

Shared decision-making when deciding on lower extremity amputation level – perceived facilitators and barriers among surgeons

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ABSTRACT

Background A major lower limb amputation profoundly affects patients' lives. Shared decision-making (SDM) can play a crucial role when a sensitive decision such as determining the appropriate level of amputation has to be made. Despite clinicians aiming for SDM and patients wanting active participation, barriers persist for implementation.

Aim To explore facilitators and barriers to SDM among orthopaedic and vascular surgeons when deciding amputation levels.

Methods An electronic survey was distributed November 2023 at 21 hospitals in Denmark, yielding responses from 28 vascular and 24 orthopaedic surgeons. The questionnaire covered four domains known to influence SDM and assessed respondents' viewpoints on the potential use and implementation of an SDM tool. Descriptive statistics and inter-specialty comparisons were performed.

Results More vascular surgeons than orthopaedic surgeons believed an SDM support tool would enhance patients' decision-making experience (77% vs 48%); benefit their praxis (62% vs 35%); and that they would use such a tool (65% vs 48%). While both groups agreed on patients' desire to participate in SDM (75%), 35% thought patients would find it difficult to understand the advantages and disadvantages of amputation at different levels. Vascular surgeons described being left out of the decision of amputation level and 63% of the orthopaedic surgeons reported a lack of a genuine choice of amputation level.

Conclusions The study identified facilitators and barriers to SDM in amputation level decisions, emphasising the need for enhanced interdisciplinary collaboration between vascular and orthopaedic surgeons. Implementing a decision support tool could facilitate collaboration between surgeons in favour of patient treatment satisfaction.

Keywords decision aid, interdisciplinary collaboration, lower extremity amputation, patient involvement, shared decision-making, surgeons.

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KEY MESSAGES

- This work describes shared decision-making (SDM) in relation to decisions about amputation levels, among vascular and orthopaedic surgeons working with amputation care in Denmark.
- The study aimed to identify and describe barriers and facilitators towards SDM, and surgeons' thoughts towards a potential decision support tool to support decision-making when deciding the level of amputations.
- Different barriers and facilitators for implementing SDM in amputation level decisions exist among vascular and orthopaedic surgeons. Implementing a decision support tool could help enhance the collaboration between vascular and orthopaedic surgeons in favour of patient treatment satisfaction.

INTRODUCTION

Patients undergoing a partial foot amputation (PFA) due to wounds and reduced blood supply (peripheral artery disease (PAD) and/or diabetes) are at high risk of significant complications.¹ These complications may comprise delayed wound healing, surgical site rupture, infections, repeated surgical revisions,¹ and ultimately a major lower extremity amputation (transtibial, knee disarticulation, or transfemoral) (MLEA).^{2,3}

Some patients are not adequately informed about their prognosis during the first wound revisions. They lack information about the potential need for debridement and amputation of one or more toes, the prolonged healing period due to arteriosclerosis, the risk of complications, the expected duration of immobility, and the alternative option of choosing

transtibial amputation (TTA) from the outset.¹ It is argued, that some patients facing the prospect of PFA, would consciously choose a more invasive TTA, especially if they understood the similarities in mobility and quality of life after PFA and TTA, as well as the mortality rates in the years following amputation.^{4,5} Furthermore, we know from the literature that patients want an active role in decision-making, even when major amputations are unavoidable.^{6,7}

To improve preoperative information, support and shared decision-making (SDM), patients and surgeons can make use of a decision-support tool.^{4,8} Decision support tools guide the choice between two different treatments, by allowing patients to share their expectations and preferences, and the clinicians to inform the patients in a balanced manner.^{4,8} Risks, benefits, and differences highlighted in this material can be supported by pictures, timelines, and text, based on existing data in the field.^{4,8,9}

Research from both the US and Australia has demonstrated promising outcomes regarding the utilisation of decision-support tools in amputation decisions.^{4,10,11} Decision-support tools are generally found to enhance individuals' sense of being well-informed, to foster greater participation in decision-making processes, and ultimately to contribute to patient satisfaction,⁸ even for decisions about amputation levels.¹² However, implementing SDM requires fundamental changes in mindset and behaviour among patients and clinicians.^{13,14}

