in this study which was also highlighted by the WMRC (5). Professional speciality associations have provided infrastructure, academic and logistical support to TRCs (2, 19) although this was not a main strategy found in our study. Several TRCs have called for more tangible support to maintain their success (17), e.g., data collection systems or funding (19) having relied on technologically expert trainees for project infrastructure and database skills (15).

To our knowledge, this is the first multi-stakeholder investigation of trainee motivations to engage in surgical TRCs and research utilising quantitative and qualitative methods. The digital animation was also a novel dissemination strategy and potentially enhanced uptake by trainees and TRCs. The range of surgical specialities and TRCs across geographical areas increased the potential generalisability of findings. Triangulation of survey, interview and observation data gave an in-depth understanding of trainee collaborative research and correlations between data sources reinforced the main themes. The survey, we believe, uniquely included trainees not involved in TRCs so giving a broader perspective to inform these strategies. There are some limitations to the study as we were only able to interview trainees involved in TRCs as the survey was anonymous. The survey response rate was unknown (as there was no access to LEFT/Deanery registers) but was likely to be low and the uptake of the invitation to the stakeholder workshop was around 40% as some individuals did not reply to the invitation or were unavailable. This study predates the NIHR Associate PI scheme (7), so we were unable to assess its impact on trainee research and engagement with TRCs. This study focused on surgical TRCs so these results may not be applicable to other TRCs although similar benefits and challenges were identified for physician TRCs in a recent study (20).

Conclusions

Trainee surgeons are generally motivated to engage with research and through TRCs can conduct RCTs. Trainee engagement in collaborative research can be facilitated by enhancing relationships between key stakeholders, maximising multi-disciplinary working, and providing trainees with training and career development opportunities. This study focussed on surgical trainees and TRCs, but these findings and recommendations may be applicable to other clinical specialities and health professional groups which is important since the NIHR API scheme has been expanded recently across the NIHR portfolio.

List of abbreviations

CCT - Certificate of Completion of Training.

CTU – Clinical Trials Unit

LETB - Local Education Training Board

NIHR – National Institute for Health Research

PI – Principal Investigator

RCS – Royal College of Surgeons

TRC – Trainee Research Collaborative

WMRC – West Midlands Research Collaborative

Declarations

Data sharing statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

NH, TP, JB, NB, JB, DN have been involved with a TRC; CC, KC, JV, RB, AA, CS, LM, GM, JAL are methodologists who work with a CTU or in trials methodology and ZH and VH are research nurses who work with clinical research networks.

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Contributorship statement

JAL and NB conceived the study idea. CC, KC, NH, TP, JB, NB, JC, RB, AA and JAL were involved in the design of the study. CC and KC conducted qualitative data collection and analysis with input from JAL. NB, NH and KC conducted the survey data collection and analysis with assistance from other trainee surgeons. CS, ZH, LM, GM and JG were involved in the stakeholder workshop. CC drafted the initial manuscript. All authors commented on drafts and have seen and approved the final manuscript.

Ethics approval statement

Ethical approval was obtained from the research ethics committee of the Faculty of Health Sciences at the University of Bristol [47721]. All interview participants gave informed consent and agreed to

publication of anonymised quotations. Survey completion was taken as implied consent and all responses were anonymised.

Patient and Public Involvement

No patient involvement.

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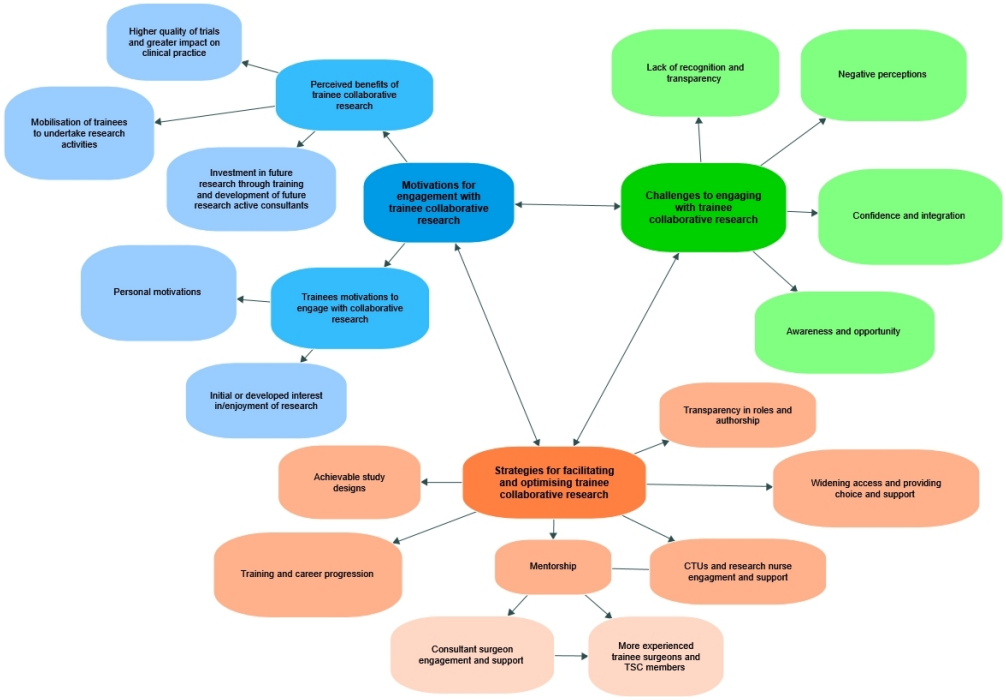

Figure 1 Thematic map of main themes for facilitating engagement with trainee collaborative research

98x68mm (300 x 300 DPI)

Supplementary 1: Observation topic guide

Topic	Field notes
Members	Who attends, what are their roles and how do they contribute?
Organisation of meeting	Who chairs the meeting and what is their role, are attendees introduced, who makes introductions?
Agenda	What are the main items for discussion, what are the goals, priorities for discussion, how much time is spent on each item for discussion? Are there presentations, documents or handouts?
Content of discussion	What is discussed? What information is provided and by whom? Are training requirements discussed? Are strategies and recommendations for the TRC or research discussed and by whom?
Group interactions and decision-making	Who contributes to discussion, who asks questions and who responds? What roles do members adopt during discussion, is there an expert, who adopts this role? Who dominates the group discussions and who is quiet of silent? What is the general atmosphere, is it rushed, tense, relaxed?

Supplementary 2: Interview topic guide

Topic	Discussion content
Participant background	Clinical, research, methodological, clinical, stage of training, current post, any TRC and trials experience.
Current TRC and research experience	Set up and running of TRCs and trials including any barriers and facilitators.
Understanding and awareness of trials	Training and knowledge and where obtained.
Current trial(s) involvement	Any current involvement with information about the trial(s)
Trial conduct and trainee involvement	Set up of the trial, roles and activities for trainees in trial(s), any barriers and facilitators, strategies for addressing issues.
Motivation and challenges to trainee engagement with trials	Why trainees engage and don't engage with trials
Stakeholder, organisation involvement and support	What the roles of these groups are and what their involvement is and what support provide, e.g. CTUs, university, research networks.
Training requirements	Any training requirements needed for trainees to engage with trials?

Supplementary 3: Survey questions

Survey - Trainee Views on Surgical Trainee-led Research Collaboratives

Please answer the following questions about yourself and your views on surgical research collaboratives. For most answers, check the box(es) most applicable to you or fill in the blanks.

About You

1. Your Age

……years

2. Your Gender (Select only one)

☐ Female
☐ Male

3. Your Grade

☐ CT1
☐ CT2
☐ ST3
☐ ST4
☐ ST5
☐ ST6
☐ ST7
☐ ST8
☐ Trust grade (please specify level)……
☐ Other (please specify)……

4. Your Speciality (Select all that apply)

☐ Cardiothoracic
☐ General Surgery
☐ Neurosurgery
☐ Oral & Maxillofacial Surgery
☐ Otolaryngology
☐ Paediatric Surgery
☐ Plastics Surgery
☐ Trauma & Orthopaedic Surgery
☐ Urology
☐ Vascular
☐ Undecided
☐ Other

5. To which region do you belong (i.e. deanery affiliation):

☐ Eastern
☐ Kent, Sussex & Surrey
☐ Leicestershire, Northamptonshire & Rutland
☐ London
☐ Mersey
☐ Northern
☐ Northern Ireland
☐ North West
☐ Trent
☐ Oxford

☐ Scotland
☐ Southwestern
☐ South Yorkshire and South Humber
☐ Wales
☐ West Midlands
☐ Wessex
☐ Yorkshire

6. Are you full-time or less than full-time
☐ Full-time
☐ Less than full-time

Have you obtained/are you undertaking a formal research qualification (Select all that apply)
☐ MRes
☐ MPhil
☐ MD
☐ PhD
☐ Other (please specify)…….
☐ No

Are you an Academic Trainee?
☐ Academic Trainee (current)
☐ Academic Trainee (previous)
☐ No

About Your Publications

9. In the following table, please state the number of PubMed citable publications you have at each type of authorship, for either trainee-led research collaborative studies or other research

	(i) Trainee-led collaborative study (please state the Journals for each and if you paid to publish)	**(ii) Other research study (please state the Journals for each and if you paid to publish)**
a. First author		
b. Co-author (named appears on PubMed alongside title and other part of citation)		
c. Corporate authorship (i.e. as part of a larger group with which the study group itself is the named author)		
d. 'Other' (i.e. citable contributor)		

About Surgical Research Collaboratives

10. Are you currently involved in any studies through a surgical research collaborative?
☐ No
☐ Yes

11. Have you previously been involved in any studies through a surgical research collaborative?
☐ No
☐ Yes

12. If you have been involved in surgical research collaborative research projects, what has your contribution been to these projects? Please select the appropriate category(ies) for your contributions and state the number for each.

