

Health systems solutions to prosthetic service delivery obstacles in a low-resource setting



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Background: Lower limb prostheses improve functioning and quality of life after amputation. The challenges in prosthetic service provision in South Africa have been researched. However, possible solutions have not been explored.

Objectives: This article presents obstacles to prosthetic services in the Eastern Cape province of South Africa, and suggests research and development, health systems and clinical care solutions to alleviate these obstacles.

Method: Using a pragmatic approach, current evidence, unpublished research, grey sources and author expert opinion are presented in an integrated manner to show the barriers and recommendations for solutions in five key areas that are budget, supply chain and stock barriers, poor continuity of care, insufficient human resource numbers and skills, unrecorded demand for services, and geographical stumbling blocks.

Results: Tender documents, ring fencing budgets and appointing professional procurement officers are recommended to address supply chain barriers. Conscientious record keeping and an audit of appointment practices are recommended to enhance continuity of care. Outreach clinics, compulsory community service and skill shifting should be explored in response to geographical barriers and shortage of human resources. Early screening and referral might decrease waiting times. Innovative manufacturing strategies such as 3D printing and direct socket manufacturing should be researched. A database can assist with predicting new device-repair and replacement needs.

Conclusion: Prosthetic service delivery is a complex open system, and a systems approach should be followed when implementing any of the suggested solutions.

Contribution: The suggested solutions might assist in alleviating the barriers experienced in prosthetic service delivery in low-resourced settings.

Keywords: assistive technology; budget; supply chain; tenders; continuity of care; human resources; skills; database; geographical barriers.

Introduction

An amputation is often a lifesaving procedure. Even so the loss of a limb is associated with psychological trauma and reduction of physical function (Calabrese et al. 2023; Piscitelli et al. 2023) that often impacts quality of life negatively (Calabrese et al. 2023). Prostheses assist with functional restoration, psychological wellbeing, economic activity, enhancement of quality of life (Von Kaeppler et al. 2021), decreased mortality rates (Brügger et al. 2023) and health care cost saving (Diment et al. 2024). Achieving these outcomes are dependent on fitting a prosthesis at the earliest possible time (Baumann et al. 2020), ensuring a comfortable fit, correct alignment and length (Paquette et al. 2024; Piscitelli et al. 2023; Webster, Borgia & Resnik 2023), providing components suitable to support the person's activity level within cost constraints (Baumann et al. 2020), satisfying the person's aesthetic requirements (Paquette et al. 2024; Piscitelli et al. 2023) and rehabilitation by a multidisciplinary team (Fard et al. 2023).

Despite the advantages of prostheses, few South Africans are fitted with prosthesis after amputation (Ennion & Wu 2019; Manickum, Ramklass & Madiba 2019). Figures as low as 8% are mentioned by Manickum et al. (2019). Evidence further shows long waiting times for first time prostheses, repairs and replacement (Ennion & Johannesson 2018; Ennion & Manig 2019;

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Pienaar & Visagie 2019; Theron & Visagie 2024). In 2018, Mduzana, Visagie and Mji (2018) reported a backlog of over 600 prosthetic devices in the Eastern Cape (EC) province. This number has increased to 1276 in 2024 (Eastern Cape Department of Health [ECDoH] 2024). The ECDoH annual report of 2023/2024 shows that 331 users received a prosthesis in the financial year as opposed to a target of 600. Repairs and accessories were supplied to just under 2000 prostheses users during the same period.

The reasons for low fitting rates, long waiting times and waitlists are multifaceted and complex. The public health system in South Africa is under siege and prosthetic services are not exempted from the general health system challenges such as procurement and supply chain challenges (ECDoH 2024; Morris et al. 2021), management challenges (ECDoH 2024; Ennion & Johannesson 2018; Morris et al. 2021), inadequate infrastructure, equipment and material (Ennion & Manig 2019), and insufficient staff numbers (Ennion & Johannesson 2018; Maqaqa, Ariana & Polack 2021; Morris et al. 2021).

Furthermore, prostheses are expensive devices with price tags that can exceed \$50 000.00 (ZAR 900 000.00). Because of subsidies and the use of less technologically advanced components, the average cost per prosthetic device in the EC province government sector is R7000.00 (\$390.00) (ECDoH 2024). Even so, individuals often cannot afford to pay for them out of pocket, making them unattainable for many (World Health Organization [WHO] 2025). In South Africa, prostheses are funded by government, medical insurance schemes, the Road Accident Fund and Workman's Compensation (Theron & Visagie 2024). The South African government subsidised prostheses according to the patient's economic status under the Uniform Patient Fee Schedule. This system categorises patients into three groups: fully subsidised, partially subsidised and full paying. The classification is based primarily on household income. It is estimated that approximately 70% – 80% of the population qualifies as fully subsidised, making them eligible to receive prostheses free of charge through the public healthcare system (Gordon, Booyesen & Mbonigaba 2020).

Government prosthetic services are provided across the country through 23 orthotic and prosthetic (O&P) centres, which are usually situated in cities or bigger towns. Some of these prosthetic centres conduct outreach clinics to surrounding areas. Nevertheless, economic challenges affect both service provision and users' ability to access services. On the provision side, economic challenges manifest in a shortage of providers, stock and equipment as well as an inability to finance more expensive prosthetic components that support higher levels of functionality (ECDoH 2024). Users might struggle to afford the transport (Burger & Christian 2020; Ennion & Johannesson 2018; Gordon et al. 2020) to access service provision points that are usually in larger centres and might be hundreds of kilometres from their homes (Burger & Christian 2020; Ennion & Manig 2019; Naidoo & Ennion 2018; Tshaka, Visagie & Ned 2023).

Despite these known challenges that prosthetic services and users face in South Africa and the EC province specifically, there is little to no evidence on possible solutions. The notable exception being a study performed by Ennion, Johannesson and Rhoda (2017) that explored the use of a direct manufacturing socket system to enhance prosthetic service provision in a rural area of KwaZulu-Natal province. Thus, this article aims to present the current evidence regarding access to prosthetic services in the EC province of South Africa and suggests research and development, health systems and clinical care solutions to alleviate the barriers.

The article is structured according to certain key areas to be addressed (Figure 1). Under each key area, current evidence from the literature, unpublished research, grey sources and author opinion will be presented in an integrated manner to show the barriers and recommendations for solutions in research and development, health systems and clinical care.

Context: Eastern Cape province

The EC province, one of South Africa's poorest provinces, has vast rural areas with limited healthcare access. The three O&P service centres in the province are situated in urban areas that is Nelson Mandela Bay Metro, Buffalo City and OR Tambo district (ECDoH 2024) (Figure 2). Thus, users who often live in poverty must travel extensive distances over poorly maintained roads, while few transport options are available, to attain care (Tshaka et al. 2023). Limited outreach programmes and a lack of capacity to provide follow-up worsens the situation (Maqaqa et al. 2021).

Research methods and design

Design and data sources

A pragmatic approach was followed because the article reports on a real-world problem at a specific time and place and identifies possible solutions to the problem (Allemang, Sitter & Dimitropoulos 2021; Kaushik & Walsh 2019). Adhering to principles of pragmatism, the most appropriate data sources and knowledge that could shed light on the problem and suggest solutions were identified through reflective decision making. Pragmatism acknowledges the value of experiential knowledge and does not privilege certain knowledge types above others (Allemang et al. 2021).

Thus, our data sources include current evidence, unpublished research, financial reports and the first author's clinical and research experience. The criterion for including sources was that it provided information that could assist with facilitating problem solving and enhancement of social justice (Allemang et al. 2021). Possible solutions are based on evidence and strategies that have been implemented and seem useful, but have not been researched, and finally those that are in the incubator stage and must still be implemented.