Clinicians working with amputations, strive to consider patients' preferences in amputation-level decisions but face obstacles concerning patients' health issues (e.g., hearing, vision, cognitive function), emotional distress,¹⁵ inadequate Health Literacy¹⁶ and the clinicians' clinical context.^{15,17}

In Denmark, healthcare is primarily funded through taxes, ensuring that all residents have access to free or highly subsidised medical services. This system covers most healthcare services, including hospital stays, doctor visits, and specialist treatments. Patients with foot ulcers at risk of MLEA are recommended to be treated by multidisciplinary teams.^{18,19} This treatment can occur in various settings, such as by specialist nurses in municipalities or by nurses and doctors in outpatient clinics specialising in medicine, vascular, or orthopaedic surgery. Patients suffering from infections, prolonged wound healing or ischemia are referred to a vascular surgeon. If no reperfusion is possible, the orthopaedic surgeon will make the final decisions regarding the amputation level.

Despite several initiatives to implement SDM in Danish healthcare, progress is hindered by the absence of legislation, clear definitions, and a central initiative promoting real SDM.²⁰ There is a lack of understanding about how healthcare professionals in Denmark engage in and view SDM in the care of patients at risk of and undergoing MLEA. Additionally, there is no information on their thoughts and attitudes towards using a decision-support tool for determining the level of amputation.

Thus, the primary aim of this project was to investigate potential facilitators and barriers among Danish orthopaedic and vascular surgeons to work with SDM. The second aim was to investigate attitudes towards a decision-support tool, to

support decisions regarding the choice of amputation level for individuals facing a forefoot or MLEA.

METHODS

A national, cross-sectional survey, using electronic self-administrated questionnaires (via www.survey-xact.dk) was conducted with vascular and orthopaedic surgeons specialised in treating patients at risk of amputations. Data was collected in November-December 2023. Results were reported following the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).²¹

Respondents and data collection

In Denmark, orthopaedic surgeons at 21 hospitals nationwide perform approximately 1600 amputations annually on 1200 patients.⁵ Vascular surgeons treat patients at six different hospitals, five of which have an orthopaedic department on site. Using professional societies' member lists, a purposive sample of one to three surgeons from each orthopaedic and vascular department specialising in amputation care was identified, resulting in 81 potential respondents. A link to an open questionnaire was distributed via e-mail, with a reminder sent 14 days later. No incentives were offered to participants.

The questionnaire

A validated questionnaire on barriers and facilitators towards SDM when deciding the level of amputation did not exist. Thus, we created a study-specific questionnaire using the guide by Burns and colleagues.²² For the primary aim to investigate potential facilitators and barriers, the work of Waddell and colleagues served as a framework for developing the questionnaire items. The framework consists of four dominant themes found to affect SDM in hospital settings¹⁷ (see Table 1). To address the second aim, we developed items regarding attitudes towards a potential decision support tool, with inspiration from existing decision support tools.^{4,10,11} The initial version of the questionnaire consisted of 66 items, formulated by the first author. The remaining authors assessed all items for inclusion by rating each item as 'yes', 'maybe', or 'no' individually. The first author compiled all ratings, and items were subsequently reassessed linguistically and reevaluated for inclusion by all authors. Finally, the questionnaire underwent face validation and pilot testing by four surgeons, which prompted a few adjustments.

Questionnaire domains

The final questionnaire contained 32 items divided into five domains. (Contact the corresponding author for the original questionnaire). Seven items covered Domain 1: *Environmental Context and Resources* referring to any element of a person's situation or environment that could act as a barrier or facilitator for engaging in SDM. Two items covered Domain 2: *The surgeons' Social/Professional Role and Identity* concerning

Table 1. Waddell's themes

Waddell's themes	Items within each theme
1. Environmental context & resources	1, 2, 10, 11, 12, 13, 14
2. Social/professional role & identity	5, 15
3. Knowledge & skills	3, 4, 6, 17, 18
4. Beliefs about capabilities	7, 8, 9, 16 (CPS), 19

performing/engaging in SDM. Five items covered Domain 3: *Knowledge and Skills*, investigating the surgeons' knowledge about and use of SDM. Five items covered Domain 4: *Beliefs about Capabilities*, investigating the surgeons' experience/evaluation of the patient's preference and ability to engage in SDM. One item was based on the Control Preference Scale (CPS), which is validated and adapted for both patients' and clinicians' views of patients' desire for involvement.²³ (See Table 1). Thirteen items covered Domain 5: *The surgeons' viewpoints* on the potential use and implementation of a tool to facilitate SDM in the determination of amputation levels.