Contribution	Previously Involved		Currently Involved	
	(i.) Regional (Involves hospitals within one collaborative)	(ii.) National or international (Involves hospitals across two or more collaboratives)	(iii.) Regional (Involves hospitals within one collaborative)	(iv.) National or International (Involves hospitals across two or more collaboratives)
a. Steering Committee (i.e. project development and running of studies)				
b. Writing Group (i.e. contribution to writing manuscript)				
c. Regional Lead (i.e. coordinating project at regional hospital sites)				
d. Local Lead (i.e. coordinating project at local hospital site)				
e. Local Collaborator (i.e. data collection)				
f. Data Validation (i.e. validation of selected patients)				
g. Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)				

13a. For each of the roles listed below please indicate how likely you would be to get involved in a future trainee-led surgical collaborative study?

Steering Committee (i.e. project development and running of studies)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Writing Group (i.e. contribution to manuscript)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Regional Lead (i.e. coordinating project at regional hospital sites)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Local Lead (i.e. local hospital lead)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Local Collaborator (i.e. data collection)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Data Validation (i.e. validation of data previously collected for a study)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely

Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely

13b. Please use the free text space below for any comments for your answers to the above questions

……

……

14a. If you have been involved in a surgical collaborative research project, what was/were the reason(s) you got involved? (please select all that apply)

☐ I have an interest in surgical research
☐ I wanted to improve patient care
☐ I wanted to increase my number of publications
☐ For networking
☐ I was encouraged to by programme director
☐ To educate myself about research and governance
☐ To satisfy ARCP requirements
☐ Other……..

14b. What was the main reason you got involved (please select one)

☐ I have an interest in surgical research
☐ I wanted to improve patient care
☐ I wanted to increase my number of publications
☐ For networking
☐ I was encouraged to by programme director
☐ To educate myself about research and governance
☐ To satisfy ARCP requirements
☐ Other……..

14c. Please provide any further details about your answer

……

……

15a. If you have never been involved, or have decided not to participate in further surgical collaborative research projects, what reason(s) prevented you from taking part? (select all that apply)

☐ I am not interested in collaborative research
☐ I do not have time
☐ There is no surgical research collaborative in my region
☐ It is not recognized at CCT (certificate of completion of training)
☐ The location of the meeting is too far away
☐ The time of the meeting means I cannot attend
☐ The projects are not of interest to me
☐ I do not feel welcome at the collaborative
☐ I feel I am too junior to be part of the collaborative
☐ I have issues with authorship of collaborative research
☐ Other (please specify)……

15b. Please provide any further comments, including any other barriers to your involvement:

……
……
……
16. Do you think trainee-led research collaboratives have a place in surgical training?
☐ Yes – Why……
☐ No – Why not……
17a. How should CCT requirements recognize involvement in trainee-led research collaboratives? (select all that apply)
☐ Number of projects involved with
☐ Number of publications
☐ Number of first author publications
☐ A points based system based on contribution
☐ Merit judgement by the Speciality Advisory Committee (SAC)
☐ Other, please specify:……..
☐ Should not be recognized at CCT (please go to question 18)
17b. What specific aspects of the research process should be recognized? (Select all that apply)
☐ Steering Committee (i.e. project development and running of studies)
☐ Writing Group (i.e. contribution to manuscript)
☐ Regional Lead (i.e. coordinating project at regional hospital sites)
☐ Local Lead (i.e. coordinating project at local hospital site)
☐ Local Collaborator (i.e. data collection)
☐ Data Validation (i.e. validation of selected patients)
☐ Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)
☐ Other, please specify:……..
17c. For publication purposes, how should authorship contribution of trainee-led research collaborative projects be recognised?
☐ Steering committee as named Co-authors with Contributors citable
☐ Single Corporate Authorship – Steering group and all contributors citable together
☐ Other (please specify)…….
18. Do you think involvement in surgical research collaboratives should be recognized by….? (select all that apply)
☐ UK Foundation Programme (UKFPO)
☐ Core Trainee interview process
☐ Higher surgical training interview process
☐ Academic training posts
☐ Certificate of Completion of Training (CCT)
☐ None of the above (Why?)
……

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How surgical Trainee Research Collaboratives achieve success: a mixed methods study to develop trainee engagement strategies

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How surgical Trainee Research Collaboratives achieve success: a mixed methods study to develop trainee engagement strategies

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Abstract

Objectives

This study aimed to understand the role of Surgical Trainee Research Collaboratives (TRCs) in conducting randomised controlled trials (RCTs) and identify strategies to enhance trainee engagement in trials.

Design

This is a mixed methods study. We used observation of TRC meetings, semi-structured interviews, and an online survey to explore trainees' motivations for engagement in trials and TRCs, including barriers and facilitators. Interviews were analysed thematically, alongside observation field notes. Survey responses were analysed using descriptive statistics. Strategies to enhance TRCs were developed at a workshop by 13 trial methodologists, surgical trainees, consultants, and research nurses.

Setting

This study was conducted within a secondary care setting in the UK.

Participants

The survey was sent to registered UK surgical trainees. TRC members and linked stakeholders across surgical specialities and UK regions were purposefully sampled for interviews.

Results

We observed 5 TRC meetings, conducted 32 semi-structured interviews and analysed 73 survey responses. TRCs can mobilise trainees thus gaining wider access to patients. Trainees engaged with TRCs to improve patient care, surgical evidence and to help progress their careers. Trainees valued the TRC infrastructure, research expertise and mentoring. Challenges for trainees included clinical and other priorities, limited time and confidence, and recognition, especially by authorship. Key TRC strategies were consultant support, initial simple rapid studies, transparency of involvement and recognition for trainees (including authorship policies) and working with Clinical Trials Units (CTUs) and research nurses. A 6-minute digital story on YouTube disseminated these strategies.

Conclusion

Trainee surgeons are mostly motivated to engage with trials and TRCs. Trainee engagement in TRCs can be enhanced through building relationships with key stakeholders, maximising multi-disciplinary working and offering training and career development opportunities.

Strengths and limitations of this study

- The mixed methods approach and triangulation of data from surveys, interviews and observations that included multi-stakeholder perspectives enabled an in-depth and comprehensive understanding of TRC research.
- A range of surgical specialities and TRCs across geographical areas increased the potential generalisability of findings.
- The survey uniquely included the views of trainees not engaged in TRCs that allowed broader insight into what influences trainee engagement in trials research.
- We only interviewed trainees involved in TRCs.
- The study only focussed on surgical TRCs.

Introduction

Trainee Research Collaboratives are a supportive infrastructure established by surgical trainees collaborating on multi-centre research with advice and mentoring from senior surgeons, trial methodologists and CTUs. The Royal College of Surgeons of England (RCS Eng) and the UK National Institute of Health Research (NIHR) also established Surgical Trials Centres and Surgical Speciality Leads to increase surgical research, led by Professor Dion Morton (1). The West Midlands Research Collaborative (WMRC) was the first TRC (2) and 24 regional and national speciality surgical TRCs were formed subsequently (2, 3), including GlobalSurg internationally (4). TRCs have conducted multi-centre studies ranging from clinical audits and observational studies to RCTs such as ROSSINI (5, 6). The National Institute for Health Research (NIHR) launched an Associate Principal Investigator (API) scheme in 2019 which built on the TRC experiences and aims to encourage trainee clinicians to engage in research with recognition given for activity and training (7). In 2020 the API scheme was utilised in the COVID-19 RECOVERY trial and thereafter was expanded to all NIHR portfolio studies – underlining its success. Understanding why this scheme has been so well received and beneficial will give insights into how to maintain and develop it further. This paper, therefore, aimed to identify reasons for successful trial conduct by surgical TRCs and to develop strategies to increase clinician engagement in trials.