Current evidence: The search was pragmatic rather than scoping or systematic as the focus was on identifying evidence that could illuminate (Allemang et al. 2021) the key

areas addressed in this article. Key words used in the literature search included:

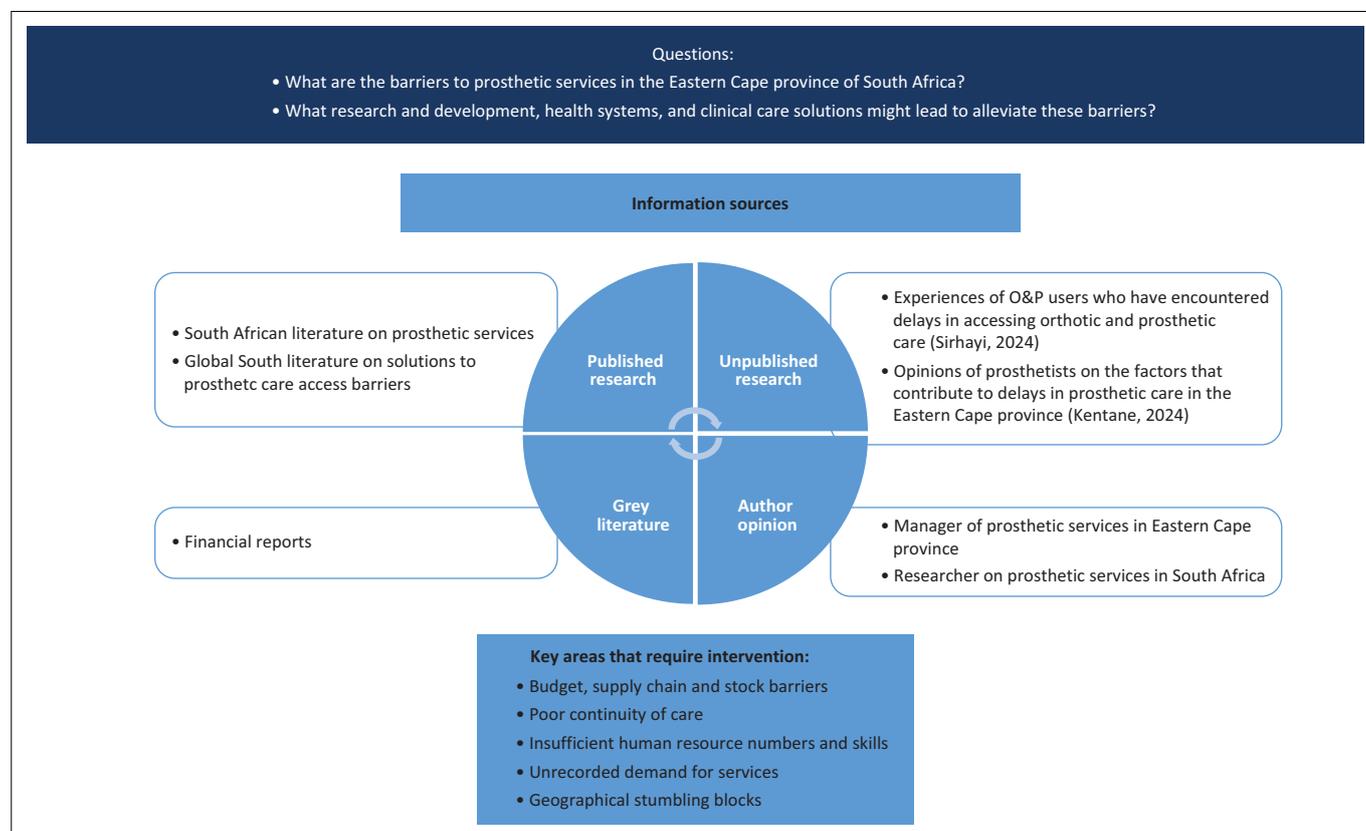
- Procurement, budget, expenditure, supply chain, tender processes, South Africa.
- Prosthetic design, manufacture, additive manufacture, 3D.
- Prosthetic service, prosthetic rehabilitation, provision, access, South Africa.
- Posts, vacant, South Africa.
- Rehabilitation systems, South Africa.

Unpublished master's theses: Both studies used a qualitative descriptive design to gather information on the present conditions regarding prosthetic service access in the EC province from persons experiencing those conditions directly (Bradshaw, Atkinson, & Doody 2017). Sirhayi (2024) explored the experience of persons waiting for a lower limb prosthesis, while Kentane (2024) explored the experiences of prosthetists.

User experiences (Sirhayi 2024): The aim of our study was to explore the experiences of people needing O&P services who have encountered delays in accessing O&P care at one O&P centre in the EC province. Data were collected in 2024 from people who experienced delays of more than 3 months. A convenient sample of six participants, of whom four were waiting for prosthetic services, was identified from the records of the O&P centre. Participants were between the ages of 38 years and 63 years. The distance they had to travel

to prosthetic services varied between 15 km and 200 km. They had been waiting from 10 months to 6 years for their devices (Table 1). Data were collected with semi-structured in person interviews conducted in isiXhosa, the participants' first language. Interviews were guided by a self-developed interview schedule and lasted between 30 min and 50 min. Questions focused on the causes of the delay in accessing services, and the effect these delays had on participants' emotional and functional well-being. Data were transcribed verbatim and then translated into English. Inductive thematic analysis was used (Braun & Clarke 2022).

Prosthetists' opinions (Kentane 2024): The aim of the study was to explore the opinions of prosthetists on the factors that contribute to delays in prosthetic measurement and fitting in the three EC province O&P centres. The study population included 29 medical orthotists and prosthetists (MOPs) who were full-time employees of the ECDoH for a minimum of 2 years at the time of our study in 2024. Although assistants and orthopaedic footwear technicians are involved in production of prostheses devices in the laboratory, they were excluded from the study as only prosthetists participated in patient-interactions and clinical decision-making processes. Total population sampling was used (Etikan, Musa & Alkassim 2016). Of the 29 prosthetists, 15 consented to participate. Table 2 shows the demographic information of the participants. Data were collected through three focus group discussions (FGDs), conducted by the third author. A FGD guide was used, which focused on:



Note: Please see full reference list of this article, Visagie, S.J., Kentane, N., Sirhayi, A., Sineke, P.N. & Mdzana, L.L., 2025, 'Health systems solutions to prosthetic service delivery obstacles in a low-resource setting', *African Journal of Disability* 14(0), a1837. <https://doi.org/10.4102/ajod.v14i0.1837>, for more information.

O&P, orthotic and prosthetic.

FIGURE 1: Conceptual framework.

- The reasons why patients wait for an appointment to be measured for a prosthesis.
- The reasons why patients wait to be fitted with the finished prosthesis.
- Other service delivery challenges participants faced.
- What participants thought could be done to reduce waiting times.

Data from the three FGDs were analysed separately, through inductive thematic analysis (Braun & Clarke 2022) after which cross-centre analysis and triangulation was carried out. Trustworthiness was supported by total population sampling, using verbatim quotes, member checking, cross-centre triangulation, a reflective diary, and a description of the setting, methods and participants' demographics (Kentane 2024).

Financial reports: The ECDoH annual report 2023–2024 provided financial information (ECDoH 2024).