Response options were presented on a five-point Likert scale, ranging from "I strongly agree" to "I strongly disagree," with the option to answer, "I don't know" in the middle. Some response options were formulated, such as "Yes," "No" or "I don't know". To capture more detailed and nuanced feedback from respondents that may not be fully expressed through fixed-response options, additional explanations as text were possible for five of the items. Information regarding the surgeons' age, gender, workplace (region), years of experience, and the number of patients at risk of MLEA seen annually was collected. Additionally, orthopaedic surgeons provided data on the number of MLEAs performed annually and whether they worked at a hospital with a vascular department onsite.

Ethics

Information about the study was outlined in the introduction email, and respondents had the option to click on the provided link to access and complete the questionnaire at their discretion. Responding to the electronic questionnaire was considered to express voluntary consent. No identifying data was collected. According to Danish legislation, this study did not require ethical approval from the National Committee on Health Research Ethics §14, 2 (Committee on Health Research Ethics, 2011). The study was registered with the Record of Data Process of the Registry of Southern Denmark (Journal no. 23/21681). Data were stored in a secure server only available to the researchers in accordance with the General Data Protection Regulation.²⁴

Data Analysis

Fully completed questionnaires from vascular and orthopaedic surgeons are presented separately and divided into the five questionnaire domains. Responses were grouped into three categories for analysis: "Agree," "Don't know," and "Disagree," combining the positive and negative responses for clarity. Although a five-item Likert scale was used to capture nuanced opinions, consolidating responses allows for clearer comparisons and more straightforward discussion of results. Descriptive questionnaire data and categorical respondent characteristics are expressed as numbers and proportions. Numeric respondent characteristics are expressed in means (SD) with $p < 0.05$ as the significance level or medians with 25 and 75 percentiles, if not normally distributed. When comparing categorical responses Chi-squared (Fisher's exact) tests were employed, and numeric responses were compared using Mann-Whitney U Test. Data was analysed in IBM SPSS Statistics 21.

Furthermore, the open-text responses were condensed and used to elaborate the results, providing a richer understanding of the data beyond quantitative analysis.

RESULTS

In total, 51 of the 81 highest possible number of respondents (63%) fully completed the questionnaire: 27 vascular and 24 orthopaedic surgeons. The orthopaedic surgeons were significantly younger than the vascular surgeons (43 vs 49 years; $p = 0.05$). However, no significant differences were found in sex distribution (female: 56% vs. 46%; $p = 0.58$), time of working experience with patients at risk of MLEA (8 years vs 5 years, $p = 0.23$), and the number of patients at risk of MLEA treated per year (Median 80 vs. 100 patients, $p = 0.69$). The orthopaedic surgeons performed on average 35 amputations per year (SD: 25). (See Table 2 for further data).

Domain 1: environmental context and resources

In total, 45% of vascular and 63% of orthopaedic surgeons indicated that they 'Seldom' or 'Never' experience a genuine choice between levels (Item 1) (See table 3: domain 1). The surgeons commented narratively on factors leading to the absence of choice and these could be categorised into three themes; 1) Expected healing potential, 2) The degree of arteriosclerosis, and 3) The surgeon's assessment of the patient's (biological) functional level concerning rehabilitation and potential prosthetic provision.

The vascular and orthopaedic surgeons did not record poor health (Item 10) (56% vs 66%) or poor cognition (Item 11) (70% vs 84%) as factors that could act as a barrier to engaging the patient in the conversation about different amputation levels. Furthermore, 48% of the vascular surgeons and 71% of the orthopaedic surgeons felt that they had the time needed to include patients in the decision (Item 12) and the majority anticipated no problems finding a quiet and private place for having conversations about the amputation levels (Item 13), (70% vs 75%). Finally, the surgeons agreed that involving the patients' relatives in the decision was an advantage (Item 14).