Methods

This study included non-participant observation of TRC meetings, semi-structured interviews, and a survey to gain an in-depth understanding of trainee engagement in research and TRCs. A stakeholder workshop utilised these findings to devise strategies for TRCs to enhance clinician engagement in trials which were disseminated in a digital animated story. The study was underpinned by a pragmatic research paradigm which emphasises practicality and real-world application in research. The Standards for Reporting Qualitative Research (SRQR) were used (8).

Observations and semi-structured interviews

Sample and setting

Initially, we conducted a review of TRC webpages and with co-authors (CC/KC/TP/JB/NB/AL) identified a range of TRCs, the types and frequency of TRC meetings and key members. A request to observe meetings was sent to the meeting organiser and TRC Chair by a study researcher (CC/KC). TRC meetings were sampled opportunistically focused on TRCs, trials or training meetings between March-December 2017. Due to timing and participant confidentiality issues, no trainee-led Trial Management Group meetings were observed.

Interviewees were purposively sampled to ensure people across clinical specialities, geographical locations and roles were included. Inclusion criteria were 1) either be a trainee or consultant surgeons, research nurse, or trial methodologists with experience of TRC research and 2) speak English. Thirty two people of 70 invited were interviewed (two declined (time restraints), 36 did not reply to a single invitation without financial incentive (reasons unknown)) 19 were interviewed in person and 13 by telephone (May 2017 to January 2018) for between 20 and 59 minutes (mean 37 minutes) until information power (adequate quality and depth of information) was reached (9).

Data collection

Observational and interview data were collected in parallel by experienced qualitative researchers in health research (CC and KC). Observations were non-participant (i.e., observing study researchers were not TRC members and did not participate in meetings they were observing) although researchers were known to some meeting attendees and interviewees prior to data collection. Detailed field notes were taken during TRC meetings guided by an observation topic schedule (Supplementary materials 1) based on the research questions (10). Interviews were audio-recorded with permission and transcribed verbatim using a professional transcription service. Interviews were

guided by a flexible topic guide (Supplementary materials 2) which enabled a focus on the research questions and participants to introduce topics.

Qualitative analysis

Interview transcripts and field notes were analysed using thematic analysis (11). Analysis began shortly after data collection started with early insights utilised in subsequent data collection. The main study researcher (CC) analysed all transcripts and field notes and the second researcher (KC) analysed nine transcripts. A hybrid approach using both deductive coding based on study aims and inductive coding to allow for theme development was used to create an initial coding framework based on the nine double-coded transcripts (12) (Supplementary materials 3). The framework was agreed by the study team (CC, KC and JAL) and applied to remaining data. Triangulation addressed differences and similarities within themes across interviews and meeting observations for disconfirming and confirming instances. Data management and coding were facilitated using NVIVO 10 software (13).

Survey and analysis

An email invitation for the online survey was sent to trainees from all surgical specialities via administrators at the 18 Local Education Training Boards (LETB) in England and Deaneries in Scotland, Wales and Northern Ireland and advertised on social media in 2017. The anonymous survey asked about attitudes to, and involvement in, surgical research and collected basic demographic information (Supplementary materials 4). Survey data were collected using Bristol Online Surveys (https://onlinesurveys.ac.uk/). Participants could enter a prize draw for a £50 voucher. Responses were analysed using descriptive statistics in STATA statistical software. Responses to open-ended survey questions were transferred into Microsoft Excel and two researchers (KC and NH) independently coded each response thematically then agreed the final themes to be integrated with the observation and interview data.

Stakeholder workshop and digital story

Thirty-seven expert stakeholders were invited to a workshop in 2018, of whom 13 attended: two consultant surgeons, four trainee surgeons, four trial methodologists, two research nurses, one Chief Operating Officer for an NIHR Clinical Research Network, plus the study chief investigator (JAL) and researchers (CC & KC). Findings from the interviews, observations and survey were developed into key statements (CC/KC/AL/NB/NH) (Supplementary materials 5) and these experts ranked the most useful strategies for TRCs and trainee development. Subsequently, a digital story outlining key strategies for enhancing trainee engagement in trials was produced using an Integrated Participant

Digital Storytelling Technique (IPDS). IPDS utilises digital storytelling techniques and participant data to combine stories from personal experiences with multi-media tools to communicate evidence in an approachable and engaging manner.

Patient and Public Involvement

As the primary focus of engagement in trials was on trainees as the key stakeholders who would be affected by the research, we did not include a Patient and Public representative.

Reflexivity

Throughout our research, we recognised the impact of our multidisciplinary team's roles on data interpretation and recommendations. While analysing data and shaping strategies, we embraced multiple perspectives, resulting in comprehensive data representation and more relevant findings. The team comprised social researchers, methodologists, clinicians, and TRC members. Regular study management group meetings were held to review findings and key decisions.

Results

TRC meeting observation and interview participants

We observed five TRC meetings at different geographical locations, four were approximately two hours in the evening, and a one-day national TRC meeting with plenary sessions and breakout workshops. Interviews included trainees from 9 of the 14 LETBs and five clinical specialities (characteristics in Supplementary materials – 6) and half of the consultant and trainee surgeons had been involved in RCTs (n = 16, 50%).

Trainee survey participants

Seventy-three participants completed the survey from 11 LETBs and 10 clinical specialities (Supplementary materials – 6 for respondent characteristics). Of these trainees, 36 (49%) were currently involved in TRC research, 7 had previously been involved (10%) and 30 had never been involved (41%). In total, 37 trainees (51%) were undergoing or had completed formal research training and 12 reported being a current or former Academic Trainee (16%).

Thematic findings

Three main themes were developed which are mapped in Figure 1, i) motivations for engagement in trainee collaborative research, ii) challenges to that engagement and, iii) facilitating and optimising trainee collaborative research.

Motivations for engagement in trainee collaborative research

Trainees, consultants, and researchers recognised that TRCs provided momentum to trial conduct, contributed to higher quality study designs which produced greater impact on clinical practice than individualised research and so motivated their involvement. Interviewees spoke of the *"power" (P02, trainee, interview)* of TRCs to deliver large studies relatively quickly by mobilising a cohort of trainees who facilitated access to, and recruited, patients and collected and reported data. Trainee engagement in TRCs and trials was viewed as mutually beneficial. It was also thought that trainees who engaged with TRCs would develop into research-active consultants (Table 1).

Table 1 Interviewee quotes for motivations for engagement in trainee collaborative research and challenges to that engagement

Theme	Participant quotes
Benefits of Trainee Collaborative Research	**Higher quality trials and greater impact** *"Hopefully, the attitude's changing from you can be a one-man band in your hospital and perform a small study that may not…have all that much influence…to do things in larger networks and nationally having a greater power…greater significance, better for patients." (P06, trainee, interview)* **Ability to deliver trials** *"We're able to turn over larger multi-centre studies quite quickly…that study…recruited 900 patients in a 12-week period over a national recruitment drive of about 50 sites." (P02, trainee, interview)* *"When we were trying to roll the study out, we were conscious that we needed the help of the registrars [trainees] all over [region] and the [collaborative] was a great forum to access that." (P29, research nurse, interview)* *"Trainees are pretty important in the way we deliver the trials. Nearly all of our patients are recruited in a very quick turnaround. A lot of it is out of hours...and the only people there are the surgical team [trainees]…a patient that comes in that's eligible and they will recruit them and randomise them…we really rely on the registrars [trainees]... You'd have quite substantial, well double the amount of staff that we do now." (P11 consultant, interview)* **Mutually beneficial relationship** *"I don't like the word using. I would say working with the trainees, and that's really important. It's a collaboration. They're not doing us a job. We are working with them and they're working with us, so I see it as them working with us, but equally our role with them is an apprenticeship in trials, and that's what they gain as well as a certificate and*

	all the rest of it. They are actually gaining this exposure to working with an expert team, which is really valuable and unique, so that's what I'd like to think." (P08, consultant, interview) **Investment in future research** *"Some of them [trainees] become research-active consultants and take their role to champion research in their unit...actually that's very valuable...the whole point of collaborative research is that we want to prepare trainees to be research active clinicians." (P07, trainee, interview)* *"They [TRCs] also give the next generation of academic's real experience of the difficulties and politics involved in running research projects." (P16, trainee, survey)*
Trainee motivations to engage with collaborative research	**Personal motivations** *"I think the initial carrot is always going to be the line on the CV that they become a named author, they get a publication or a presentation out of it and I think that is definitely what brings them into the room." (P05, trainee, interview)* **Interest in research** *"There was … that [training requirement] when I first got involved…didn't really know much about research. As I got involved, I actually found it enjoyable." (P02, trainee, interview)* **Altruistic motivations** *"Best opportunity as a trainee to contribute to meaningful research that has the potential to improve patient care." (P5, trainee, survey)* **Gaining knowledge and skills** *"They [trainees] understand that participation will develop skills for them not just understanding how to do research, but…transferable skills – communications skills, how you talk to patients, colleagues…leadership skills, and so on." (P07, trainee, interview)*
Challenges in engagement with trainee collaborative research	**Awareness and opportunity** *"Never been informed of the existence of a trainee research collaborative." (P29, trainee, survey)* **Time restraints** *"The time is a big constraint…there's so many other demands on your time as a surgical junior. It's the wards want you, theatre…nurses, clinic…assessments as part of your training…to leave time for research…it all gets a bit squeezed…shifted to the bottom of the pile." (P06, trainee, interview)* **Perceptions of poor quality** *"Research should be led by people with the sufficient time and training to do so and who are paid from this role." (P65, trainee, survey).* *"Some people… would say that it's a risk in terms of poor quality data… if you involve a hundred people at a site rather than three, there's an understandable concern that you will have a lower quality trial." (P08, Consultant, interview)* **Lack of recognition and transparency in roles** *"At the end of the day really are one or two people who put a lot of time and effort in who are actually going to benefit from this…there can be some cynicism that although it states collaborative, the person whose name is at the front or at the back of the authorship is really the one that you're doing it for." (P24, trainee, interview)* **Confidence and integration**