Experiential knowledge: The authors provided experiential knowledge. They came from different backgrounds but share an interest in prosthetic service improvement. Surona J. Visagie, a qualified physiotherapist, is an academic with a background in prosthetic rehabilitation and research. Andile Sirhayi and Nomvano Kentane are MOP service providers in the EC province who did a masters' degree on the topic. Princess N. Sineke is the provincial manager of O&P services in the province. Luphiwo L. Mduzana is the head of the O&P department at Walter Sisulu University (a tertiary education institution in the EC province) and is working towards a PhD with prosthetic service provision as a central concept. The first author drafted the manuscript after which all authors provided feedback and additional information. Where authors did not agree on content it was discussed, and consensus was reached by them.

Data analysis: Iterative deductive thematic analysis was performed. The five key areas provided in Figure 1 constituted



Source: Wikimedia Commons, 2017, *Map of the municipalities in the Eastern Cape province of South Africa, with all municipalities named and district municipalities shaded different colours*, viewed n.d., from [https://commons.wikimedia.org/wiki/File:Map_of_the_Eastern_Cape_with_municipalities_named_and_districts_shaded_\(2016\).svg](https://commons.wikimedia.org/wiki/File:Map_of_the_Eastern_Cape_with_municipalities_named_and_districts_shaded_(2016).svg)

FIGURE 2: Map of the Eastern Cape province.

TABLE 1: Demographic profile of the prosthetic user participants.

Participant number	Gender	Age (years)	Travel distance (km)	Device in use while waiting for prostheses	Waiting period
1	F	43	200	Wheelchair	6 years
2	M	50	20	Crutches	2 years
3	M	49	50	Crutches	10 months
4	F	63	15	Wheelchair	3 years

F, female; M, male.

the themes. Data from the four sources were triangulated during the analysis.

Ethical considerations

Approval and permission to conduct the studies were obtained from the Health Research Ethics Committee at Stellenbosch University (reference numbers S23/10/252 and S23/10/263, respectively). The ECDoH and the O&P unit's head of departments provided permission. Participation was voluntary and written informed consent was obtained from participants. All data are secretly stored on password-protected computers.

Results and discussion

Budget, supply chain, and stock barriers

Financial constraints are often cited as the reason for poor health care service delivery in South Africa. This is true for rehabilitation (Maqaqa et al. 2021; Van Biljon et al. 2022), assistive technology (Ennion & Manig 2019; Maart et al. 2024; Visagie et al. 2020) and prosthetic services also (Ennion & Johannesson 2018; Pienaar & Visagie 2019). The allocated EC province budget for O&P was R106334 million in the 2023/2024 financial year with an under expenditure of R56572 million (ECDoH 2024). There was also under expenditure of the budget allocated for O&P services in the EC province in the 2022/2023 financial year (ECDoH 2024) (Table 3).

Earlier we have shown that the prosthetic target was not met for the 2023/2024 financial year. The annual financial report blames this on a shortage of consumables. Supplier invoices were not paid, and suppliers stopped delivery of consumables and components (ECDoH 2024). Kentane (2024) concurred. Participants in this study also shared similar views and stated:

'Production came to a halt; guys be frank here. Since October we have not been able to do much production work. It's April now.' (P5, FGD3, F, 25 years)

'There is no material as we speak. We hope to have it soon but now we don't. Our reality is that there is no material.' (P4, FGD3, F, 26 years)

In addition to a lack of consumables and components Kentane (2024) found that equipment was also inadequate. One participant stated the following on the subject:

'We do not have all the necessary tools to push production. There is a lot of borrowing, and it delays having to go around borrowing tools before you can get the work done. Some of the machines are also not working so we have to do things manually which can take your time.' (P5, FGD1, M, 40 years)

Cumbersome procurement processes might be at the heart of these challenges. All ECDoH invoice payments must be approved by the ECDoH Cost Containment Committee. This contributes to delayed or non-payment of suppliers. In addition, general overspending within the ECDoH impacts cash flow and prevents processing of O&P invoices. Consequently, although the budgeted funds exist on paper, they are not actually available in the O&P accounts.

Irregularities and challenges related to procurement processes, such as underspending, have been plaguing the South African public sector (Fourie & Malan 2020). Fourie and Malan (2020) attributed underspending to planning and implementation challenges because of inadequate project and financial management skills, alluding to the fact that procurement officers might be unqualified for the job. In EC province O&P centres, at least one MOP is appointed to assist with procurement. They are not trained in procurement processes and learn on the job. Including service providers, with technical expertise, in the procurement process is good practice. However, they must be trained (Israel 2023).

An integrated procurement system with different stakeholders (administrative and clinical staff) jointly planning, implementing and problem-solving procurement and supply chain actions with the assistance of appropriate software programmes optimise flow of information, funds and goods in a timely and cost-effective manner, reduce waiting times and instances of stock-outs (Israel 2023). It also enhances transparency, responsibility and accountability in procurement (Israel 2023). Fourie and Malan (2020) makes the following general suggestions to improve procurement:

- rigorous stewardship and strategic approach instead of the current administrative approach that focusses on technical aspects

TABLE 3: Orthotics and prosthetics budget and expenditure over the financial years 2023/2024 and 2022/2023.

Descriptor	2023/2024	2022/2023
Appropriated budget	R106 334 million	R87 710 million
Expenditure	R49 762 million	R53 386 million
Under expenditure	R56 572 million	R34 324 million

TABLE 2: Demographic details of the focus group participants.

Participant number	Gender	Age (years)	Number of years working for ECDoH	Degree or diploma
Focus group discussion 1				
1	M	40	12	Diploma
2	F	35	11	Degree
3	F	32	6	Diploma
4	M	53	13	Diploma
5	M	52	9	Degree
Focus group discussion 2				
1	F	29	7	Degree
2	M	29	4	Degree
3	F	27	4	Degree
4	M	26	4	Degree
Focus group discussion 3				
1	F	34	4	Degree
2	F	28	4	Degree
3	F	26	4	Degree
4	F	26	4	Degree
5	F	25	4	Degree
6	F	26	4	Degree

M, male; F, female; ECDoH, Eastern Cape Department of Health.

- collect, analyse and provide feedback on high quality data and evidence on the procurement system's performance
- assess whether more central procurement systems might not enhance efficiency (i.e. at provincial level rather than at prosthetic centre level)
- invest in professional procurement officers.

The financial report further indicates that the lack of a tender document necessitates the use of a three-quote system, which might increase the cost of components (ECDoH 2024) and lead to the purchasing of poor-quality components (Kentane 2024):

'Substandard components. That supplier gave us [prosthetic] knees that were faulty. Everything was a mess.' (P4, FDG3, F, 26 years)

Louw et al. (2023) indicated that tender documents are advantageous to assistive technology (AT) procurement processes, while off tender procurement is hampered through its complexity. A tender provides protection to the funder, the ECDoH, in this instance, because it specifies function and design features, minimum quality and durability standards, minimum numbers of products that should be available throughout the course of the year, set prices, delivery timeframes, warranties and guarantees (Visagie et al. 2020).

Finally, stock theft is an unfortunate reality that puts the supply chain under further pressure. In May 2025, the Eastern Cape Herald (a local newspaper) reported that assistive devices worth around R130000.00 (\$720.00) (still in their original packaging and labelled as the property of an O&P centre in the province) were found at a scrap metal dealership. Stronger inventory management systems with frequent risk assessments, stock audits and enhanced physical security via surveillance and access control might be effective strategies that can be adapted to prevent theft. In addition, provision of refresher training to store managers on inventory management policy, and ethical conduct training for all support staff are essential.

In addition to supply chain challenges, poor continuity of care hampers prosthetic service delivery in the EC province.

