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Exploring UK clinician perceptions of through-knee amputation compared to above-knee amputation: a mixed methods study

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ABSTRACT

Background: Through-knee amputation (TKA) has potential advantages over above-knee amputation (AKA) but is rarely performed in the United Kingdom (UK). This mixed methods study aimed to explore clinicians' perceptions of TKA compared to AKA.

Method: An online survey of vascular surgeons, prosthetists, and physiotherapists between May 2019 and April 2020. Follow-up semi-structured interviews explored themes from the survey. Thematic analysis was used to draw conclusions from the data.

Results: Seventy-eight clinicians returned surveys, and follow-up interviews were completed with 21 clinicians. Reported advantages of TKA include its long lever and the femoral condyles to anchor (suspend) the prosthesis. Perceived disadvantages include poor wound healing and unsatisfactory prosthetic appearance. The interviews uncovered ineffective communication along the amputation pathway, contributing to a compartmentalised approach to amputation surgery and rehabilitation. Clinicians with strong feelings against TKA and a lack of desire/perceived ability to drive change from clinicians in favour of TKA are barriers to increasing its use.

Conclusion: Current TKA surgery and rehabilitation practice is based on personal opinions, assumptions, or "accepted wisdom" and lacks an underpinning evidence base. Overall, opinions of TKA are divided, with conflicting views between different professional groups, highlighting the importance of multidisciplinary decision-making.

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> IMPLICATIONS FOR REHABILITATION

- Through-knee amputation has advantages and disadvantages compared to above-knee amputation which have been observed in clinical practice.
- Decision regarding level of amputation should involve multiple members of the multidisciplinary team.
- Lack of amputation pathway guidance and communication barriers prevent effective multidisciplinary collaboration.


Introduction

Over 3,000 major lower limb amputations are performed annually in UK vascular departments [1]. It is widely accepted that the more distal the amputation, the more likely the person is to regain independence and mobilise with a prosthesis [2–4]. Optimal rehabilitation reduces social care needs, improves long-term health, and improves quality of life [5,6]. For these reasons, below-knee (transtibial) amputation (BKA) is almost always preferred over above-knee (transfemoral) amputation (AKA) [7,8] and comprises approximately half of all UK annual lower limb amputations [1]. The remaining half are unsuitable for BKA and require amputation at a higher level. The next most distal amputation level is through-knee amputation (TKA). TKA is recommended in national and international guidelines as a suitable option for vascular patients [9,10] yet it is rarely used; only 3% of major lower limb amputations performed in the United Kingdom each year are TKA [11]. TKA is performed at the level of the knee, either leaving the

femur fully intact (knee disarticulation) or trimming the condyles and fixing the patella to the end (Gritti-Stokes) being among the most common, though several techniques exist [12]. The term through-knee amputation (TKA) is used to include all types of surgical techniques. The theoretical advantages of leaving the "intact" femur with its weight-bearing end and muscular attachments are often cited [13–15] still, the real-life impact on rehabilitation and medium to long-term function is unknown. Retrospective studies report reamputation rates of TKA to be 13–34% [15–17] compared to 4–5.4% for AKA [1,16]. Limb fitting rates are similar, however, 31–35% for TKA [16,18,19] and 30–38% for AKA [16,20]. However, the limitations of retrospective studies must be considered, and we await prospective randomised trials comparing TKA and AKA.

This study aimed to explore the experiences and perceptions of UK vascular surgeons, physiotherapists, and prosthetists regarding TKA, specifically, what advantages and disadvantages are

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observed compared to AKA, which patients should or should not be selected for TKA, and reasons why TKA is not commonly used.

Materials and methods

A mixed-methods approach utilising online surveys and semi-structured interviews was applied to explore clinician perspectives of TKA compared to AKA. Data collection and analysis were underpinned by a pragmatic viewpoint, with qualitative data from open survey items and interviews used further to explore the quantitative data from the closed survey items. The survey identified diverse views of TKA, which informed the sampling approach and interview topic guide. Ethical approval was obtained from the Hull York Medical School ethics committee (REF 2074,). Survey respondents were informed that their participation was voluntary, and that data would be processed based on consent. Interview participants received a participant information sheet and completed a consent form prior to participation.