	"When you have a group of people who are well established and you're the new person coming in…sometimes it's hard to break into the ranks of that." (P23, trainee, interview) ***Trainee movement*** *"You can look at it both sides of the coin I think, it can be a difficulty because yes trainees will find it difficult to be a CI because we're not registered in a permanent kind of role at a hospital, but it really allows trainees to move round trusts. Also to try and spread the word if you would to one site to another and get other sites involved where they might have been involved in a study at one site setting that up and then they move on to the other site and so that site then gets set up etc and they can move round each time." (P02, trainee, interview)* *"I think as the CI of a project you need to be wary of when the rotation dates are, because you don't want to plan to collect data just before or just after someone's moved a rotation. So, I think you have to be mindful of when you plan your data collection points." (P05, trainee, interview)* *"Depending on which consultant you're working with at that time is probably going to negate whether you act on that research or not but because they move around fairly quickly then most of them get a chance to do so at some point." (P29, research nurse, interview)*

In the survey, trainees engaged in collaborative research because of i) an interest in surgical research (n=43, 59%), ii) publications (n=39, 53%) and iii) improving patient care (n=37, 51%) (Table 2). Some interviewees thought that their interest in publications was *"purely selfish" (P19, consultant, interview)* to further careers, or meet training requirements so a *"line in your CV" (P06, consultant, interview).* In contrast (and in the survey) many interviewed trainees had a genuine interest and enjoyed research and took up research training positions whilst others initially engaged in research to meet training requirements but came to enjoy it (Table 1). Contributing to the advancement of their field and meaningful research for patient benefit were also important to interviewed trainees. Trainees welcomed the opportunity to generate study ideas and receive training to build their skills and confidence (Table 1) as was observed during TRC meeting presentations by a Clinical Trials Unit (CTU) member on trial methodology and Good Clinical Practice by a Clinical Research Network representative.

Table 2 Survey reasons for trainee involvement in or declining surgical collaborative research

Reason	**Number of respondents (N = 73)**
Involvement in surgical collaborative research	
Interest in surgical research	43 (58.9%)
Increase publications	39 (53.4%)
Improve patient care	37 (50.7%)
Satisfy Annual Review of Competence Progression (ARCP) requirements	22 (30.1%)

Mentoring	21 (28.8%)
Education about research and governance	17 (23.3%)
Encouraged by Programme Director	1 (1.4%)
Declining involvement in surgical collaborative research	
Insufficient time	13 (13.4%)
Timing of meetings	7 (7.2%)
Issues with authorship of collaborative research	7 (7.2%)
Not recognised at Certificate of Completion of Training	6 (6.2%)
Projects not of interest	6 (6.2%)
Too junior to be part of the collaborative	5 (5.2%)
No surgical research collaboration in my region	4 (4.1%)
Other	4 (4.1%)
Not feel welcome at the collaborative	3 (3.1%)
Not interested in collaborative research	2 (2.1%)
Location of the meeting is too far away	1 (1%)
N/A as not involved in TRCs	39 (40.2%)

Challenges in engagement with trainee collaborative research

Some interviewees and survey respondents reported a perception that trainee collaborative research is of poor quality as trainees have insufficient skills or time to conduct research. This appeared to discourage some trainees and collaborators and was also discussed at observed TRC meetings. One of the main concerns were competing clinical priorities and a lack of time for research and *"trainee fatigue" (P09, trainee, interview).* Individualised, smaller studies could be quicker to complete and publish. Trainee movement between hospitals can pose problems yet amplifies engagement opportunities but necessitates careful planning (Table 1).

Trainees were also hesitant about engaging with TRCs if they did not receive appropriate recognition for their contributions. Confidence and integration into a trainee collaborative were sometimes challenging as several survey participants were unaware of how to get involved in TRCs or had limited opportunities e.g., evening meetings due to childcare provision (*P31, trainee, survey*) (observed TRC meetings were in the evening, (Table 1). Some trainees also found it difficult if TRCs had a predominantly male membership so seen as a *"boys club" (P13, trainee, interview)* (Table 1) and we also observed that junior trainees (or those moving from a different Deanery) tended to sit at the back of TRC meetings and made fewer contributions.

Strategies for facilitating and optimising trainee collaborative research

Trainee engagement and collaborative research were optimised with support from consultants, CTUs, research nurses and by having transparency over roles and authorship. Additional facilitators were study designs that the TRCs could enact easily, training and career progression opportunities.

The role of TRCs

TRCs played an important role in providing a supportive infrastructure for collaborative research and in *"bringing together the pieces of the puzzle" (P19, consultant, interview)* through mentorship from individuals with knowledge and experience in trials. In one observed TRC meeting trainees gravitated to discussion groups led by more senior members of the TRC. Trainees also presented study ideas or had a sandpit-type session with senior academics and surgeons and some trainees providing constructive feedback. TRCs were also seen to facilitate networking and collaboration and trainees could get involved at the level and time appropriate to their circumstances (Table 3).

Consultant surgeon support for TRCs

Consultant surgeon involvement and support was critical to establishing and maintaining TRCs and clinical trials, providing consistency for trial oversight and regulatory bodies and encouraging trial completion. Interviewees recommended seeking consultants to collaborate with, including at TRC meetings (also seen in observed meetings) (Table 3).

CTU and research nurse support for TRCs

TRCs fostered communication between trainees, CTU staff and research nurses. CTUs provided important methodological and statistical support to trainees but also benefitted from the TRC-led trials in a symbiotic relationship. Research nurses helped co-ordinate trial recruitment and held knowledge about studies which could benefit trainees although they described how it was difficult initially working with multiple trainees on a trial as a new working practice. Nurses also felt it was important for early engagement by trainees and to develop good communication between all those involved which was helped by technology (Table 3).

Transparency in roles and authorship

The importance of being clear and realistic with trainees throughout a study in a 'term of engagement' and authorship agreements agreed by all parties was highlighted by many interviewees

(Table 3). Collaborative authorship models used by some TRCs recognised specific inputs and activities for group authorship which was supported by 49% (n=36) of surveyed trainees. However, 47% (n=34) of trainees surveyed stated co-authors should be individually named and in the observed meetings some trainees thought that collaborate authorship prevented first author publication requirements for the UK General Medical Council Certificate of Completion of Training (CCT).

Achievable study designs

Interviewees recommended that new TRCs commence with audits or feasibility/pilot studies to build skills and confidence as RCTs were regarded as daunting due to their duration, complexity, skills required and funding requirements. It was also helpful to identify specific aspects for trainees to contribute to obtain outputs (Table 3).

Training and career progression

Interviewees felt that greater recognition of research activity was needed in their career pathway and greater emphasis on research training in the surgical curriculum. Survey respondents also thought TRCs should be part of surgical training (94.5%, n=69) but research should not be compulsory. Trainees valued informal, experiential in addition to formal training. Having trainees co-lead studies with more senior colleagues also allowed trainees to build confidence and skills and addressed funder requirements for a 'consistent', consultant on grant applications. Trainees could benefit from dedicated research time away from their busy clinical routines or for formal research training (e.g., undertaking a PhD/MD) (Table 3).