Poor continuity of care

Continuity of rehabilitation care is often challenged in South Africa through among other things *breakdown of communication* and *ineffective referral pathways* (Charumbira et al. 2024; Van der Westhuizen & Visagie 2025). Participants

in an EC province study done by Charumbira et al. (2024) on access to rehabilitation indicated that improved telephonic communication with service providers would improve access. Sirhayi (2024) also found communication between healthcare providers and users lacking with users not being updated on progress.

One participant noted:

'The communication between me and the service providers is not there. For instance, there were people who came to do those things, measuring and all that [at an outreach clinic] but I never heard from them again on the progress ... we do not get any information or feedback on when we should come for the devices that they casted us for.' (P1, waiting 6 years, F, 43 years)

On the other hand, Kentane (2024) showed that prosthetists occasionally tried to contact users without success.

Another participant stated the following on the subject:

'Sometimes you call to find out when they will be able to come but do not find them, or you leave a message, and she or he does to come back to you. Then they come months later, and the prosthesis is now not fitting because of stump changes maybe.' (P2, FDG2, M, 29 years)

Giving a return date for fitting at the time of measuring a device seems like a good idea:

'If patients can leave here with a return date that would be great. Because you'll say to your patient, I will call you but now maybe the phone is lost or something and you don't find it. If they had a date, they would just come without you even having to call.' (P2, FDG3, F, 28 years)

Another participant in the study carried out by Kentane (2024) raised concerns about this strategy and stated:

'But giving a date is sometimes a risk. Remember this [prosthesis] is custom made and manufactured by one MOP. Now if I say come back 3 weeks from now and on the day I'm sick or fall sick before I even begin the leg. The patient comes and won't get their leg.' (P1, FDG3, F, 34 years)

Precise record keeping including phone numbers, residential addresses, and contact details of next of kin might be helpful. Information on the nearest clinic should also be recorded. Clinic staff and community workers can use this information to trace patients that could not be reached via phone.

Communication barriers are compounded by unclear referral pathways. Patients are often referred to the O&P centre for a prosthesis without being referred to pre-prosthetic rehabilitation (Ennion & Rhoda 2016; Manickum et al. 2019).

TABLE 4: Established and filled orthotic and prosthetic service positions in the Eastern Cape province.

Profession	Nelson Mandela Bay		Buffalo City		OR Tambo District		Total	
	Est.	Filled	Est.	Filled	Est.	Filled	Est.	Filled
Chief MOP	2	1	2	1	2	0	6	2
MOP	8	8	9	5	10	10	27	23
MOP assistant	12	2	12	4	14	3	38	9
Total	22	11	23	10	26	13	71	34

Est., established; MOP, medical orthotist and prosthetist.

Thus, when the patient accesses the O&P centre the residual limb might not be matured or the O&P centre might be out of manufacturing materials as described earlier. The patient is then told to access a district hospital for pre-prosthetic rehabilitation. This practice causes delays, a need to return a second time to secure an appointment, a lack of follow-up and frustration, particularly when combined with financial constraints and transport challenges:

'I cannot go to BOH [Bedford Orthopaedic Hospital] by myself [without an initial referral]. I must first go to the nearest referral hospital to book an appointment. I spent one and a half hours reaching this hospital.' (P1, waiting 6 years, F, 43 years)

It is also disconcerting to encounter the situation where appointment slots are fully booked. It seems easy to address this by simply moving to the subsequent month or year in the scheduling system. Sending people home without an appointment and telling them to return later shows little empathy and possibly little understanding of the cost implications and transport barriers people face. Continuity of care is also adversely affected by insufficient human resources.

Human resources

According to the approved establishment, 71 personnel positions are allocated for O&P services in the EC province. As shown in Table 4, less than 50% of these positions are filled. Only 2 out of 6 chief positions and 9 out of 38 MOP assistant positions were filled at the time of writing the article.

Kentane (2024) concurred with the findings reported in Table 4.

One of the participants stated:

'We're short staffed in this centre and most people are not replaced when they resign or go on pension. We don't have MOP assistants. There is also the issue of not having a receptionist and having to sacrifice one MOP for that.' (P4, FDG1, M, 53 years)

Of the prosthetists, 8 hold diplomas, 13 have bachelor's degrees and 2 have a master's degree. In South Africa, there is no differentiation between MOPs who hold a diploma, bachelor's or master's degree when it comes to occupational title and employment. They are registered as MOPs at the Health Professionals Council of South Africa and employed in the government sector without recognition of qualification in salary scale, job levels or promotion (Mduzana et al. 2020). Promotion and salary increase is based solely on years working for government rather than qualifications, continuous education exploits, skills and/or other professional attributes. These poorly structured career pathways do not comply with international standards (WHO 2017) and might lead to losing professionals to the private sector and international markets.

The norm for MOPs is 5–10 per million of the population (WHO 2017). Thus, 23 prosthetists should be ample for the EC province population of 7.23 million (Republic of South Africa [RSA] 2022). However, the norms were determined, assuming sufficient support and managerial staff (WHO 2017). With less than 50% of management and support staff positions filled, MOPs must juggle responsibilities and cannot focus on their core jobs. Time-consuming older manufacturing methods are still used in the EC province, which means MOP assistants are crucial to facilitate timeous manufacturing processes. In addition to filling vacant posts, compulsory commentary service and skills shifting might lessen the human resource challenges.

Kentane (2024) suggested that compulsory community service might help to alleviate the burden. Compulsory community service was implemented in 1998 in South Africa and currently includes most health care service professions (Gardiner 2023; Reid et al. 2018), albeit not MOPs. The aim of compulsive community services is to facilitate health care service provision to all citizens and to afford young professionals the opportunity to further clinical and professional skills (Reid et al. 2018). Studies have shown that compulsory community service makes a positive contribution to service delivery and facilitate professional development in South Africa (Gardiner 2023; Matlhaba 2023; Reid et al. 2018; Van Stormbroek & Buchanan 2016). However, supervision is not always deemed adequate (Matlhaba 2023; Reid et al. 2018). The community service health professionals (health professionals doing compulsory community services in South Africa) are also faced with heavy work loads, frustration (Van Stormbroek & Buchanan 2016), theory practice implementation gaps, inexperience (Matlhaba 2023) budget and equipment constraints, language barriers as well as physical and emotional exhaustion (Gardiner 2023; Matlhaba 2023). Thus, compulsory community service might help alleviate staff shortages implementation in the MOP profession should be approached with caution and would benefit from lessons learned by other professions.

Skills shifting: Skills shifting might provide another option for managing a shortage of prosthetists. Currently, the scope of practice in South Africa follows Global North realities where all categories of staff are available at all levels of care in sufficient numbers. In settings such as the EC province where only one or two professional groups are available at many service delivery points, it might be worthwhile to reconsider scope of practice and introduce skills transference where possible (Visagie et al. 2020)

Skills: Prosthetic function depends on socket comfort and fit among other things, which depends on the skills of the prosthetist (Yang, Aslani & McGarry 2019). Participants in the study by Kentane (2024) explained the challenges caused by varying competency levels among the MOPs:

'We had two or three cases here where we saw that this patient will end up not being helped because no one was experienced enough [to assist him or her].' (P3, FGD3, F, 26 years)

Ongoing professional development also seems to be a problem:

'We have been struggling to get proper training workshops.' (P4, FGD2, M, 26 years)

Insufficient skills among rehabilitation service providers in South Africa are also described by Maart et al. (2024). The Health Professionals Council of South Africa requires professionals to obtain a minimum of 30 continuous professional development (CPD) points per annum. However, being compliant does not mean prosthetists are obtaining relevant training and skills. The CPD points can be obtained outside the scope of practice of MOPs. In-house CPD accredited training appropriate to local needs sourced by the Department of Health might be a solution. This can be performed in partnership with Walter Sisulu University, a local tertiary institution that trains MOPs.