Domain 2: social/professional role and identity

Investigating the surgeons' perspective on their own and the patients' roles in the decision-making process, both vascular and orthopaedic surgeons (67% vs 67%) agreed on asking whether the patient would like to be a part of the decision when there was a genuine choice (Item 5) (See Table 3: domain 2). This was also reflected in their preferred role in the decision process with 59% and 63% of the vascular and orthopaedic surgeons, respectively expressing a preference for collaborative decision-making between patient and surgeon (Item 15). The comments revealed that some surgeons felt they had the final responsibility, but they always discussed it with the patients.

Comments also revealed that nearly half of the vascular surgeons reported that they were not involved in the ultimate decision regarding amputation or the level thereof, as this responsibility lay with orthopaedic surgeons. Consequently, some of the vascular surgeons experienced, that they had to be careful about not saying too much about the amputation or the amputation level to the patient, only informing them that no further vascular treatment existed, thereby resulting in superficial and often very brief information.

Domain 3: knowledge and skills

In general, both vascular and orthopaedic surgeons reported explaining the advantages and disadvantages of different amputation levels to patients (Item 3) (70% vs 96%), and they

reported individualising information (Item 4) (89% vs 100%) (See table 3: domain 3). Furthermore, 56% of the vascular surgeons and 88% of the orthopaedic surgeons felt prepared to include patients in SDM (Item 6). In total, 26% and 45% of the vascular and orthopaedic surgeons reported having little or no knowledge of SDM (Item 17), yet 67% and 46% knew that SDM was being used for other patient groups in their department, respectively (Item 18).

Domain 4: beliefs about capabilities

Vascular and orthopaedic surgeons agreed (85% vs 67%) that most patients wanted to talk about the advantages and disadvantages of amputating at different levels (Item 7) (See Table 3: domain 4). Two-fifths (41% vs 37%) of the surgeons found that patients struggled to understand the advantages and disadvantages of different amputation levels (Item 8). Furthermore, one-third of vascular and orthopaedic surgeons found that patients are too emotional to engage in discussions regarding amputation levels (Item 9) (37% vs 33%). Additionally, over half of the vascular surgeons (59%) foresaw no issues in utilising a decision support tool for this specific patient demographic compared to their orthopaedic counterparts (38%) (Item 19).

When employing the Control Preference Scale (See Table 3: domain 4, item 16), 37% of vascular and 54% of orthopaedic surgeons responded that patients prefer the surgeon to ultimately make the final decision, but with careful consideration of the patient's opinion (response option d). Nearly half of the vascular surgeons (48%) believed that patients preferred shared responsibility between surgeon and patient in deciding the optimal level of amputation (response option c). This perspective was shared by 25% of orthopaedic surgeons.

Domain 5: attitudes towards a potential decision support tool

When asking the surgeons about a potential decision support tool for future use, the surgeons agreed regarding the key

functions that a potential tool shall assist (see Table 4). These include clarifying the advantages and disadvantages of various levels of amputation (Item 20) (89% vs. 84%), assessing mobility possibilities at different levels (89% vs. 79%), understanding the risk of re-amputation (81% vs. 92%), facilitating discussions about mortality post-amputation (67% vs. 75%), and the tool's printability for use during conversations (71% vs. 63%) (Item 21-23, 25). Their opinions were split on whether the tool needed to be available online (Item 24). Significantly more vascular surgeons than orthopaedic surgeons believed that a decision support tool would improve: the conversation between surgeons and patients (Item 26) (70% vs 42%, $p=0,01$); the patients' decision-making experience (Item 27) (78% vs 46%, $p=0,03$); and benefit their work (Item 28) (63% vs 33%, $p=0,01$).

All surgeons were asked whether they would use a decision support tool in the future (if available) when deciding the level of amputation (Item 31) and 55% agreed that they would, while 31% didn't know. Two-fifths of the surgeons (37% vs 42%) were concerned about the implementation and application of a possible tool (Item 29), but only 7% of the vascular and 12% of the orthopaedic surgeons thought a tool would require major changes to their workflow (Item 30).

Additionally, most of the vascular and orthopaedic surgeons (93% vs. 79%) were unaware of any existing tools to aid SDM when determining the level of amputation (Item 32). The comments revealed that some surgeons found the use of a tool relevant earlier in the treatment process before the decision about amputation was made, making it possible to consider the different options when there was still time and choices to be made.