Table 3 Interviewee quotes for facilitating and optimising trainee collaborative research

Facilitator	Participant quotes
TRCs facilitation of collaborative research and consultant support	***Mentorship*** *"Medical students coming, they can see that senior registrars want to make contributions and hopefully inspire people or guide them in the path…there's an educational, a mentorship element." (P04, trainee, interview)* ***Consultant support*** *"Our role with them is an apprenticeship in trials…they are actually gaining the exposure to working with an expert team, which is really valuable and unique." (P11, consultant, interview)* *"The consultants are there for mentorship but also because we need consistency within the site…because trainees move around the region." (P02, trainee, interview)*

	Widening access and providing choice *"There are a few people that like to get involved in different aspects of the research pathway…part of the attractiveness of it [TRC involvement] is that you can be as much or as little invested in it as you like." (P12, trainee, interview)*
TRCs engaging with CTU and research nurses	***CTUs*** *"A person who will be based within the [CTU], whose remit will be to spend their entire time working with trainees…on an idea that we have said it's worth taking forward and they will help them deliver the first steps of it." (P28, methodologist, interview)* *"[methodologist] has been supporting us …we are trying to build that link…he came along to our meetings…you can't do these things out of thin air; you need to link in with people who have expertise, and the trials unit is great for that." (P06, trainee, interview)* ***Research nurses*** *"Tap into your research nurse. Because the research nurses are the ones with all the protocols, all the paperwork, they've probably got more time to discuss the studies with you than the consultants." (P29, research nurse, interview)* *"We'd never done anything like this before…it's not bad, it's just the enormity of the challenge… previously… there's one or two doctors that you liaise with…it's a very clear linear pathway as to who's your point of contact, and who's recruiting the patients…then…there is this new idea of getting as many trainees involved in research, and …a whole new strategy that we had to come up with." (P32, research nurse, interview)* *"We managed to set up a WhatsApp group…liaising on a daily basis making sure that you connected with the surgical trainee that was on that day, what they had and hadn't done, who were the eligible patients?" (P32, research nurse, interview)*
Transparency in roles and authorship	***Clarity and transparency in roles and responsibilities*** *"For trainee involvement to work well there has to be a clear objective task for them to do…for a specific award had to be clearly defined." (P26, methodologist, interview)* *"In the [CTU] we've got a policy that if somebody moves on, they do not lose their intellectual property rights…we expect you to respond to requests and…a system like…the International Committee of Medical Journal Editors as to who is eligible to be an author." (P21, methodologist, interview)* ***Collaborative authorship*** *"The research collaborative is offering something different…we have a corporate authorship policy whereby this single authorship for anything that comes from the groups and then within…will be broken down into different groups…writing groups, steering group, data analysis, local leads, collaborators." (P12, trainee, interview)* *"I think there's a perception that it's more useful, more important to have your own first-author paper." (P07, trainee, interview)* *"It [corporate authorship] doesn't in any way recognise the disproportionate or the varying effort that different trainees make… we ended up with…sixty-five authors…it's promoting a lot of the worst practice that happens with medical authorship in my opinion." (P26, methodologist, interview)*
Achievable study designs	*"Don't start with a trial, because it takes a long time, you need a grant, stats, a protocol and ethics, and those are the hardest things to do…Start with a simple,*

	collaborative prospective snapshot audit or cohort study…a quick win, then set up some bigger stuff, like trials." (P08, consultant, interview) *"I think another thing is running simpler studies…entry step, so that they can see, well this is what collaborative studies are about…and maybe they'll be excited and inspired to then take part in an RCT." (P07, trainee, interview)*
Training and career progression	*"We've moved towards changing some of our CCT requirements from…you have to produce three papers…that actually nobody seems to really care what the quality is and what the content is it's just sort of a box ticking exercise. There's a move from that to having recruited a certain number of patients…I think that if you were to make it a requirement that would shift the culture and the way people think about these things." (P06, trainee, interview)* *"I think you need to understand the methodology more, so I absolutely think there is a place in the curriculum. I think if you're going to shift critical mass of understanding about research, that's one of the only ways it's going to happen." (P05, trainee, interview)* *"They have set up what they call a co-PI network, so they've got the PIs…the experienced [clinician] and they've all identified a junior colleague who is working with them." (P20, methodologist, interview)* *"Ideally, we would give people time, because I think that's the biggest, constraint people have. Everyone's busy, you know, they've got on-call rotas, they're busy looking after patients on the ward, they're trying to go to theatre to get their surgical training, and this stuff does take time. It takes time to get your head around the trial, to see a patient, talk to patients about it, so if there was one thing we could do, I would say, 'Well, let's give every single trainee in the region half a day a week or whatever to spend participating in research.' That would be a huge help." (P07, trainee, interview)* *"There's no substitution for being involved and learning on the job as you would because you see the pitfalls, you understand the drawbacks and limitations of things, hurdles that you have to get across then also you learn about the rules and regulations of everything, why they're in place, the importance of the protecting patients, protecting clinicians and all that kind of thing as well that you don't really grasp unless you apply it in practice." (P02, trainee, interview)*

TRC engagement strategies and dissemination

The expert workshop prioritised five strategies for enhancing TRCs (Table 4). These strategies were converted into a 6-minute animated digital story on YouTube in 2019 (https://www.youtube.com/watch?v=vbITEHMjQfU) with 378 views (Supplementary material – video 1). A presentation at the National TRC meeting in 2019 received positive feedback including 232 twitter impressions and was subsequently uploaded to four national and international TRC websites illustrating its perceived usefulness.

Table 4 Top five strategies for enhancing TRC engagement

Strategy	Strategy	Examples of how strategy can be achieved

1	Create opportunities for trainees to generate study ideas and complete trial methodology training.	- Having trainees get involved in trial development alongside more experienced colleagues. - Trainees taking formal methodology courses and undertaking on the job training.
2	Promote trainee and collaborative engagement by having achievable study designs with quick wins.	- Getting involved in simpler studies like audits and feasibility studies can help build research skills and confidence. - Provide flexibility for trainees to be involved in different research aspects that suit their needs and circumstances.
3	Seek out the support of a consultant champion to provide consistency for a trial and mentorship to trainees.	- Have consultants involved in a trial to provide advice and guidance to trainees. - Having senior expertise can increase perceived credibility of a study to funding and oversight bodies. - Provide consultants with summaries of what is expected of them (e.g., agreeing to their patients being recruited) and what the trainee will be responsible for doing (e.g., data collection and follow up). - Have consultants attend monthly trainee collaborative meetings to provide feedback and expertise.
4	Be transparent about what is expected from all those involved in the trial and clarify roles, responsibilities and working practices early on.	- Ensure the work of trainees is recognised. - Terms of engagement can help define expectations for all those involved from the outset. - Creating a transparent authorship policy makes it clear up front how everyone will be credited for both trainees and collaborators such as universities and clinical trials units. - Consider having a corporate authorship model which can ensure everyone is acknowledged when a large group are involved.
5	Engage with and have better communication with collaborators such as Clinical Trials Units and Clinical Research Networks.	- Clinical trials units can provide expertise clinicians do not have (e.g., statistical support, data management and trial oversight). - Have a key person from the trials unit to work with, provide guidance and help develop the trial. - Build good relationships with research nurses. They will have trial protocols and paperwork and have more time to discuss the trial with trainees.

Discussion

Interviewees thought that surgical TRCs were generally successful in engaging trainees in research. However, we identified barriers and issues for trainees engaging in TRCs including time

pressures due to clinical and other competing priorities (e.g., childcare), concerns about research quality, and wanting recognition for their inputs, most notably authorship. Trainees wished to increase surgical evidence and improve patient care; advance their careers and receive training and we utilised these motivations in developing strategies for enhancing engagement in TRCs. TRC strategies included gaining consultant and CTU support, creating opportunities for mentoring of trainees and to design studies, promoting the TRC with a rapid simple study and transparency about involvement and recognition, including authorship. These principles are valuable insights for TRCs as they are now being expanded into all clinical areas by the NIHR through their API scheme. The strategies can be accessed most easily by TRCs through the digital animation which was produced to promote their dissemination and wider uptake.

The establishment of TRCs, their structure and conduct of trainee-led studies have been described for several clinical specialities (14), (15) (16), including some of the strategies developed in this research e.g., a consultant champion (5). Consultant support was also highlighted in a recent study of a trainee-led clinical trial involved with the NIHR API scheme (17). Some TRC-led publications also advocated starting with a simple study design to give rapid recruitment and outcomes (15) since trainee and consultant support can be variable until they are convinced of the merits of TRCs (15, 16). Providing opportunities for trainees to generate study ideas and take on leadership roles e.g., as Co-PI in TRC-led studies had not been highlighted previously to engage trainees. The interests of trainees in progressing their careers were also highlighted clearly in this study and although regarded by some as “selfish” this benefitted the TRCs and potentially research more broadly. Identifying committed trainees was a WMRC principle (5) but we showed that time and competing priorities are significant barriers, possibly reflecting increased trainee workloads since the formation of the WMRC. If TRCs can offer different options and levels of activity this could potentially increase trainee engagement.

The expectation of trainees for transparency around their involvement in a TRC and recognition of their inputs has been raised by several TRCs (5, 15) and in an analysis of TRC-led publications (18). Some TRCs have collaborative authorship policies to acknowledge trainee inputs (5, 14). Although our study found some support for this model, others preferred “headline” named authors, in part through concerns about publication requirements for the CCT. A consensus group has subsequently defined which TRC roles qualify for “significant authorship” for journal and CCT requirements (19) although acknowledging that named authorship for a TRC writing group could be appropriate. The

National Research Collaborative (a TRC umbrella organisation) is also campaigning for recognition of collaborative research in training pathways (20).