Demand for services

It is unclear whether the numbers of users are steadily increasing or whether these challenges have led to the growing backlog. Participants in the focus groups (Kentane 2024) indicated that users waited 3–4 years to be measured for a prosthesis. In some instances, recently referred users were seen as referred while the historic backlog is dealt with separately (Kentane 2024):

'Yes, we have a list or backlog we are working to clear. We book those patients to come for measurement. At the same time a patient who is not on that list, if they walk in now, are referred to us now, we cast them. We do not book him for another date because if we do that it will increase the same backlog, we are trying so hard to clear.' (P4, FGD2, M, 26 years)

This in-house decision is not equitable and the ethics behind it are questionable.

Two strategies that might speed up the prosthetic manufacturing process and thus reduce waiting times are three dimensional (3D)-printing and direct socket manufacturing. 3D-printing can provide functional patient-specific prosthetic parts in short times, at low prices (Abbady et al. 2022; Van der Stelt et al. 2021). In a 3D pilot project, in Sierra Leone, patella tendon bearing transtibial prosthetic sockets were manufactured for eight users. At 6 weeks follow up, all eight were still wearing and walking with the prosthesis (Van der Stelt et al. 2021). Despite rapid growth and a positive inclination towards additive manufacturing in South Africa (Dzogbewu et al. 2022), it has not been taken up extensively in the field of lower limb prosthetic production. This might be because of safety concerns. A lower limb prosthesis must be structurally strong enough to carry the weight of the user. Additional research is needed.

Ennion et al. (2017) explored the satisfaction, function and quality of life users' who received a transtibial prosthesis using the direct socket manufacturing method in a South African setting. Findings showed that although this method reduced waiting times, but it was inconclusive regarding user function, satisfaction and quality of life. The initial

outlay also comes at a high cost, and prosthetists must be trained and certified to use the system. In the final quarter of 2024, 19 MOPs from all three O&P centres in the EC province received direct socket manufacturing training and certification. In this period, 78 users were fitted with transtibial prostheses using the direct socket manufacturing method. Direct socket manufacturing will be rolled out further in the EC province, through outreach clinics (late 2025 or early 2026). Further research is required to determine which socket manufacture procedure is most efficient and effective in South African settings.

The demand for prosthetic services is inflated by inappropriate referral for prostheses and a lack of early screening:

'Everyone who is amputated is put on the [waiting] list but not everyone is eligible to receive and use the prosthesis. That makes the waiting list look longer than it is.' (P4, FGD1, M, 53 years)

Owolabi and Chu (2022) indicated that people are frequently promised a prosthesis at the time of amputation, even when prosthetic rehabilitation is not the most suitable and/or the safest option (Donaghy et al. 2020). Therefore, a person might access prosthetic services only to be informed that they will not receive a prosthesis. The person will have to wait additional time for the appropriate services and devices. Extra costs might be incurred, and rehabilitation outcomes might be compromised. There is also a risk of emotional trauma as a prosthesis symbolises hope and normalcy for people with amputations (Groud & Perennou 2022; Jefferies, Gallagher & Philbin 2018). To ensure that services are optimally focused, a screening tool to predict whether a person is a candidate for prosthetic rehabilitation or will be best supported through another rehabilitation pathway should be utilised.

Several screening tools, for example, Guidelines for screening of prosthetic candidates: Lower limb (Mdzuzana et al. 2018), the amputee mobility predictor assessment tool (AMPnoPRO) (Gailey et al. 2002), classification guidelines on industry websites for example Össur® and Otto Bock® as well as in-house guidelines used at some O&P centres exist. However, none of these have been standardised and validated for a South African context. They are used interchangeably and intermittently. Often prosthetic description is based on empirical knowledge causing a lack of transparency and possible inequity in prescription (Donaghy et al. 2020). The final decision is made by prosthetists during the initial appointment. As shown in the EC province, this might be more than 2 years after amputation surgery. A standardised tool, to be completed after surgery, must be developed and used throughout the province to guide appropriate referral and rehabilitation intervention after lower limb amputation. A study is currently under way to develop such a tool.

An additional barrier is the lack of provincial and national databases with information on the number of people with amputations, prostheses issued and components used. Without this information, future prosthetic needs cannot be forecasted,

and budgets and services cannot be planned (Morris et al. 2021). Developing a database is a costly time-consuming endeavour. However, some advances towards establishing prosthetic needs can be made over the short term by capturing relevant data through ongoing monitoring of services (Morris et al. 2021). The regular collection, analysis and feedback of service delivery data are essential to determine if the service achieves its objectives. Without ongoing monitoring, it is impossible to measure success, plan future services and apportion limited resources (Fourie & Malan 2020).

A database will also assist with planning to ensure that repair and replacement services can be provided as needed. Prostheses maintenance and repairs can be a challenge in lower-income countries because of the high costs, limited materials and resources, small workforce and restricted access to prosthetic centres (Abbadly et al. 2022). Focus group participants reported that servicing existing users led to a reduction in the manufacturing time and components available to manufacture new prosthetic devices (Kentane 2024):

'Patients that are already prosthetic users don't go on a waiting list. So the components or the resources that we use mostly get depleted on those patients and only a few new patients are usually attended to in a financial year.' (P1, FGD1, M, 40 years)

Prosthetic services span the user's lifetime; repairs and replacement will be needed (Diment et al. 2024). This need should be included in the budget and procured number of components and consumables for any given period. Not having sufficient components to provide services to current and new users points to a lack of planning and might mean records are not used for future planning. It further underscores the need for monitoring and databases at service delivery points and provincial level.

Geographical access

Transport systems, road infrastructure and distances: Several authors have recognised inadequate transport systems, poorly maintained roads and long distances as factors limiting access to health care and assistive technology services generally in South Africa (Maart et al. 2024; Morris et al. 2021; Van Biljon et al. 2022; Visagie et al. 2020), the EC province (Tshaka et al. 2023; Vergunst et al. 2016) and prosthetic rehabilitation specifically (Ennion & Johannesson 2018; Ennion & Manig 2019; Naidoo & Ennion 2018). These barriers are closely tied to users' financial status (Ennion & Johannesson 2018; Naidoo & Ennion 2018). While inconvenient to wealthier South Africans, transport and geographical barriers can be overcome through access to a privately owned vehicle and financial resources to cover the running costs of travelling long distances. However, if indigent, your choice is reduced or sometimes removed completely. Public transport in the form of minibus taxis is the only means of transport between many rural and urban areas. Their costs, in addition to poor accessibility for people with physical impairments, especially wheelchair users, prevent some people from using them (Duri & Luke 2022; Fredericks, Visagie & van Niekerk 2024). Furthermore, they seldom provide door-to-door service.