DISCUSSION

This was the first attempt to identify facilitators and barriers to SDM among Danish surgeons treating patients at risk

Table 2. Respondents' demographics

Demographics	Vascular surgeons (n=27)	Orthopaedic surgeons (n=24)	p value
Age in years, mean (SD)	49 (12)	43 (9)	0.05
Female, n (%)	15 (56)	11 (46)	0.58
Region, n (%)			
Regional Capital	1 (4)	4 (17)	
Central Jutland	7 (26)	7 (29)	
Northern Jutland	6 (22)	2 (8)	
Zeeland	2 (7)	5 (21)	
Southern Denmark	11 (41)	6 (25)	0.20
Experience			
Years of experience, median (25;75 percentiles) *	8 (1,5;20)	5 (3;8)	0.23
Number of patients, median (25;75 percentiles) **	80 (50;200)	100 (50;200)	0.69
Number of amputations performed annually, mean (SD)	N/A	35 (25)	
Facilities			
Orthopaedic surgeons working at a hospital with a vascular department on-site, n (%)	N/A	10 (42)	

*Years working as a specialised surgeon seeing patients at risk of major lower limb amputation

**Number of patients at risk of amputation seen annually

of forefoot amputation and MLEA. We uncovered several facilitators for SDM already present in the treatment and decision-making process. Surgeons recognised patients' openness to discussing the advantages and disadvantages of different amputation levels. They actively invited patients to participate in the decision-making, and they perceived decision-making as a collaborative effort. Contrary to findings in other studies, issues regarding time, location,^{17,25} or patients' cognition¹⁵ did not seem to pose noteworthy challenges in our study. Surgeons reported that they provided tailored information, felt prepared to engage patients in decision-making, and elucidated the pros and cons of different amputation levels.

However, some barriers to implementing SDM in amputation level decisions were also identified. Notably, surgeons reported a lack of choice between amputation levels in some cases due to factors such as expected healing, severity of PAD, and patients' functional levels, leaving only one (technical) amputation level appropriate and thereby excluding the possibility of SDM. Newly presented data has found that the initial MLEA more often occurs at the transfemoral level.⁵ This indicates that if SDM were to be implemented for patients at risk of MLEA, more knowledge about the reasons for lack of choice, patients' treatment trajectories and reasons for more proximal amputations would be needed.

Patient factors influencing SDM

The involvement of patients in SDM depends on several factors and can be affected by the combination of health professional's skills and knowledge about SDM, the environmental setting, and patient characteristics.¹⁷ In this study, we identified that the patient's emotional state and the lack of a genuine choice of amputation level could act as barriers to SDM. This finding is similar to what other studies have found, where amputation often is described as an acute decision²⁶ and where patients' poor health affects the possibility of SDM.¹⁵ In our study, surgeons reported that they find patients struggling to grasp information regarding different amputation levels. In addition, pain and being affected by medicine and/or emotions are found to influence the patient's ability to receive information²⁷ and engage in SDM.²⁶ The surgeons' evaluation of the patient's informational capacity can act as a barrier for SDM, making patients with less capacity less likely to be included in SDM,¹⁵ and may explain why not all patients perceive that SDM elements have been present at these conversations.^{7,28}

Furthermore, patients have described a sense of chaos leading up to the decision regarding amputation which can be amplified by mixed messages from healthcare professionals, complex information about treatment options, and the experience that they are in a hurry to decide on amputation.²⁶ From the literature, we know that patients want to be a part of the decision, even when there is no choice between amputation levels.⁶

Other factors influencing SDM

In our survey, some vascular surgeons indicated that orthopaedic surgeons made the final decision regarding the level of amputation, making them cautious about sharing information with patients on this matter. Additionally, orthopaedic surgeons mentioned seeing patients too late to engage in meaningful SDM. This suggests a potential lack of

collaboration between these specialities, possibly delaying discussions about amputation and amputation levels for some patients undergoing vascular treatment. Postponing these conversations is consistent with findings from other studies,^{7,29} where clinicians' lack of discourse about amputation²⁹ and individual fear of talking about amputation and causing distress in cases where the patient is later deemed to not need amputation, were cited as reasons.⁷ Postponing the conversation and thereby the decision about amputation can hurt patient outcomes in terms of length of hospitalisation and mortality after MLEA.³⁰ It has been found that patients and their families prefer the conversation about a possible amputation to be initiated as soon as the clinician considers it a potential option.⁷

One way of making information more accessible for patients, and initiating and supporting the conversation about amputation is by actively ensuring SDM via a decision support tool earlier in the treatment process.¹⁰ Hereby, clinicians support patients and their relatives in identifying the patients' priorities concerning treatment options (such as wound care, amputation, palliative care) early in the process, before the situation becomes acute and the patient is affected by emotions, declining health, medicine, and pain.