Advice and support from methodologists and CTUs in designing and conducting TRC studies was a key strategy in this study which was also highlighted by the WMRC (5). Professional speciality associations have provided infrastructure, academic and logistical support to TRCs (2, 20) although this was not a main strategy found in our study. Several TRCs have called for more tangible support to maintain their success (18), e.g., data collection systems or funding (20) having relied on technologically expert trainees for project infrastructure and database skills (16).

Challenges in clinician involvement with TRCs, like competing priorities and time constraints, also impact engagement at the trial level (21). Limited awareness of research chances and training also hinders clinician engagement with trials (22). We propose addressing these through TRC involvement and provide organisational/network level strategies to surmount trial-level clinician engagement challenges.

To our knowledge, this is the first multi-stakeholder investigation of trainee motivations to engage in surgical TRCs and research utilising quantitative and qualitative methods. The digital animation was also a novel dissemination strategy and potentially enhanced uptake by trainees and TRCs. The positive evaluation of using digital videos in science communication has highlighted their potential to expand dissemination, enhance understanding, and shift perspectives (23-26). The range of surgical specialities and TRCs across geographical areas increased the potential generalisability of findings. Triangulation of survey, interview and observation data gave an in-depth understanding of trainee collaborative research and correlations between data sources reinforced the main themes. The survey, we believe, uniquely included trainees not involved in TRCs so giving a broader perspective to inform these strategies. There are some limitations to the study as we only interviewed trainees involved in TRCs and those who were not involved may have held different views, possibly more negative or less informed about TRCs and enhanced understanding of engagement. The survey response rate was unknown (as there was no access to LEFT/Deanery registers) but was likely to be low and the uptake of the invitation to the stakeholder workshop was around 40% as some individuals did not reply to the invitation or were unavailable. The causes of interview non-response are unknown. Therefore, those who took part in interviews and the survey

might have had greater interest and stronger beliefs about TRCs than non-respondents, possibly affecting these findings. This study predates the NIHR Associate PI scheme (7), so we were unable to assess its impact on trainee research and engagement with TRCs which would be an interesting extension to this study. Involving patients and public in the research process may also have added value. This study focused on surgical TRCs so these results may not be applicable to other TRCs although similar benefits and challenges were identified for physician TRCs in a recent study (27). Limited time during the COVID-19 pandemic led to a publication delay from 2019 to 2023, during which time practice may have changed. However, reports of continuing challenges to clinician engagement in trials (21) (22) suggest these strategies are still relevant.

Conclusions

Trainee surgeons are generally motivated to engage with research and through TRCs can conduct RCTs. Trainee engagement in collaborative research can be facilitated by enhancing relationships between key stakeholders, maximising multi-disciplinary working, and providing trainees with training and career development opportunities. This study focussed on surgical trainees and TRCs, but these findings and recommendations may be applicable to other clinical specialities and health professional groups which is important since the NIHR API scheme has been expanded recently across the NIHR portfolio.

List of abbreviations

ARCP - Annual Review of Competence Progression

CCT - Certificate of Completion of Training.

CTU – Clinical Trials Unit

LETB - Local Education Training Board

NIHR – National Institute for Health Research

PI – Principal Investigator

RCS Eng – Royal College of Surgeons England

TRC – Trainee Research Collaborative

WMRC – West Midlands Research Collaborative

Declarations

Data sharing statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

NH, TP, JB, NB, JB, DN have been involved with a TRC; CC, KC, JV, RB, AA, CS, LM, GM, JAL are methodologists who work with a CTU or in trials methodology and ZH and VH are research nurses who work with clinical research networks.

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Contributorship statement

JAL and NB conceived the study idea. CC, KC, NH, TP, JB, NB, JC, RB, AA and JAL were involved in the design of the study. CC and KC conducted qualitative data collection and analysis with input from JAL. NB, NH and KC conducted the survey data collection and analysis with assistance from other trainee surgeons. CS, ZH, LM, GM, JG, DN and VH were involved in the stakeholder workshop. CC

drafted the initial manuscript. All authors commented on drafts and have seen and approved the final manuscript.

Ethics approval statement

Ethical approval was obtained from the research ethics committee of the Faculty of Health Sciences at the University of Bristol [47721]. All interview participants gave informed consent and agreed to publication of anonymised quotations. Survey completion was taken as implied consent and all responses were anonymised.

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Figure 1. Thematic map of main themes for facilitating engagement with trainee collaborative research

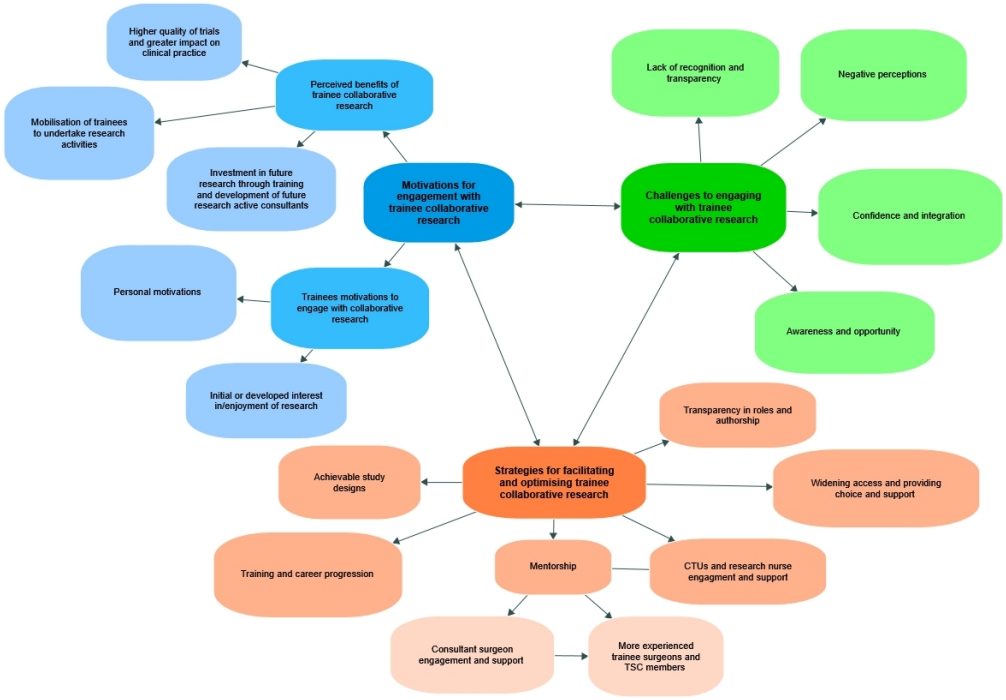

Figure 1 Thematic map of main themes for facilitating engagement with trainee collaborative research

98x68mm (300 x 300 DPI)

Supplementary 1: Observation topic guide

Topic	Field notes
Members	Who attends, what are their roles and how do they contribute?
Organisation of meeting	Who chairs the meeting and what is their role, are attendees introduced, who makes introductions?
Agenda	What are the main items for discussion, what are the goals, priorities for discussion, how much time is spent on each item for discussion? Are there presentations, documents or handouts?
Content of discussion	What is discussed? What information is provided and by whom? Are training requirements discussed? Are strategies and recommendations for the TRC or research discussed and by whom?
Group interactions and decision-making	Who contributes to discussion, who asks questions and who responds? What roles do members adopt during discussion, is there an expert, who adopts this role? Who dominates the group discussions and who is quiet of silent? What is the general atmosphere, is it rushed, tense, relaxed?

Supplementary 2: Interview topic guide

Topic	Discussion content
Participant background	Clinical, research, methodological, clinical, stage of training, current post, any TRC and trials experience.
Current TRC and research experience	Set up and running of TRCs and trials including any barriers and facilitators.
Understanding and awareness of trials	Training and knowledge and where obtained.
Current trial(s) involvement	Any current involvement with information about the trial(s)
Trial conduct and trainee involvement	Set up of the trial, roles and activities for trainees in trial(s), any barriers and facilitators, strategies for addressing issues.
Motivation and challenges to trainee engagement with trials	Why trainees engage and don't engage with trials
Stakeholder, organisation involvement and support	What the roles of these groups are and what their involvement is and what support provide, e.g. CTUs, university, research networks.
Training requirements	Any training requirements needed for trainees to engage with trials?