Thus, people still need to negotiate the distance between their houses and the pickup points (Fredericks et al. 2024; Naidoo & Ennion 2018). These access routes are usually unpaved, uneven, with rocks, potholes, tree roots, dust and mud depending on the season. They often traverse uneven terrain with steep hills and tight bends (Morris et al. 2021; Tshaka et al. 2023). Participants in the study performed by Sirhayi (2024) also confirmed these barriers:

'I am unable to get to the main road ... there are big stones that I cannot traverse. The roads are gravel and full of stones and hilly ... They get muddy when it's rainy and because I only have one leg, it's risky.' (P3, waiting 10 months, M, 49 years)

Maqaqa et al. (2021), Ennion and Johannesson (2018) and Van Biljon et al. (2022) found that patients choose to reduce rehabilitation visits because of transport costs. Participants in the study carried out by Sirhayi (2024) highlighted poverty and unaffordable transport:

'I must pay taxis to get to the hospital, yet I am not working because the skill that I have requires me to stand, so money is the problem.' (P1, waiting 6 years, F, 43 years)

Wheelchair users are charged double and sometimes triple as shown by Fredericks et al. (2024) and supported by findings from Sirhayi (2024):

'Whenever I must go to the hospital ... I pay for it [*the wheelchair*], myself and the person I am with, and finances are the problem.' (P4, waiting 3 years, F, 63 years)

Government subsidised transport was provided between health care institutions (Sirhayi 2024):

'I wait overnight at the local hospital for the ambulance to take us to BOH. The schedules of the ambulances vary. [*Sometimes*] I miss the information and only hear about it afterwards.' (P1, waiting 6 years, F, 43 years)

However, people accessing prosthetic services might be left behind if the vehicle is full since they do not have a life-threatening condition (Visagie & Likando 2025). Transport challenges can be mediated by bringing services closer to users through outreach clinics and decentralisation.

Mobile *outreach units* can be used to bring rehabilitation practitioners to rural areas regularly (Morris et al. 2021). However, participants in the study by Kentane (2024) described not having enough staff to conduct outreach clinics and not having a vehicle:

'We end up being short staffed so we haven't been able to spare staff that can go out and do outreach, and the fact that we don't have an allocated vehicle.' (P2, FGD2, M, 29 years)

Studies have also found that a lack of suitable vehicles hamper outreach visits (Ennion & Johannesson 2018; Maart et al. 2024; Maseko, Adams & Myezwa 2024). Maseko et al. (2024) confirm that outreach services suffer because of insufficient staff numbers. In addition, challenges such as the department not paying for accommodation and the MOP assigned to the clinic falling sick, lead to cancelling of outreach clinics.

Outreach clinics might still be part of the answer. But then the services provided there must be expanded and the clinic must be a steady feature, included in service planning (Maseko et al. 2024) not stopped when snags hit such as a reduced number of service providers. It can be operated from a provincial level with service providers appointed specifically to be employed at outreach clinics. The mobile delivery point is set up with the necessary equipment, consumables and stock.

Another option is to employ service providers at decentralised points as suggested by one participant in the study by Kentane (2024).

One of the participants stated:

'It would be better if instead of the outreach clinics we just had an MOP in every hospital like they do with other clinical support staff.' (P4, FGD3, F, 26 years)

Prosthetic services are dependent on expensive equipment in addition to human resources. Thus, the preceding suggestion might not be financially viable. However, the Health and Welfare Sector Education and Training Authority of South Africa provides limited funding for employment of recently qualified MOPs who struggle to find employment. It might be possible to place some of these MOPs at district hospitals with the necessary equipment and stock and pilot the effectiveness of MOP services at district level. The district-based MOP can address basic needs while users with more complex needs can be referred to the O&P centres.

Limitations

While the literature has been used, much of the information provided is based on the experience of the authors and thus open to bias. Consensus between the four authors on the shared information should reduce personal biases but it remains a reality to be aware of. The research carried out by Sirhayi (2024) and Kentane (2024) was part of formal graduate studies and were examined; however, these articles were not published in peer reviewed accredited journals.

Conclusion

The described barriers might be more widespread in South African and other Global South settings. Thus, the suggested solutions might be applicable to a wider context than in the current article. Prosthetic services are dependent on a complex open system and a systems approach should be followed when implementing the suggested solutions. The local, up and downstream effect of change at any one point must be considered to ensure the most appropriate solutions are identified (De Savigny & Adam 2009). In addition, implementation should go hand in hand with research. Any new strategy whether it relates to operational systems or clinical care must be researched to ensure it is efficient,

effective and support end user function and satisfaction (De Savigny & Adam 2009). Budgets must be ring fenced, and posts must be filled. It is important to do comprehensive research that includes end user outcomes over time of new technologies such as direct socket (DS) manufacturing and 3D printing before full scale implementation.

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CRediT authorship contribution

Surona J. Visagie: Conceptualisation, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Supervision. Nomvano Kentane: Conceptualisation, Methodology, Formal analysis, Investigation, Data curation, Writing – review & editing. Andile Sirhayi: Conceptualisation, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing. Princess N. Sineke: Writing. Luphiwo L. Mdzana: Writing – review & editing.

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Data availability

The data that support the findings of this study are openly available from the corresponding author, Surona J. Visagie, upon reasonable request.