All of the above clarifies that the complex situation in the time leading up to the amputation includes several obstacles for engaging the patients in SDM.^{15,26,29} To alleviate vascular surgeons' exclusion from the decision-making process and their fear of talking about amputation, there needs to be a focus on increased collaboration via joint meetings/consultations and SDM training among vascular and orthopaedic surgeons.

A potential decision support tool and importance of multidisciplinary approach

Over half of the responding surgeons expressed positivity towards using a potential decision support tool, despite some lacking familiarity with SDM concepts or existing tools. While there was agreement on the content of the tool, vascular surgeons were more positive about its use and implementation compared to orthopaedic surgeons. Moreover, nearly half of the vascular surgeons felt excluded from the decision-making process, while orthopaedic surgeons sometimes encountered patients too late for meaningful SDM. This difference could be related to the divided treatment courses, leaving both specialities in challenging positions when transferring patient responsibility.

We know from the literature that a multidisciplinary approach can have a positive effect on patient outcomes.^{31,32} In Denmark, only five out of 21 hospitals performing MLEAs have both vascular and orthopaedic departments at the same location. This makes it challenging for the treating surgeons to comply with Danish recommendations, which advocate for multidisciplinary teams to treat patients with leg ulcers facing potential MLEAs.^{18,19}

Our survey also revealed that surgeons agreed a potential tool could support them in discussing mortality after MLEA, acknowledging that a group of these patients are in their final stage of life,⁵ and sometimes palliative care is the choice instead of amputation. Talking about mortality when discussing amputation is not common, but has been found to be meaningful for clinicians and patients.³³

Table 3. Questionnaire results (Domain 1-4) : Questionnaire data by Waddell's domains and by vascular and orthopaedic surgeons (n=51), n (%)

Domain 1: Environmental context and resources					
Item No	Surgeons' experiences of the patients' situations in relation to SDM	Response options	Vascular surgeons (n=27) %	Orthopaedic surgeons (n=24) %	Fisher's Exact Test (p value)
1	How often do you find that there is a real choice between amputation levels (forefoot, tibia or femur)?	Never	1 (4)	0 (0)	
		Seldom	11 (41)	15 (63)	
		Don't know	3 (11)	0 (0)	
		Often	10 (37)	7 (29)	
		Always	2 (7)	2 (8)	0,33
10	... that the patients are too ill in terms of health to be able to participate in the conversation about different levels of amputation.	Disagree	15 (56)	16 (66)	
		Don't know	7 (26)	4 (17)	
		Agree	5 (18)	4 (17)	0,79
11	... that the patients are too poor cognitively to be able to participate in the conversation about different levels of amputation.	Disagree	19 (70)	20 (84)	
		Don't know	5 (19)	2 (8)	
		Agree	3 (11)	2 (8)	0,63
Item No	Surgeons' experience of the environment (surrounding the patient) in relation to SDM				
12	... that there is the necessary time available to be able to involve the patients in the decision.	Disagree	13 (48)	6 (25)	0,19
		Don't know	1 (4)	1 (4)	
		Agree	13 (48)	17 (71)	
13	... that it is difficult to find a quiet and private place where I can talk to the patient about the choice of amputation level.	Disagree	19 (70)	18 (75)	1
		Don't know	3 (11)	2 (8)	
		Agree	5 (19)	4 (17)	
14	... that it is an advantage to involve the patient's next of kin in the decision on the choice of amputation level.	Disagree	0 (0)	1 (4)	0,35
		Don't know	2 (7)	0 (0)	
		Agree	25 (93)	23 (96)	
Domain 2: Social/professional role and identity					
5	I ask if the patient would like to be part of the decision	Disagree	4 (15)	6 (25)	
		Don't know	5 (18)	2 (8)	
		Agree	18 (67)	16 (67)	0,5
15	Which statement best describes the role you prefer to have during the decision-making process?				
	a) I prefer to inform the patient about possible amputation levels and then let the patient make the decision.		0 (0)	0 (0)	
	b) I prefer that the patient and I collaborate in making the decision.		16 (59)	15 (63)	
	c) I prefer to orientate/inform the patient about the possible levels of amputation and then make the final decision.		0 (0)	1 (4)	
	d) As a doctor, I take on the responsibility of choosing the level.		0 (0)	1 (4)	
	None of the above		11 (41)	7 (29)	0,5
Domain 3: Knowledge & Skills					
Item No	Surgeons' skills	Response options	Vascular surgeons (n=27) %	Orthopaedic surgeons (n=24) %	Fisher's Exact Test (p value)
3	I explain to the patient the advantages and disadvantages of amputating at the various levels.	Disagree	2 (8)	0 (0)	
		Don't know	6 (22)	1 (4)	
		Agree	19 (70)	23 (96)	0,04
4	I target the information on the choice of amputation level to the patient's individual situation.	Disagree	2 (7)	0 (0)	
		Don't know	1 (4)	0 (0)	
		Agree	24 (89)	24 (100)	0,49