Survey

The online survey used open and closed questions informed by literature [14,21,22] and was adapted to the focus of each clinical group. It was piloted at the Vascular Societies Annual Scientific Meeting 2018, reviewed by prosthetists at Hull University Teaching Hospitals NHS Trust and the research officers for the British Association of Chartered Physiotherapists in Amputee Rehabilitation (BACPAR). The survey was distributed in May 2019 *via* the following professional networks: The Vascular Society of Great Britain and Ireland (VSGBI), The British Association of Prosthetists and Orthotists (BAPO), the Scottish Physiotherapy Amputee Research Network (SPARG), and BACPAR.

Interviews

A sampling framework was used to capture views from clinicians with different experiences and opinions of TKA. Previous qualitative studies exploring clinicians’ perspectives of post-amputation prosthetic rehabilitation reached data saturation between six and 11 interviews with rehabilitation doctors, physiotherapists and prosthetists [23–25]. The additional view of surgeons is essential to this study; therefore, the target sample range was set as 15 to 20 to gain insight from key clinical roles along the amputation pathway [22]. Clinicians with diverse opinions of TKA were targeted to achieve a balanced view. Participants were contacted face-to-face or *via* email and recruited using a snow-ball technique [26]. Recruitment was stopped when the data quality was considered adequate to answer the research question [27]. Although the interview participants were not exclusively chosen from survey respondents, some of them had also completed the survey. The interviews were semi-structured using a topic guide generated in response to survey responses and lasted up to 30 min. One researcher (HG – female, physiotherapist and PhD student) completed the telephone, video call, or face-to-face interviews when COVID-19 pandemic restrictions allowed, at the participant’s convenience. Interviews were completed between July 2019 and April 2021 with pauses in recruitment due to the pandemic and resulting work pressures of the participants. Interviews were voice recorded, then transcribed verbatim and anonymised. Field notes were written after each interview to help with the reflexive process [28]. To prepare for the interviews, HG completed a qualitative methods masters level module and

practised pilot interviews. MT, an experienced qualitative researcher, supervised her. HG had worked in the same trust as a small number of the participants so knew them prior to interview.

HG produced the following reflexivity statement before starting the interviews:

“While working as a physiotherapist, I have heard contrasting views from colleagues regarding TKA. Some had told me that TKA always ends in poor outcomes for the patients, and others had told me that TKA is their preferred type of amputation. I was interested to determine if one of these views was dominant across UK clinicians. I had limited first-hand experience with patients with TKA, so I had no strong opinion either way.”

Data analysis

Survey data were analysed using descriptive statistics for numerical data and content analysis [29,30] for qualitative data. Content analysis was used to identify categories from the qualitative data and calculate their frequency of occurrence. Interview data were analysed using reflexive thematic analysis consisting of the following steps: familiarisation, generating initial codes, theme development, reviewing and defining themes, and writing the analysis [31]. Analysis was conducted by HG, a physiotherapist with experience in vascular and prosthetic rehabilitation, and MT, an academic behavioural scientist. NVivo software [32] was used for data management.

Results

Seventy-eight survey responses were received in total from 22 (28%) vascular surgeons, 43 (55%) physiotherapists, and 13 (17%) prosthetists. The response rate was low (5.5% vascular surgeons, 14% physiotherapists, and 4.3% prosthetists) but data-rich answers to open-ended questions and subsequent interviews allowed conclusions to be drawn.

Responses came from clinicians across the United Kingdom (Table 1). Most vascular surgeons were consultants (86%), and 93% of the responding physiotherapists worked in prosthetic outpatients, though many had a combined role with vascular inpatients or another speciality area. The prosthetists had an average of 23 years of clinical experience, and most (77%) worked in the National Health Service (NHS) rather than private practice.

Respondents had seen relatively few patients with TKA in the previous 12 months: surgeons performed a median of 15 major lower limb amputations at any level (IQR 13–21) but only median 2 TKA (IQR 0–3) in the last 12 months. Physiotherapists saw a median of 3 TKA (IQR 2–7) in 12 months and prosthetists saw a median of 3 TKA (IQR 2–7) in 3 months.

Table 1. survey responses by region.

Region	Number of responses
Scotland	13
Northern Ireland	2
North East	3
North West	7
Yorkshire	12
East Midlands	3
West Midlands	4
Wales	3
East of England	3
London	12
South East	13
South West	3

Table 2. Survey results - advantages of TKA compared to AKA.