Supplementary 3: Coding framework

01. Why do trainees get involved in research
    - Altruism
    - Advancement of field
    - Contribution to the evidence base
    - Patient benefit
    - Personal Development
    - Being naturally inquisitive
    - Enjoyment
    - Knowledge and skills development
    - Ownership and responsibility

02. Why trainees don't get involved in research
    - Challenges to trainees' engagement in trials
    - Overcoming challenges to the engagement of trainees
    - Streamlining
    - Clinical vs. academic or research work
    - Feeling intimidated
    - Pushback from others
    - Recognition
    - Authorship issues
    - Time and movement
    - Trainee Fatigue
    - Trial resources

03. Overcoming challenges to trainee engagement with trials
    - Access to training research events and meetings
    - Choice and control
    - Consideration of trial design and conduct
    - Ownership and responsibility Co PI or CI role for trainees
    - Strategies for engagement of trainees
    - Working with others

04. Roles of key people
    - Academics
    - Clinical Trials Unit Staff
    - Models or strategies for CTUs working with trainees
    - Surgical Trials Unit
    - Working with trainees from perspective of CTU
    - Consultant
    - Key people
    - Research Nurses
    - Working with trainees from the perspective of Research Nurses
    - Roles of trainees in research
    - Trainee Network Chair

05. Characteristics of Trainee Collaboratives
    - Aims and objectives of collaborative
    - Collaborative meetings
    - Collaborative resources
    - Collaborative studies and trials
    - Selecting studies or trials
    - Setting up collaborative
    - Structure of collaboratives and sustainability

06. Benefits of working with trainees
    - Access to clinical skills
    - Increased people power and reach
    - Using vs. working with
07. Benefits of collaborative working
    - Bringing together the Pieces of the puzzle
    - Interdisciplinary working
    - Investment in future surgical trial leaders
    - Mentorship
08. Engagement with Collaboratives
    - Challenges to engagement with collaboratives
    - Cross Collaboration working
    - Facilitators to engagement with collaboratives
    - Collective momentum or critical mass
    - What doesn't work and why
    - What works well or why it works
09. Authorship
10. Challenges in surgical trials
    - Overcoming challenges in surgical trials
    - Role of trials in surgery
11. Funding and resources for conducting trials
12. Interviewee advice to trainees
13. Interviewee Background
    - Research experience
    - Role in collaborative
14. Trainee knowledge and training in trials
    - Formal training and knowledge
    - Informal training and knowledge
    - Recommendations for training from interviewees

Supplementary 4: Survey questions

Survey - Trainee Views on Surgical Trainee-led Research Collaboratives

Please answer the following questions about yourself and your views on surgical research collaboratives. For most answers, check the box(es) most applicable to you or fill in the blanks.

About You

1. Your Age

……years

2. Your Gender (Select only one)

☐ Female

☐ Male

3. Your Grade

☐ CT1

☐ CT2

☐ ST3

☐ ST4

☐ ST5

☐ ST6

☐ ST7

☐ ST8

☐ Trust grade (please specify level)……

☐ Other (please specify)……

4. Your Speciality (Select all that apply)

☐ Cardiothoracic

☐ General Surgery

☐ Neurosurgery

☐ Oral & Maxillofacial Surgery

☐ Otolaryngology

☐ Paediatric Surgery

☐ Plastics Surgery

☐ Trauma & Orthopaedic Surgery

☐ Urology

☐ Vascular

☐ Undecided

☐ Other

5. To which region do you belong (i.e. deanery affiliation):

☐ Eastern

☐ Kent, Sussex & Surrey

☐ Leicestershire, Northamptonshire & Rutland

☐ London

☐ Mersey

☐ Northern

☐ Northern Ireland

☐ North West

☐ Trent

☐ Oxford

☐ Scotland

☐ Southwestern
☐ South Yorkshire and South Humber
☐ Wales
☐ West Midlands
☐ Wessex
☐ Yorkshire

6. Are you full-time or less than full-time
☐ Full-time
☐ Less than full-time

Have you obtained/are you undertaking a formal research qualification (Select all that apply)
☐ MRes
☐ MPhil
☐ MD
☐ PhD
☐ Other (please specify).....
☐ No

Are you an Academic Trainee?
☐ Academic Trainee (current)
☐ Academic Trainee (previous)
☐ No

About Your Publications

9. In the following table, please state the number of PubMed citable publications you have at each type of authorship, for either trainee-led research collaborative studies or other research

	(i) Trainee-led collaborative study (please state the Journals for each and if you paid to publish)	**(ii) Other research study (please state the Journals for each and if you paid to publish)**
a. First author		
b. Co-author (named appears on PubMed alongside title and other part of citation)		
c. Corporate authorship (i.e. as part of a larger group with which the study group itself is the named author)		
d. 'Other' (i.e. citable contributor)		

About Surgical Research Collaboratives

10. Are you currently involved in any studies through a surgical research collaborative?
☐ No
☐ Yes

11. Have you previously been involved in any studies through a surgical research collaborative?
☐ No
☐ Yes

12. If you have been involved in surgical research collaborative research projects, what has your contribution been to these projects? Please select the appropriate category(ies) for your contributions and state the number for each.

Contribution	Previously Involved		Currently Involved	
	(i.) Regional (Involves hospitals within one collaborative)	(ii.) National or international (Involves hospitals across two or more collaboratives)	(iii.) Regional (Involves hospitals within one collaborative)	(iv.) National or International (Involves hospitals across two or more collaboratives)
a. Steering Committee (i.e. project development and running of studies)				
b. Writing Group (i.e. contribution to writing manuscript)				
c. Regional Lead (i.e. coordinating project at regional hospital sites)				
d. Local Lead (i.e. coordinating project at local hospital site)				
e. Local Collaborator (i.e. data collection)				
f. Data Validation (i.e. validation of selected patients)				
g. Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)				

13a. For each of the roles listed below please indicate how likely you would be to get involved in a future trainee-led surgical collaborative study?

Steering Committee (i.e. project development and running of studies)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Writing Group (i.e. contribution to manuscript)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Regional Lead (i.e. coordinating project at regional hospital sites)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Local Lead (i.e. local hospital lead)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Local Collaborator (i.e. data collection)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely
Data Validation (i.e. validation of data previously collected for a study)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely

Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)	Very Unlikely	Unlikely	Neither Likely or Unlikely	Likely	Very Likely

13b. Please use the free text space below for any comments for your answers to the above questions

……

……

14a. If you have been involved in a surgical collaborative research project, what was/were the reason(s) you got involved? (please select all that apply)

☐ I have an interest in surgical research
☐ I wanted to improve patient care
☐ I wanted to increase my number of publications
☐ For networking
☐ I was encouraged to by programme director
☐ To educate myself about research and governance
☐ To satisfy ARCP requirements
☐ Other……..

14b. What was the main reason you got involved (please select one)

☐ I have an interest in surgical research
☐ I wanted to improve patient care
☐ I wanted to increase my number of publications
☐ For networking
☐ I was encouraged to by programme director
☐ To educate myself about research and governance
☐ To satisfy ARCP requirements
☐ Other……..

14c. Please provide any further details about your answer

……

……

15a. If you have never been involved, or have decided not to participate in further surgical collaborative research projects, what reason(s) prevented you from taking part? (select all that apply)

☐ I am not interested in collaborative research
☐ I do not have time
☐ There is no surgical research collaborative in my region
☐ It is not recognized at CCT (certificate of completion of training)
☐ The location of the meeting is too far away
☐ The time of the meeting means I cannot attend
☐ The projects are not of interest to me
☐ I do not feel welcome at the collaborative
☐ I feel I am too junior to be part of the collaborative
☐ I have issues with authorship of collaborative research
☐ Other (please specify)……

15b. Please provide any further comments, including any other barriers to your involvement:

……
……
……
16. Do you think trainee-led research collaboratives have a place in surgical training?
☐ Yes – Why……
☐ No – Why not……
17a. How should CCT requirements recognize involvement in trainee-led research collaboratives? (select all that apply)
☐ Number of projects involved with
☐ Number of publications
☐ Number of first author publications
☐ A points based system based on contribution
☐ Merit judgement by the Speciality Advisory Committee (SAC)
☐ Other, please specify:……..
☐ Should not be recognized at CCT (please go to question 18)
17b. What specific aspects of the research process should be recognized? (Select all that apply)
☐ Steering Committee (i.e. project development and running of studies)
☐ Writing Group (i.e. contribution to manuscript)
☐ Regional Lead (i.e. coordinating project at regional hospital sites)
☐ Local Lead (i.e. coordinating project at local hospital site)
☐ Local Collaborator (i.e. data collection)
☐ Data Validation (i.e. validation of selected patients)
☐ Advisory Group (i.e. mentored a project with expert advice either in design or writing phase)
☐ Other, please specify:……..
17c. For publication purposes, how should authorship contribution of trainee-led research collaborative projects be recognised?
☐ Steering committee as named Co-authors with Contributors citable
☐ Single Corporate Authorship – Steering group and all contributors citable together
☐ Other (please specify)…….
18. Do you think involvement in surgical research collaboratives should be recognized by….? (select all that apply)
☐ UK Foundation Programme (UKFPO)
☐ Core Trainee interview process
☐ Higher surgical training interview process
☐ Academic training posts
☐ Certificate of Completion of Training (CCT)
☐ None of the above (Why?)
……