6	I feel prepared to involve the patient in the decision.	Disagree	8 (29,6)	3 (13)	
		Don't know	4 (15)	0 (0)	
		Agree	15 (56)	21 (88)	0,03
Item no	Surgeons' knowledge about SDM				
17	How much do you know about the concept of 'shared decision-making' (between doctor and patient)?	No knowledge	0 (0)	5 (21)	
		Some knowledge	7 (26)	6 (24)	
		Good knowledge	11 (41)	5 (21)	
		Great knowledge & Active user of SDM	6 (22)	4 (17)	
		Don't know	3 (11)	4 (17)	0,1
18	Is shared decision-making used in your department for one or more patient groups?	Yes	18 (67)	11 (46)	
		No	4 (15)	8 (33)	
		Don't know	5 (18)	5 (21)	0,28
Domain 4: Beliefs about capabilities					
7	My experience is that patients do not want to talk about the advantages and disadvantages of amputating at different levels.	Disagree	23 (85)	16 (67)	
		Don't know	3 (11)	6 (25)	
		Agree	1 (4)	2 (8)	0,39
8	It is my experience... ... that patients find it difficult to understand the advantages and disadvantages of amputation at different levels.	Disagree	12 (44)	11 (46)	
		Don't know	4 (15)	4 (17)	
		Agree	11 (41)	9 (37)	1
9	... that patients are too emotionally affected to be able to talk about different levels of amputation.	Disagree	12 (44)	15 (63)	
		Don't know	5 (19)	1 (4)	
		Agree	10 (37)	8 (33)	0,3
CPS 16	Which of the following statements best reflects your understanding of how patients prefer to be involved in decisions about their amputation level?				
	a. Patients prefer to make the final decision		0 (0)	0 (0)	
	b. Patients prefer to make the final decision after considering the doctor's opinion.		4 (15)	4 (17)	
16	c. Patients prefer that the doctor and the patient share responsibility for deciding which amputation level is best for the patient.		13 (48)	6 (25)	
	d. Patients prefer that the doctor makes the final decision, but that the doctor carefully considers the patient's opinion		10 (37)	13 (54)	
	e. Patients prefer to leave the decision to the doctor.		0 (0)	1 (4)	0,26
19	I see no problem using an SDM tool for this patient group.	Agree	16 (59)	9 (38)	
		Disagree	1 (4)	7 (29)	
		Don't know	10 (37)	8 (33)	0,04

Table 4: Questionnaire results (Decision support tool)