Code	Category	Total n (%)	Surgeon n (%)	Physio n (%)	Prosthetist n (%)
Rehabilitation	Better sitting balance	35 (45)	8 (36)	24 (56)	3 (23)
	Long lever advantageous	29 (37)	9 (41)	17 (40)	3 (23)
	Functional residual limb	19 (24)	0 (0)	14 (33)	5 (38)
	Early rehabilitation easier	13 (17)	5 (23)	7 (16)	1 (7)
Prosthetics	Greater prosthetic function	28 (36)	4 (18)	18 (42)	6 (46)
	Superior suspension method	22 (28)	0 (0)	11 (26)	11 (85)
	Greater socket comfort	14 (18)	0 (0)	7 (16)	7 (54)
Surgical	Quick and easy procedure	21 (27)	7 (32)	8 (19)	6 (46)
	Muscles left intact	20 (26)	2 (9)	12 (28)	6 (46)
	Less pain	4 (5)	0 (0)	1 (2)	3 (23)
End weight bearing	Improves function for non-limb wearers	13 (17)	0 (0)	11 (26)	2 (15)
	Improves comfort and gait for limb wearers	6 (8)	0 (0)	4 (9)	2 (15)
	Only if knee disarticulation	4 (5)	0 (0)	2 (5)	2 (15)
	Only if Gritti-Stokes	3 (4)	2 (9)	1 (2)	0 (0)

<25% 26–50% 51–75% >75%

Shading key

Bold text = most common answer for that group.

The respondents reported the most common advantages of TKA were better sitting balance, a longer lever, and easier prosthesis use (Table 2). The superior suspension method for TKA was reported as an advantage by 85% of prosthetists, but only 26% of physiotherapists and no surgeons reported this advantage. The most reported disadvantages of TKA (Table 3) were poor cosmetic appearance, limited choice of prosthetic components, and poor wound healing. Diverse opinions between groups were more apparent for disadvantages; while 92% of prosthetists complained of limited componentry options, only 5% of surgeons shared this concern. Sixty-four per cent of surgeons described poor wound healing; no prosthetists reported any concern with wound healing post-TKA.

Nearly all (91%) surgeons responded that TKA is unsuitable for patients with tissue loss around the knee, while three-quarters (77%) of prosthetists and one-third (33%) of physiotherapists felt patients who place high importance on the cosmetic appearance of their prosthesis are not suitable. When asked which patient groups benefit most from TKA most (82%) of surgeons agreed that patients requiring bilateral amputation had the most benefit, whilst (42%) of physiotherapists reported it was those predicted not to use a prosthesis, and (62%) of prosthetists answered paediatrics due to the preservation of the growth plate.

Ten surgeons, six prosthetists and five physiotherapists completed interviews (Table 4). Twenty-seven clinicians were interested in participating in the study; six did not complete an interview due to lack of time, did not meet the inclusion criteria, or saturation had already been met from their clinical group or vascular centre. A greater proportion of surgeons were interviewed as their survey response rate was low, with the greatest variation between respondents in their answers. Moderate consistency was found between survey responses from the physiotherapists and prosthetists; therefore, fewer were recruited for interviews. Eight clinicians

Table 3. Survey results - disadvantages of TKA compared to AKA.

Code	Category	Total n (%)	Surgeon n (%)	Physio n (%)	Prosthetist n (%)
Asymmetrical knees	Uncosmetic	44 (56)	4 (18)	29 (67)	11 (85)
	Uneven knee centres	18 (23)	1 (5)	11 (26)	6 (46)
Prosthetics	Componentry limitations	31 (40)	1 (5)	18 (42)	12 (92)
	Socket challenges	12 (15)	2 (9)	9 (21)	1 (8)
Surgical	Poor wound healing	23 (29)	14 (64)	9 (21)	0 (0)
	Poor surgical technique	7 (9)	2 (9)	4 (9)	1 (8)
	Difficult surgery	7 (9)	6 (27)	0 (0)	1 (8)
	Uncommon practice	5 (6)	5 (23)	0 (0)	0 (0)
	Unable to end weight bear	5 (6)	0 (0)	3 (7)	2 (15)

<25% 26–50% 51–75% >75%

Shading key

Bold text = most common answer for that group.

Table 4. Interview participant demographics.