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References

- Abbad, H.E., Klinkenberg, E.T., De Moel, L., Nicolai, N., Van der Stelt, M., Verhulst, A.C. et al., 2022, '3D-printed prostheses in developing countries: A systematic review', *Prosthetics and Orthotics International* 46(1), 19–30. <https://doi.org/10.1097/PXR.0000000000000057>
- Allemang, B., Sitter, K. & Dimitropoulos, G., 2021, 'Pragmatism as a paradigm for patient-oriented research', *Health Expectations* 25(1), 38–47. <https://doi.org/10.1111/hex.13384>
- Baumann, M.F., Frank, D., Kulla, L.C. & Stieglitz, T., 2020, 'Obstacles to prosthetic care – Legal and ethical aspects of access to upper and lower limb prosthetics in Germany and the improvement of prosthetic care from a social perspective', *Societies* 10(1), 10. <https://doi.org/10.3390/soc10010010>
- Bradshaw, C., Atkinson, S. & Doody, O., 2017, 'Employing a qualitative description approach in health care research', *Global Qualitative Nursing Research* 4, 2333393617742282. <https://doi.org/10.1177/2333393617742282>
- Braun, V. & Clarke, V., 2022, 'Conceptual and design thinking for thematic analysis', *Qualitative Psychology* 9(1), 3–26. <https://doi.org/10.1037/qp0000196>
- Brügger, A., Luthi, F., Vuustiner, P., Cherix, S., Borens, O. & Steinmetz, S., 2023, 'Prosthetic fitting associated with better survival at 5 years after above-knee amputation because of vascular insufficiency', *Annals of Physical and Rehabilitation Medicine* 66(5), 101727. <https://doi.org/10.1016/j.rehab.2022.101727>
- Burger, R. & Christian, C., 2020, 'Access to health care in post-apartheid South Africa: Availability, affordability, acceptability', *Health Economics, Policy and Law* 15(1), 43–55. <https://doi.org/10.1017/S1744133118000300>
- Calabrese, L., Maffoni, M., Torlaschi, V. & Pierobon, A., 2023, 'What is hidden behind amputation? Quantitative systematic review on psychological adjustment and quality of life in lower limb amputees for non-traumatic reasons', *Healthcare* 11(11), 1661. <https://doi.org/10.3390/healthcare11111661>
- Charumbira, M.Y., Conradie, T., Berner, K. & Louw, Q.A., 2024, 'Bridging the chasm between patients' needs and current rehabilitation care: Perceptions of adults presenting for primary care in the Eastern Cape', *BMC Health Services Research* 24(1), 166. <https://doi.org/10.1186/s12913-024-10564-5>
- De Savigny, D. & Adam, T., 2009, *Systems thinking for health systems strengthening*, WHO, Geneva, viewed 12 July 2025, from <https://www.who.int/alliance-hpsr/resources/9789241563895/en/>.
- Diment, L., Curtin, S., Kenney, L., Reynolds, K.J. & Granat, M.H., 2024, 'Priorities when designing a service-focused delivery model for mobility devices: A systematic review', *Disability and Rehabilitation: Assistive Technology* 19(7), 2442–2453. <https://doi.org/10.1080/17483107.2024.2313077>
- Donaghy, A.C., Morgan, S.J., Kaufman, G.E. & Morgenroth, D.C., 2020, 'Team approach to prosthetic prescription decision-making', *Current Physical Medicine and Rehabilitation Reports* 8, 386–395. <https://doi.org/10.1007/s40141-020-00289-x>
- Duri, B. & Luke, R., 2022, 'Transport barriers encountered by people with disability in Africa: An overview', *Journal of Transport and Supply Chain Management* 16(2), 826. <https://doi.org/10.4102/jtscm.v16i0.826>
- Dzogbewu, T.C., Fianko, S.K., Amoah, N. & De Beer, D., 2022, 'Additive manufacturing in South Africa: Critical success factors', *Heliyon* 8(11), e11852. <https://doi.org/10.1016/j.heliyon.2022.e11852>
- Eastern Cape Department of Health (ECDoH), 2024, *Eastern Cape department of health annual report 2023–2024*, viewed 08 May 2025, from <https://www.ehealth.gov.za/index.php/document-library/annual-reports>.
- Ennion, L. & Johannesson, A., 2018, 'A qualitative study of the challenges of providing pre-prosthetic rehabilitation in rural South Africa', *Prosthetics and Orthotics International* 42(2), 179–186. <https://doi.org/10.1177/0309364617698520>
- Ennion, L., Johannesson, A. & Rhoda, A., 2017, 'The use of a direct manufacturing prosthetic socket system in a rural community in South Africa: A pilot study and lessons for future research', *Prosthetics and Orthotics International* 41(5), 455–462. <https://doi.org/10.1177/0309364616683982>
- Ennion, L. & Manig, S., 2019, 'Experiences of lower limb prosthetic users in a rural setting in the Mpumalanga Province, South Africa', *Prosthetics and Orthotics International* 43(2), 170–179. <https://doi.org/10.1177/0309364618792730>
- Ennion, L. & Rhoda, A., 2016, 'Roles and challenges of the multidisciplinary team involved in prosthetic rehabilitation, in a rural district in South Africa', *Journal of Multidisciplinary Healthcare* 9, 565. <https://doi.org/10.2147/JMDH.S116340>
- Ennion, L. & Wu, T.Y., 2019, 'Participation restrictions and vocational rehabilitation needs experienced by persons with a unilateral lower limb amputation in the Western Cape, South Africa', *African Journal of Disability* 8(1), 1–7. <https://doi.org/10.4102/ajod.v8i0.456>
- Etikan, I., Musa, S.A. & Alkassim, R.S., 2016, 'Comparison of convenience sampling and purposive sampling', *American Journal of Theoretical and Applied Statistics* 5(1), 1–4. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Fard, B., Persoon, S., Jutte, P.C., Daemen, J.W.H., Lamprou, D.A., Ten Hoope, W. et al., 2023, 'Amputation and prosthetics of the lower extremity: The 2020 Dutch evidence-based multidisciplinary guideline', *Prosthetics and Orthotics International* 47(1), 69–80. <https://doi.org/10.1097/PXR.0000000000000170>
- Fourie, D. & Malan, C., 2020, 'Public procurement in the South African economy: Addressing the systemic issues', *Sustainability* 12(20), 8692. <https://doi.org/10.3390/su12208692>
- Fredericks, J.P., Visagie, S. & van Niekerk, L., 2024, 'A qualitative exploration of community mobility experiences of wheelchair users', *African Journal of Disability* 13, 1253.
- Gailey, R.S., Roach, K.E., Applegate, E.B., Cho, B., Cunniffe, B., Licht, S. et al., 2002, 'The amputee mobility predictor: An instrument to assess determinants of the lower-limb amputee's ability to ambulate', *Archives of Physical Medicine and Rehabilitation* 83(5), 613–627. <https://doi.org/10.1053/apmr.2002.32309>
- Gardiner, C.V., 2023, 'Empirical bioethics and the health 'brain-drain': A qualitative study of the experiential and ethical landscape of compulsory community service for a group of South African doctors', *Medical Humanities* 49(3), 416–426. <https://doi.org/10.1136/medhum-2022-012494>
- Gordon, T., Booyesen, F. & Mbonigaba, J., 2020, 'Socio-economic inequalities in the multiple dimensions of access to health care: The case of South Africa', *BMC Public Health* 20(1), 1–13. <https://doi.org/10.1186/s12889-020-8368-7>
- Groud, P. & Perennou, D., 2022, 'After the rehabilitation unit. Accommodating daily life with a prosthesis', *Alter* 16(1), 1–20. <https://doi.org/10.4000/9if3>
- Israel, B., 2023, 'Mediating effect of integrated health commodities procurement system on the relationship between responsiveness and health service delivery', *International Journal of Health Governance* 28(3), 284–298. <https://doi.org/10.1108/IJHG-03-2023-0028>
- Jefferies, P., Gallagher, P. & Philbin, M., 2018, 'Being "just normal": A grounded theory of prosthesis use', *Disability and Rehabilitation* 40(15), 1754–1763. <https://doi.org/10.1080/09638288.2017.1312564>
- Kaushik, V. & Walsh, C.A., 2019, 'Pragmatism as a research paradigm and its implications for social work research', *Social Sciences* 8(9), 255. <https://doi.org/10.3390/socsci8090255>
- Kentane, O., 2024, 'Factors contributing to delays in prosthetic measurement and fitting in Eastern Cape public hospitals', Unpublished master's research assignment, Stellenbosch University, Stellenbosch.
- Louw, Q.A., Conradie, T., Xuma-Soyizwapi, N., Davis-Ferguson, M., White, J., Stols, M. et al., 2023, 'Rehabilitation capacity in South Africa – A situational analysis', *International Journal of Environmental Research and Public Health* 20(4), 3579. <https://doi.org/10.3390/ijerph20043579>
- Maart, R.A., Mji, G., Morris, L.D. & Ernstzen, D.V., 2024, 'The rehabilitation landscape in a low-to-middle-income country: Stakeholder perspectives and policy implications – A qualitative study', *Journal of Health Care Organization, Provision, and Financing* 61, 00469580241271973. <https://doi.org/10.1177/00469580241271973>
- Manickum, P., Ramklass, S.S. & Madiba, T.E., 2019, 'A five-year audit of lower limb amputations below the knee and rehabilitation outcomes: The Durban experience', *Journal of Endocrinology, Metabolism and Diabetes of South Africa* 24(2), 41–45. <https://doi.org/10.1080/16089677.2018.1553378>
- Maqaqa, Q., Ariana, P. & Polack, S., 2021, 'Examining the availability and accessibility of rehabilitation services in a rural district of South Africa: A mixed-methods study', *International Journal of Environmental Research and Public Health* 18(9), 4692. <https://doi.org/10.3390/ijerph18094692>
- Maseko, L.J., Adams, F. & Myezwa, H., 2024, 'Perceptions of integrated rehabilitation service delivery in a metropolitan district', *African Journal of Primary Health Care & Family Medicine* 16(1), a4069. <https://doi.org/10.4102/phcfm.v16i1.4069>
- Mathaba, K.L., 2023, 'Compulsory community service for new nurse graduates in South Africa: A narrative literature review', *Journal of Nursing Regulation* 13(4), 66–80. [https://doi.org/10.1016/S2155-8256\(23\)00031-5](https://doi.org/10.1016/S2155-8256(23)00031-5)
- Mdzuzana, L., Visagie, S. & Mji, G., 2018, 'Suitability of 'Guidelines for Screening of Prosthetic Candidates: Lower Limb' for the Eastern Cape, South Africa: A qualitative study', *South African Journal of Physiotherapy* 74(1), 396. <https://doi.org/10.4102/sajp.v74i1.396>
- Mdzuzana, L., Tiwari, R., Ned, L. & Chikte, U., 2020, 'Exploring national human resource profile and trends of Prosthetists/Orthotists in South Africa from 2002 to 2018', *Global Health Action* 13(1), 1792192.
- Morris, L.D., Grimmer, K.A., Twizeyemariya, A., Coetzee, M., Leibbrandt, D.C. & Louw, Q.A., 2021, 'Health system challenges affecting rehabilitation services in South Africa', *Disability and Rehabilitation* 43(6), 877–883. <https://doi.org/10.1080/09638288.2019.1641851>
- Naidoo, U. & Ennion, L., 2019, 'Barriers and facilitators to utilisation of rehabilitation services amongst persons with lower-limb amputations in a rural community in South Africa', *Prosthetics and Orthotics International* 43(1), 95–103. <https://doi.org/10.1177/0309364618789457>
- Owolabi, E.O. & Chu, K.M., 2022, 'Knowledge, attitude, and perception towards lower limb amputation amongst persons living with diabetes in rural South Africa: A qualitative study', *African Journal of Primary Health Care & Family Medicine* 14(1), a3398. <https://doi.org/10.4102/phcfm.v14i1.3398>
- Paquette, R., Highsmith, M.J., Carnaby, G., Reistetter, T., Phillips, S. & Hill, O., 2024, 'Duration, frequency, and factors related to lower extremity prosthesis use: Systematic review and meta-analysis', *Disability and Rehabilitation* 46(20), 4567–4585. <https://doi.org/10.1080/09638288.2023.2276838>
- Pienaar, E. & Visagie, S., 2019, 'Prosthetic use by persons with unilateral transfemoral amputation in a South African setting', *Prosthetics and Orthotics International* 43(3), 276–283. <https://doi.org/10.1177/0309364619825891>
- Piscitelli, D., Beghi, M., Bigoni, M., Diotti, S., Perin, C., Peroni, F. et al., 2021, 'Prosthesis rejection in individuals with limb amputation: A narrative review with respect to rehabilitation', *Rivista Di Psichiatria* 56(4), 175–181.
- Reid, S.J., Peacock, J., Kornik, S. & Wolvaardt, G., 2018, 'Compulsory community service for doctors in South Africa: A 15-year review', *South African Medical Journal* 108(9), 741–747. <https://doi.org/10.7196/SAMJ.2018.v108i9.13070>
- Republic of South Africa (RSA). Department of Statistics, 2022, *Provincial profile: Eastern Cape*, viewed 31 July 2025, from <https://www.statssa.gov.za/publications/Report-03-01-71/Report-03-01-712022.pdf>.