Supplementary 5: Stakeholder workshop strategy statements

Potential strategies for enhancing trainee engagement in research in full used in the stakeholder workshop

Letters in brackets relate to whom the strategy might be applicable (e.g., who could help take it forward):

CC=Consultant Champions, CI=Chief Investigators, CTU=Clinical Trials Units, F=Funders, RCS=Royal College of Surgeons, RN=Research Nurses, SA=Speciality Associations, TP=Training Programme(s), TRC=Trainee Research Collaboratives, U=Universities

1	**Trainee Research Collaboratives (TRC) organisation and conduct of research**
1.1	A "flagship" study with 'quick wins' to promote the collaborative (TRC)
1.2	Design trial so that trainees only collect key outcome data (that will be published) so their efforts are not wasted (TRC)
1.3	Seek Consultant Champion(s) to support the collaborative (TRC, CC)
1.4	Focus on engaging junior trainees and students (succession planning) (TRC)
1.5	Include several trainees on trial management groups/engage in trial problem-solving (spreads the word, builds skills, enhances ownership) (TRC, CTU, CI)
1.6	Competitions for trainees to generate study ideas (TRC, CC, CTU)
1.7	Piggy-backing TRC meetings to specialty meetings/training (critical mass) (TRC)
1.8	Social media to promote the group and facilitate communications e.g., Twitter, WhatsApp (TRC)
1.9	Help with small costs to facilitate TRC meetings (e.g. refreshments), TRC admin, websites, and projects e.g. software (CTU, CRNs, SA, RCS)
1.10	Dedicated time to conduct research but acknowledged as impossible! (TP, CC)
1.11	Different communication methods (e.g. video conference/Skype) for those further away to join TRC meetings (TRC)
1.12	Small group working for confidence-building in trainees new to the TRC (TRC)
1.13	Encourage simple studies that are more accessible to new trainees (pressure to do large "gold standard" trials can be intimidating) (TRC, CTU)
1.14	Ensure new pathways involving trainees in trials are clarified with research nurses at the outset (TRC, CI, RN)
1.15	Brief initiation with research nurses on new rotation (discuss studies and how to be involved, easier than with consultants) (RN, TRC)
1.16	Study summaries/simple agreements of roles and responsibilities to be drawn up, for information and agreement when moving to new departments or initiating a new study (enhances consultant buy-in) (TRC, CTU, CI, CC)
2	**Wider facilitation of TRCs and trainee-led research**
2.1	CTUs to be (more) open to working with smaller TRC studies (CTU)

2.2	CTUs to have a presence at and support TRC events (CTU)
2.3	More CTU support or posts for trainees to work within CTUs (CTU, F, CC)
2.4	Engagement/better communication with University methodologists (TRC, U)
2.5	Engaging with CTUs to "sell" benefits of working with trainees (TRC, CTU)
2.6	Improve communication of the benefits of TRCs to trainees, training bodies, and specialty associations (TRC)
2.7	Creating a positive research culture within Trusts so research is second nature (All?)
2.8	Facilitate dialogue between sponsors, funders, TRC, and HRA/R&D to support Co-CI/PI applications (CC, others)
3.	**TRC publications and authorship**
3.1	Transparency (e.g. realistic about what's involved, timings, authorship policy) (TRC)
3.2	Memorandum of understanding: what is expected from all parties at the start of a trial e.g. trainee 'moves on' in role or geographically and what they can expect. (TRC, CTU)
3.3	Criteria for corporate authorship to include quality of data collected (TRC)
3.4	Change publication requirements for career progression (TRC, TP)
3.5	Accessible key liaison person at CTU or University for trainees to help with study design and methodological advice (CTU, U, F)
3.6	Work with journals to support/clarify corporate authorship (TRC?)
4	**Trainee research skills development**
4.1	Training for medical students – wider availability of GRANULE course
4.2	GCP integrated into medical training (TP)
4.3	Making NIHR GCP courses more applicable to non-CTIMP trials and people recruiting (TRC, F)
4.4	Methodology Courses (e.g. BOSTIC or others) more widely available so all trainees have a baseline understanding of trials (U, CC, F, CTU?)
4.5	Free access to research methods courses for trainees doing it in their spare time (F, CTU, U, CC?)
4.6	Contribute research training to registrar induction/teaching days, conferences (TRC)
4.7	Rotate trainees on writing committees to develop writing skills (TRC)
4.8	Trainees as co-CIs, co-PIs, and support interested trainees (TRC, CTU, CC)
4.9	Study-specific training (if on rotation so can't attend site initiation visit) (CTU, RN)
4.10	Involve surgeons in adapting generic clinical trial training so the nuances of surgical trials are covered when delivering courses to surgeons. (TRC, CC)
4.11	Incorporate training in research methods within the trial meetings (CTU, CI)

Supplementary 6: Interview and survey participant characteristics

Participant characteristics	Interview participants (n=32)	Survey respondents (n=73)
Role		
Consultant Surgeon	5 (15.6%)	-
Clinical Trial Unit methodologist	7 (21.9%)	-
Research Nurse	3 (9.4%)	-
Trainee Surgeon	17 (53.1%)	73 (100%)
Gender		
Female	15 (46.9%)	29 (60.3%)
Male	17 (53.1%)	44 (39.7%)
Trainee surgeon grade	(n = 17)	
CT1/CT2	2 (11.8%)	22 (30.5%)
ST3/4/5	4 (23.5%)	22 (30.5%)
ST6/7/8	11 (50.0%)	24 (32.9%)
Trust Grade	-	2 (2.7%)
Other	-	3 (4.1%)
Surgical speciality	(n = 22)	
Cardiothoracic	0	1 (1.4%)
Colorectal	4 (18.2%)	0
General Surgery	7 (31.9%)	30 (41.1%)
Neurosurgery	1 (4.5%)	3 (4.1%)
Oral and Maxillofacial	0	1 (1.4%)
Otolaryngology	0	2 (2.7%)
Oncoplastic	2 (9.2%)	0
Paediatric	1 (4.5%)	2 (2.7%)
Plastic	1 (4.5%)	3 (4.1%)
Transplantation	1 (4.5%)	0
Trauma and Orthopaedic	1 (4.5%)	18 (24.7%)
Urology	0	6 (8.2%)
Upper gastro-intestinal	3 (13.7%)	0
Vascular	1 (4.5%)	5 (6.8%)
Undecided	0	2 (2.7%)
Clinician regions		
Eastern	2 (9.1%)	3 (4.1%)
London	2 (9.1%)	3 (4.1%)
Mersey	0	3 (4.1%)
Northern	1 (4.5%)	1 (1.4%)
Northern Ireland	1 (4.5%)	0
Northwest	1 (4.5%)	12 (16.4%)
Oxford	4 (18.2%)	0
Scotland	0	21 (28.8%)
Southwestern	4 (18.2%)	11 (15.1%)
Wales	2 (9.1%)	1 (1.4%)
West Midlands	5 (22.8%)	13 (17.8%)
Wessex	0	23 (2.7%)
Yorkshire	0	3 (4.1%)

Standards for Reporting Qualitative Research (SRQR)*

http://www.equator-network.org/reporting-guidelines/srqr/

	Page/line no(s).
Title and abstract	
Title - Concise description of the nature and topic of the study Identifying the study as qualitative or indicating the approach (e.g., ethnography, grounded theory) or data collection methods (e.g., interview, focus group) is recommended	P1/L1
Abstract - Summary of key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results, and conclusions	P3/L1
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	P5/L1-17
Purpose or research question - Purpose of the study and specific objectives or questions	P5/L14-17
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	P6/L2-7
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	P6/L10-11 P7/L20 P7/L26-27 P8/L4-8 P21/L2-5
Context - Setting/site and salient contextual factors; rationale**	P6/L9-31
Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	P6/L13 P6/L16-18
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	P21/L28-32
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	P6/L22-31

Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection; if/how the instrument(s) changed over the course of the study	P6/L27-31
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	P9/L1 to P10/L7
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	P6/L28 to P7/L10
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	P7/L1-10
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	P7/L1-10

Results/findings

Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	P8/L7 to P17/L1
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	P10/L20 to P11/L2 (table 1) P14/L11 to P16/L2 (table 4)

Discussion

Integration with prior work, implications, transferability, and contribution(s) to the field - Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	P8/L2 to P18/L16
Limitations - Trustworthiness and limitations of findings	P19/L1-8

Other

Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	P21/L1-5
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	P20/L7-19

*The authors created the SRQR by searching the literature to identify guidelines, reporting standards, and critical appraisal criteria for qualitative research; reviewing the reference lists of retrieved sources; and contacting experts to gain feedback. The SRQR aims to improve the transparency of all aspects of qualitative research by providing clear standards for reporting qualitative research.

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Reference:

O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. **Standards for reporting qualitative research: a synthesis of recommendations.** *Academic Medicine*, Vol. 89, No. 9 / Sept 2014
DOI: 10.1097/ACM.0000000000000388