Item no	Items regarding a potential decision support tool	Response options	Vascular surgeons (n=27) %	Orthopaedic surgeons (n=24) %	Fisher's Exact Test (p-value)
	If I were to use a decision support tool, it is important that it...				
20	... helps to clarify the advantages and disadvantages of different levels of amputation.	Disagree	1 (4)	2 (8)	
		Don't know	2 (7)	2 (8)	
		Agree	24 (89)	20 (84)	0,84
21	... helps to clarify the possibility of mobility for the current patient at different levels of amputation.	Disagree	1 (4)	3 (13)	
		Don't know	2 (7)	2 (8)	
		Agree	24 (89)	19 (79)	0,63
22	... clarifies the risk of further amputation, by amputating at different places on the leg (on the foot versus below the knee).	Disagree	1 (4)	1 (4)	
		Don't know	4 (15)	1 (4)	
		Agree	22 (81)	22 (92)	0,67
23	... supports me in the conversation about the mortality after amputation.	Disagree	3 (11)	3 (13)	
		Don't know	6 (22)	3 (13)	
		Agree	18 (67)	18 (75)	0,68
24	... can be accessed online/digitally.	Disagree	4 (15)	5 (21)	
		Don't know	11 (41)	6 (25)	
		Agree	12 (4)	13 (54)	0,57
25	... can be printed out and taken to the interview with the patient.	Disagree	2 (7)	3 (12)	
		Don't know	6 (22)	6 (25)	
		Agree	19 (71)	15 (63)	0,76
26	I think a decision support tool will improve conversations with patients about the level of amputation.	Disagree	0 (0)	6 (25)	
		Don't know	8 (30)	8 (33)	
		Agree	19 (70)	10 (42)	0,01
27	I believe that a decision support tool will improve patients' experience of the decision-making process surrounding the amputation.	Disagree	0 (0)	3 (12)	
		Don't know	6 (22)	10 (42)	
		Agree	21 (78)	11 (46)	0,03
28	I think a decision support tool will benefit my work and me.	Disagree	1 (4)	8 (33)	
		Don't know	9 (33)	8 (33)	
		Agree	17 (63)	8 (33)	0,01
29	I will be concerned about how it will be implemented and applied.	Disagree	12 (44)	7 (29)	
		Don't know	5 (19)	7 (29)	
		Agree	10 (37)	10 (42)	0,46
30	I think a decision support tool will require major changes in my workflow.	Disagree	19 (71)	11 (46)	
		Don't know	6 (22)	10 (42)	
		Agree	2 (7)	3 (12)	0,18
31	If there were a decision support tool for amputation level selection, I would use it.	Disagree	2 (7)	5 (21)	
		Don't know	8 (30)	8 (33)	
		Agree	17 (63)	11 (46)	0,34
32	Do you already know of a tool that can support the decision-making process when choosing the amputation level?	Yes	2 (7)	5 (21)	
		No	25 (93)	19 (79)	0,23

Implementing a decision support tool could enhance collaboration between the two disciplines, providing a shared language from early ulcer treatment, to being at risk of MLEA, to the potential amputation decision (or palliative care). The tool could thereby facilitate smooth transitions between specialities, ensuring the employment of active and clear SDM for all involved parties, even when the surgeons are located at different hospitals.

Method - strengths and weaknesses

As no validated questionnaire was available, we developed a study-specific questionnaire based on domains influencing SDM in hospital settings, literature on healthcare professionals' perspectives on patients with MLEA, and guidelines on developing questionnaires. Furthermore, the questionnaire was pilot tested. This study is an initial endeavour to explore a crucial area and contribute valuable new insights into SDM in determining the level of amputation, which holds considerable significance for future patients undergoing a MLEA. Strengths include a national cross-sectoral design, a representative sample of surgeons being active in this specific area from all regions in Denmark, and a high response rate compared to similar web-based surveys.³⁴ We therefore have confidence in the credibility of our findings.

CONCLUSION

In conclusion, our study sheds light on facilitators and barriers to implementing SDM in amputation level decisions, from the perspectives of vascular and orthopaedic surgeons in Denmark. Barriers to SDM in amputation level decisions include the lack of choice between amputation levels in certain cases, the complex situation in the time leading up to the amputation, and hampered collaboration between disciplines. Facilitators include the surgeons' openness to involve patients in SDM, preparedness to engage in SDM, and that they have the necessary time and locations available.

Implementing a potential tool to support SDM in amputation decisions appears promising, recognising the benefits of multidisciplinary approaches and SDM in improving patient outcomes and satisfaction and supporting increased collaboration between vascular and orthopaedic surgeons.

IMPLICATIONS FOR CLINICAL PRACTICE

- A more structured collaboration between vascular and orthopaedic surgeons is needed to make shared decision-making in amputation care possible.
- Engaging in SDM early in the treatment process could potentially benefit the decision-making process when deciding on amputation level.

FURTHER RESEARCH

- Future research should focus on evaluating the feasibility and effectiveness of decision-support tools for this specific patient population.
- More knowledge about patients' experiences of decision-making with amputation level is needed.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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