Subject ID	Profession	Experience
PHYS001	Physiotherapist	Sees small numbers of all types of TKA
PHYS002	Physiotherapist	See small numbers of all types of TKA
PHYS003	Physiotherapist	Sees small numbers of all types of TKA
PHYS004	Physiotherapist	Sees moderate numbers of all types of TKA
PHYS005	Physiotherapist	Sees large numbers knee disarticulation only
PHYS006	Physiotherapist	Sees large numbers Gritti-Stokes only
PROS001	Prosthetist	Sees small numbers of all types of TKA
PROS002	Prosthetist	Saw large numbers in previous trust but small numbers currently
PROS003	Prosthetist	Sees moderate numbers knee disarticulation only
PROS004	Prosthetist	Sees small number knee disarticulation only
PROS005	Prosthetist	Sees moderate numbers Gritti-Stokes only
SURG001	Vascular Surgeon	Performs 3–6 Gritti-Stokes per year
SURG002	Vascular Surgeon	Performed approximately 300 Gritti-Stokes in career
SURG003	Vascular Surgeon	Performs Gritti-Stokes once in every three proximal amputations
SURG004	Vascular Surgeon	Does not do any TKA
SURG005	Vascular Surgeon	Performs large numbers of Gritti-Stokes only
SURG006	Vascular Surgeon	Performs small numbers of knee disarticulation
SURG007	Vascular Surgeon	Always does knee disarticulation instead of AKA
SURG008	Vascular Surgeon	Does not do any TKA
SURG009	Vascular Surgeon	Performs large numbers of knee disarticulation
SURG010	Vascular Surgeon	Does not do any TKA but would like to

worked in Yorkshire, six in the South East, three in the West Midlands, and the remaining in Scotland, Wales, London and the North East. As all surgeons interviewed were consultant vascular

surgeons, they therefore had a minimum of six years working in vascular surgery. The physiotherapists were all senior specialists in vascular inpatients or prosthetic outpatients. The prosthetists ranged from junior prosthetists with 18 months experience at time of interviewing, to others with decades of experience. One prosthetist also had a TKA from childhood. Twelve participants were male and nine were female.

Three inter-connecting themes were produced from the interview data (Figure 1).

Theme I: Professional priorities

Primary wound healing was a priority that outweighed any other advantage the surgeons were aware of for TKA.

"It does give a little bit more stability in the wheelchair but not enough to warrant wound healing problems" (SURG008).

The dominant narrative was that TKA is associated with poor healing, which biased three of the surgeons to discontinue TKA from their practice altogether. Two surgeons have changed their TKA surgical technique to improve healing rates. Five surgeons base their decision as to level of amputation on whether a TKA is likely to heal and whether it will provide superior function to the patient.

Prosthetists prioritised creating a comfortable prosthetic socket, prosthetic end-weight bearing, and prosthetic self-suspension using the condyles, all made possible by TKA. Prosthetists also felt that a good-looking prosthesis is considered an important priority by their patients, which could improve patient satisfaction and use of the prosthesis.

"...people want to have optimal cosmesis and that is one of the big drawbacks of a through-knee" (PROS002).

In contrast to the prosthetists, for whom cosmetic finish was always the priority, the surgeons felt cosmetic factors should not be considered. Physiotherapists felt the poorer cosmetic finish needed to be balanced against the functional advantages offered by TKA.

"if that gentleman had been an above-knee limb wearer, yes, we would have done a better job of the cosmesis, I'm sure, but I don't think he would have walked as an above-knee limb wearer so, you know. What's more important?" (PHYS006)

"I think the ugly thing was overplayed, and I think probably it come from a dissatisfaction with their healing or something" (SURG009).

The dominant narrative from the physiotherapists was that patients with TKA find rehabilitation easier because they have better muscle control and balance and are in less pain, so they can start their rehabilitation earlier and progress quickly.

Professional priorities influenced the type of preferred TKA; prosthetists and physiotherapists almost exclusively preferred knee disarticulation, whereas many surgeons like Gritti-Stokes.

Theme II: Communication and power differential

Some prosthetists and surgeons describe a lack of visibility of each other's profession as they work in separate parts of the hospital, which creates a physical barrier to initiating communication. However, visibility does not always guarantee good communication between professional groups. Some surgeons describe needing to build trust with and confidence in the physiotherapist before they seek their opinion. Still, once a good relationship has been established, it no longer matters if the professional groups are co-located.

"The physio where I worked, I knew well, and I could phone her up and ask her advice... she was somebody who's opinion I valued..." (SURG002).