- Sirhayi, A., 2024, 'A qualitative exploration of the experiences of orthotic and prosthetic users who encountered delays in accessing orthotic and prosthetic services in an Eastern Cape setting', Unpublished master's research assignment, Stellenbosch University, Stellenbosch.
- Theron, B. & Visagie, S., 2024, 'Exploring the need for lower limb prosthetic guidelines in South Africa's private healthcare sector', *Canadian Prosthetics & Orthotics Journal* 7(2), 44450. <https://doi.org/10.33137/cpoj.v7i2.44450>
- Tshaka, B., Visagie, S. & Ned, L.Y., 2023, 'Non-use of healthcare services among persons with mobility impairments in Cofimvaba, South Africa', *African Journal of Disability* 12, a1112. <https://doi.org/10.4102/ajod.v12i0.1112>
- Van Biljon, H.M., Salie, B., Van Wyk, J.C., Daniel, J., Kersop, L.M., Naidoo, M. et al., 2022, 'Access to public healthcare rehabilitation services by persons with disabilities in South Africa: A scoping review', *Disability, CBR & Inclusive Development* 33(3), 41–67. <https://doi.org/10.47985/dcidj.620>
- Van der Stelt, M., Grobusch, M.P., Koroma, A.R., Papenburg, M., Kebbie, I., Slump, C.H. et al., 2021, 'Pioneering low-cost 3D-printed transtibial prosthetics to serve a rural population in Sierra Leone – An observational cohort study', *EClinicalMedicine* 35, 100874. <https://doi.org/10.1016/j.eclinm.2021.100874>
- Van der Westhuizen, E. & Visagie, S., 2025, 'Outcome measurement: Design of a social impact framework to measure shifts in the ecosystem for inclusion', *Assistive Technology* 37(suppl 1), S87–S95. <https://doi.org/10.1080/10400435.2024.2332689>
- Van Stormbroek, K. & Buchanan, H., 2016, 'Community service occupational therapists: Thriving or just surviving?', *South African Journal of Occupational Therapy* 46(3), 63–72. <https://doi.org/10.17159/2310-3833/2016/v46n3a11>
- Vergunst, R., Swartz, L., Hem, K.G., Eide, A.H. & Mannan, H., 2016, 'Access to health care for persons with disabilities in rural South Africa', *BMC Health Services Research* 17(1), 741. <https://doi.org/10.1186/s1291-017-2674-5>
- Visagie, S., Scheffler, E., Seymour, N. & Mji, G., 2020, 'Assistive technology service delivery in South Africa: Conceptualising a systems approach', *South African Health Review* 1, 119–127.
- Visagie, S.J. & Likando, C.M., 2025, 'An exploration of adherence to the World Health Organization's prosthetic standards in Namibia', *African Journal of Disability* 14, a1614. <https://doi.org/10.4102/ajod.v14i0.1614>
- Von Kaeppeler, E.P., Hetherington, A., Donnelley, C.A., Ali, S.H., Shirley, C. & Challa, S.T., 2021, 'Impact of prostheses on quality of life and functional status of transfemoral amputees in Tanzania', *African Journal of Disability* 10, a839. <https://doi.org/10.4102/ajod.v10i0.839>
- Webster, J., Borgia, M. & Resnik, L., 2023, 'Prosthesis nonuse and discontinuation in United States veterans with major limb amputation: Results of a national survey', *Prosthetics and Orthotics International* 47(6), 575–585. <https://doi.org/10.1097/PXR.000000000000248>
- World Health Organization (WHO), 2017, *Standards for prosthetics and orthotics*, viewed 02 June 2025, from <https://apps.who.int/iris/bitstream/handle/10665/259209/9789241512480-part1-eng.pdf?sequence=1&isAllowed=y>.
- World Health Organization (WHO), 2025, *Strengthening prosthetics and orthotics services*, viewed 09 April 2025, from <https://www.who.int/teams/health-product-policy-and-standards/assistive-and-medical-technology/assistive-technology/prosthetics-and-orthotics-services#>.
- Wikimedia Commons, 2017, *Map of the municipalities in the Eastern Cape province of South Africa, with all municipalities named and district municipalities shaded different colours*, viewed n.d. from: [https://commons.wikimedia.org/wiki/File:Map_of_the_Eastern_Cape_with_municipalities_named_and_districts_shaded_\(2016\).svg](https://commons.wikimedia.org/wiki/File:Map_of_the_Eastern_Cape_with_municipalities_named_and_districts_shaded_(2016).svg)
- Yang, S.E., Aslani, N. & McGarry, A., 2019, 'Influences and trends of various shape-capture methods on outcomes in trans-tibial prosthetics: A systematic review', *Prosthetics and Orthotics International* 43(5), 540–555. <https://doi.org/10.1177/0309364619865424>