Prosthetists and physiotherapists describe their desire to be invited by the surgeon to give their opinion, suggesting they do not feel they can share their opinions unless specifically asked. However, some surgeons criticised physiotherapists for not providing their views, not realising that the physiotherapist was waiting for an invitation. This indicates a power dynamic that acts as a barrier to effective multidisciplinary collaboration. The hierarchical culture in the NHS leads physiotherapists to feel they can only speak when spoken to by the senior consultants, even if the consultants do not think this way.

"...no reason why the physiotherapist should not be involved in the level of the amputation. The culture needs to change" (SURG001).

A similar power differential exists between surgeons and prosthetists, which manifests as the prosthetics service feeling unable to provide feedback to the surgeon because they are worried about causing offence.

"No, we never really speak to the surgeons" (PROS001)

Power Differential and Communication

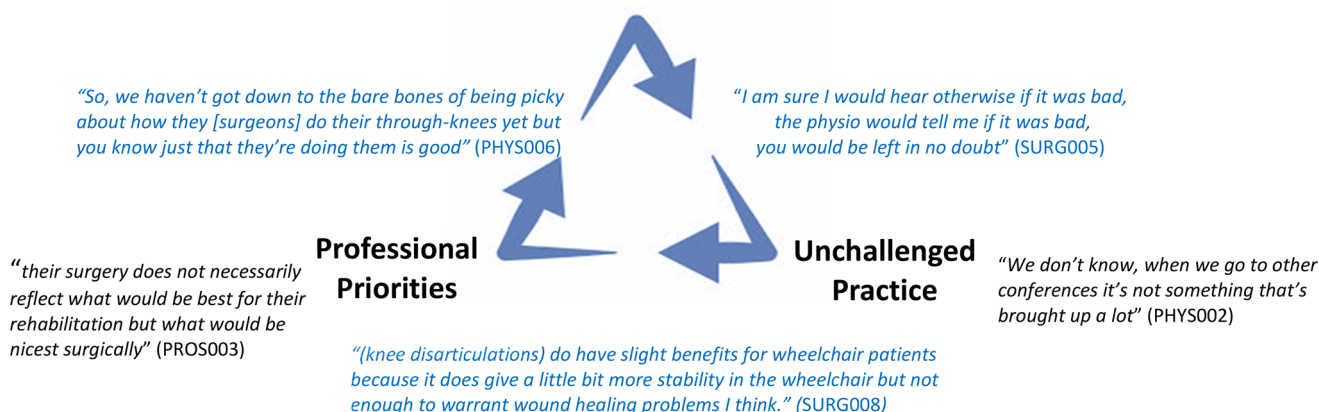


Figure 1. Interview themes.

“...traditionally surgeons won't be questioned or criticised” (PROS005).

In addition to worrying about offending, one prosthetist felt that a surgeon's time was too valuable to spend talking to the prosthetist. The prosthetists described the surgeons as being 'above' them. They did not seek to challenge the power differential between doctors and allied health professionals (AHP), reinforcing this invisible barrier between them.

“These people [surgeons] are very busy people, and that's not being condescending its, it is what it is, and have they got time to spend five minutes with the prosthetist, probably not.” (PROS002).

Theme III: Unchallenged practice

There is a lack of evolution in amputation surgical practice, which causes clinicians to feel defeated.

“We very rarely get any vascular disartic, so I would question, it might be something I need to do really, but question maybe why, is it actually considered in the process or not.” (PHYS004).

This lack of exposure caused the physiotherapists to be uncertain and lack confidence in their knowledge when treating patients with TKA. They would like more experience working with patients with TKA but are hamstrung. They feel they cannot challenge current practice because of the lack of evidence but cannot generate it themselves, so they blame others for the lack of change.

Three surgeons were not trained in TKA as junior surgeons at all; one had minimal training, and one was only trained in Gritti-Stokes. Four surgeons described that very few vascular trainees are taught how to do TKA nationally. The four surgeons interested in TKA had developed their surgical skills as consultants but described this as unusual.

“...we seem to have a problem with learning to do things as consultants.” (SURG007).

Consultant surgeons are unlikely to learn how to do TKA because amputation surgery is not considered an important surgery by some vascular surgeons, and therefore, it is not considered important to develop new skills in this area. The surgeons in this study describe a reluctance to talk with other surgeons about amputation techniques, which is very different to the prosthetists and physiotherapists.

“I think that reflects the position that amputation as a subject sort of figures in our world, we regard it as the end of the line, a failure” (SURG002).

Most of the surgeons interviewed do not feel there is a reason for their practice to change. Whether they perform TKAs or not, they are satisfied with their patient outcomes and confident in their decision-making. They justify this position by stating that there are few complaints from physiotherapists or prosthetists, so there is no reason for them to question their patients' prosthetic outcomes.

“I think on the whole, and I am sure I would hear otherwise if it was bad, the physio would tell me if it was bad, you would be left in no doubt.” (SURG005)

Discussion

This study has identified some unique features of TKA, some of which clinicians consider to be clinically meaningful advantages over AKA. Although a few of these attributes are mentioned in the literature, TKA has never been formally tested or compared to AKA [13–15]. This study is essential in confirming which factors

are observed as important differences by UK clinicians and warrant further research.

One finding from this study was the observation that people with TKA have better sitting balance without a prosthesis than people with AKA. To the authors' knowledge, there are no published studies quantifying sitting balance between people with TKA or AKA. Achieving independent sitting balance is one of the first goals in post-amputation rehabilitation [33] and has been shown to directly correlate with better mobility outcomes post-amputation [34]. Therefore, this is an important outcome to consider when choosing the level of amputation.

Several other advantages were claimed to exist thanks to the long lever arm and less insult to the musculoskeletal structures of the residuum than in AKA, including better transfer ability and superior gait quality than AKA. These advantages have been previously reported [14,19,35,36] without robust evidence to support these claims. Biomechanical outcomes have been compared between people with long and short AKA residual limbs, concluding that a longer residuum reduced hip stress in the contralateral limb [37]. The theoretical biomechanical advantages of a long lever arm may seem clear-cut, but the clinical and real-life impacts have not been demonstrated. So, the perceived benefits reported in this study and previous studies require robust evaluation if they are to influence surgical practice. One finding from our study, which is supported by evidence, was that people with TKA experience less pain than people with AKA. A cross-sectional survey [38] found that people with TKA reported less severe phantom pain, less pain that interferes with daily activities, and less back pain when compared to AKA and BKA.

Another study finding was that TKA has been observed to allow greater socket comfort and enable superior suspension methods compared to AKA. Socket comfort has been described as the most important aspect of prosthetic rehabilitation [39], without a comfortable socket, the prosthesis user will be reluctant to mobilise. While socket comfort has been previously studied, no studies have examined socket fit for TKA. While prosthetic manufacturer guidance exists for prosthetists regarding casting and socket prescription for TKA [40] there is currently little guidance for ongoing rehabilitation for this patient group. The responses from the clinicians suggest that a lack of familiarity with TKA negatively impacts the care they can provide. Patients with TKA are at risk of being treated the same as patients with AKA despite the biomechanical differences between the two. A paper from 1983 by Mensch [41] recommended specific treatment strategies for TKA; however, many of Mensch's recommendations have been invalidated over time, which raises concerns about the reliability of the guidance for TKA care. The survey and interviews did not clarify what specific guidance clinicians would like to see to improve their practice. Therefore, there is an urgent need for up-to-date rehabilitation guidelines for TKA patients.

The main disadvantages of TKA reported by the participants in this study were poor wound healing, uneven knee centres, and the cosmetic appearance of TKA prosthetic limbs. The problems raised in the survey regarding knee centres and cosmetic appearance were contested by the interviewed physiotherapists and surgeons who felt that function should be prioritised over appearance. Prosthetic knees with a smaller build height have also recently been developed to improve the overall appearance. Wound healing of TKA compared to AKA has been previously studied [15,18,19] but with conflicting outcomes between studies. Overall, wound healing is similar to other amputation levels, suggesting this should not be the criterion upon which TKA is discounted as a surgical option, as suggested by some of the surgeons in this study [10, 15, 18]. Another reason for

inconsistency in wound healing papers is the variations of the surgical technique. This also might explain why “poor technique” and “difficult surgery” were offered as reasons for not using TKA by surgeons responding to the survey. This may be why some clinicians feel TKA should be offered to patients with limited potential for rehabilitation. However, other clinicians think it should be offered to patients with good rehabilitation potential. Similar disagreement exists in the current literature regarding recommending what type of patient TKA is for [13,42].

The opinions and experiences of clinicians regarding TKA vary widely between professional groups across the UK. The survey identified perceived advantages and disadvantages of TKA, and the interviews were used to explore these in more detail. The interviews identified a lack of awareness between groups of clinicians regarding one another’s priority, suggesting gaps in communication along the amputation pathway and a compartmentalised approach to surgery and rehabilitation. This may be partly because prosthetic services are rarely on the same site as the surgical ward, with 80% of vascular centres in the UK having prosthetic services off-site. Data suggest the average distance between the surgical unit and the corresponding prosthetic centre is 21 miles [22]. Even when strict patient pathways are implemented, compartmentalisation of responsibilities between care teams has restricted the development of integrated working. Fragmented care risks poor clinical outcomes [43], and the present study highlights the effect of this compartmentalised approach on teamwork.

Effective multidisciplinary team (MDT) collaboration improves patient outcomes and quality of care across all areas of health care [44]. Specifically in amputation surgery, the Vascular Society Best Practice Guideline recommends MDT assessment for each patient pre-operatively and suitable referrals to rehabilitation post-operatively [7], while physiotherapy and prosthetics guidelines reinforce the importance of MDT communication and cooperation [33,45]. However, this study highlighted some barriers and limitations to effective MDT working. Guidelines exist for acute vascular and prosthetic services separately, with no established integrated pathway involving every stage pre- and post-amputation. A case-controlled study by Ham [46] involved prosthetic clinicians visiting the vascular ward perioperatively. This resulted in reduced hospital stay and outpatient re-attendance. The interviewed clinicians expressed their desire to have more face-to-face contact with the other professions but felt limited by the location of services. Healthcare inequalities have been identified by a 2018 NHS England patient survey [47] leading to an ongoing review of prosthetic services. One finding from the NHS England survey was the benefits of a collaborative approach between prosthetic centres and the local hospital, including MDT discussions between rehabilitation staff and vascular surgeons.

One step forward is the recent provision of services for people with vascular disease document [48], which includes both acute vascular and allied services. However, no recommendations are given regarding MDT working in the amputation pathway. While prosthetic services do not solely treat vascular patients (congenital, oncology, trauma and others), more than half of all patients referred to UK prosthetic centres have vascular aetiology [49]. The communication barriers identified in this study between prosthetists, physiotherapists, and surgeons mean there is a risk that the chosen level of amputation may not reflect the post-operative priorities of the patient and rehabilitation teams. There are circumstances whereby there is no choice of amputation level; however, when there is, surgeons may not appreciate the life-long implications of their choice of amputation level for the individual. Without expert support from prosthetists and physiotherapists, surgeons cannot use information on TKA and AKA rehabilitation

outcomes to inform their clinical decision-making. Surgeons must be aware of the prosthetic differences between TKA and AKA, and decision-making regarding the amputation level should involve all multidisciplinary team members [22].

A strength of this study was the recruitment strategy. Purposive sampling was used to capture the perspectives of clinicians from different regions of the UK and those with opposing views of TKA; this reduces the risk of bias as enthusiasts often agree to participate in interviews. A limitation of the study was that recruitment was limited only to surgeons, prosthetists, and physiotherapists, and the views of rehabilitation consultants, specialist nurses, occupational therapists, and, most importantly, patients were not explored in this study. How the type of TKA performed influenced clinicians’ perspectives was not examined in great detail in this study, mainly due to the number of different types of TKA and difficulty classifying types; however, since this study was conducted, a classification system has been created to allow for future comparison [12]. While this study focused on vascular amputations, there may be some transferability to traumatic amputations; however, wound healing is likely more successful in this group, but prosthetic appearance may be more important in this younger patient group. Ideally, the views of these patient groups should be explored.

Amputation surgery and rehabilitation is a complex pathway, with different clinical groups responsible for each essential element of the patient’s care with minimal overlap. Increasing interaction between groups of clinicians may offer numerous benefits to the major lower limb amputation pathway in terms of efficiency and outcomes, as well as patient and clinician satisfaction. Overall, clinician’s opinion of TKA is divided. Some clinicians observe poor outcomes in terms of wound healing and patient satisfaction with their prosthesis and recommend TKA only for bed-bound patients. Others feel TKA is an excellent, underused procedure with many functional benefits. Prospective trials comparing TKA to AKA are needed to help inform clinical decision-making and must include all parties, including patients, in the design of future studies.

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Data availability statement

Consent was obtained to anonymously share qualitative data with other researchers for future relevant research. Data enquiries can be sent to the corresponding author.

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