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REVIEW

Can We Reduce Diabetes-Related Lower Limb Amputations?

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Abstract

Lower extremity amputation is the most feared complication in people living with diabetes and produces a significant physical, psychosocial and economic burden. The annual cost of diabetes-related ulceration and amputation is £837–£962 million, i.e., 0.8–0.9% of the National Health Service budget for England. Major amputation rates have reduced globally, largely in association with the introduction of diabetes foot multidisciplinary team services. However, more recently, amputation rates have stagnated in the UK and started to increase again in the USA, driven by increased amputation rates in younger patients and those from areas of greater social deprivation. We discuss interventions shown to reduce lower limb amputation in diabetes including multidisciplinary team services, root cause analysis, prompt referral for expert assessment and whole systems approaches designed to improve diabetic foot care throughout the patient experience. Some recent novel clinical interventions also demonstrate potential for greater limb preservation. We also discuss recent novel plastic and vascular surgery interventions and advanced dressing solutions, which show promise in improving limb salvage rates in the context of diabetic foot ulceration.

Key words: diabetic feet; foot ulcer; peripheral vascular disease; surgical amputation

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Introduction

3.8 million people aged 16 years and over in England have diabetes, equivalent to 8.6% of the population of this age group (Public Health England, 2016). The prevalence continues to rise. There are more than 7000 amputations annually in the UK in people with diabetes, costing over £27 million (Kerr et al, 2019). The annual cost of healthcare for diabetes-related ulceration and amputation was calculated in 2019 to be £837–£962 million, equivalent to 0.8–0.9% of the National Health Service (NHS) budget for England (Kerr et al, 2019). This represents approximately 0.5% of the £157 billion 2019 national healthcare expenditure for England (King's Fund, 2024) .

In adults with diabetes, lower extremity amputation (LEA) is a major complication due to the physical, economic and psychosocial burden. We define major lower extremity amputation as above-knee, through-knee or below-knee amputation; minor amputations include partial foot, toe or ray amputations. Foot infection and amputation are the most feared complications of diabetes in those both with

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and without existing diabetic foot disease and are feared more than blindness, heart attack, stroke and death (Wukich et al, 2022).

Several aetiological pathways are linked with conditions leading to LEA. It is also a crucial indicator of the success of preventive care such as the effectiveness of glycaemic control, management of cardiovascular disease risk factors, screening, and treatment of individuals who are at high risk of foot complications (Harding et al, 2019). LEA has a significant impact on mortality, morbidity and ability to mobilise with only 41% of patients being successfully fitted with a prosthesis following a major amputation, with negative predictors of limb fitting being transfemoral and bilateral amputation (Davie-Smith et al, 2017).

30-day mortality following non-traumatic major amputation is reported as 7–22% (van Netten et al, 2016) and 5-year mortality can be as high as 52–80% (Thorud et al, 2016), although it is not clear from the data whether amputation itself hastens death or is a marker for pre-existing frailty and co-morbidity. Major amputation also contributes to weight gain and overall deconditioning (Gailey et al, 2008), although whether the quality of life is more negatively impacted by major amputation or by chronic ulceration is unclear (Quigley and Dillon, 2016).

This review will discuss the importance of the multidisciplinary teams and how they reduce major amputation rates and do so in a net cost-saving manner. The National Diabetes Foot Care Audit, performed in England and Wales, has produced much valuable data on the relationship between diabetes foot care processes and outcomes, particularly around time to first expert assessment and the evidence that whole systems approaches, which address multiple aspects of the patient journey can reduce amputation is presented. Novel therapies with evidence of efficacy in reducing amputations will be discussed as well as current challenges to further reducing amputation rates and strategies for tackling them.

Multidisciplinary Teams

The development of systems to improve the care of the diabetic foot and thus reduce amputations has a long history, going back to the establishment of the first diabetic foot clinics by Elliott Joslin at the New England Deaconess Hospital in the 1920s and, in Europe to Mike Edmunds setting up a diabetic foot multidisciplinary team (MDT) clinic in King's College Hospital, London in 1981. These were the first attempts to bring together podiatry, diabetology and specialised surgical input to reduce diabetic foot complications (Sanders et al, 2010). The King's team reported an immediate 50% reduction in major amputations following the introduction of the MDT clinic (Sanders et al, 2010).

In 1995, the Global Lower Extremity Amputation Study examined diabetes-related lower extremity amputation (DRLEA) rates across 10 international sites using a standard protocol (LEA Study Group, 1995). The study collected data on minor and major amputations in each site, ascertaining data from multiple sources at each site (e.g., hospital and operating theatre records, limb fitting centre data, disability register) and using a standard abstraction form. Of the 4 UK centres that took part in the study, South Tees was found to have by far the highest incidence

of DRLEA (Canavan et al, 2003). This led to the development of a consultant-led diabetic foot MDT service in South Tees in 1996. A continuous longitudinal study set up at the time to examine the impact of this reorganization showed a 75% reduction in major DRLEAs from 1995 to 2000 (Canavan et al, 2003).

A health economic analysis of the introduction of a diabetes foot MDT at South Tees and North West London assessed the cost of the service (consultant, podiatrist, diabetes specialist nurse staff costs) and the cost savings associated with the introduction of the service (based on the reported reduction in amputation rates). This found that the annual cost of the MDT service was £36,000 but the annual cost saving as a result of reduced major amputation rates was £169,000–£195,000 (Kerr, 2017). This suggests that the introduction of the diabetes foot MDT service resulted in a net annual cost saving of £133,000–£159,000.

A systematic review and meta-analysis published in 2020 examined the effectiveness of diabetic foot multidisciplinary teams in reducing major amputation rates in adults with diabetes (Albright et al, 2020). The authors found that the provision of a diabetic foot MDT clinic resulted in a 39–56% reduction in DRLEA rates.

The presence of a diabetic foot MDT service is not sufficient in itself as delays can be incurred earlier in the pathway. Early referral to specialist MDT care is vital to prevent limb loss; a study in Taiwan identified a 50% lower major DRLEA rate in people referred to a diabetic foot MDT in the earliest compared to the latest quartile of times to referral (Lin et al, 2021). Patient education on the importance of self-presentation with deteriorating foot problems has the potential to reduce the time to first expert assessment, however, there is no conclusive evidence that patient education reduces the risk of amputation (Adiewere et al, 2018).

The UK National Institute for Health and Care Excellence (NICE) guideline NG19 states that a diabetic foot multidisciplinary care service should include healthcare professionals with expertise in diabetes care, podiatry, diabetes specialist nursing, vascular surgery, microbiology, orthopaedic surgery, orthoses, interventional radiology, casting and wound care. It also suggests that anyone with diabetes and an active foot problem (ulceration, possible Charcot neuro-osteoarthropathy, critical ischaemia) should be referred to a multidisciplinary diabetic foot care team (MDFT) within one working day (NICE, 2019). Optimal diabetic foot care cannot be achieved by any single specialist team in isolation and requires collaborative working in an MDT. Not only do diabetic foot MDT's result in reductions in major amputations, doing so in a net cost-saving manner, they also address multiple key components of care, including glucose control, local wound management, management of vascular disease and infection (Musuuza et al, 2020). Perhaps as a result of the overwhelming evidence of benefit as well as national guidelines in the UK (NICE, 2019), there has been a widespread introduction of diabetic foot MDT's over the last few decades; 91% of NHS Trusts in England and Wales report that they have a dedicated multidisciplinary diabetes foot care service (NHS England, 2024). Once established however, the success of an MDT is dependent on leadership (Musuuza et al, 2020), rapid referral into the team (Lin et al, 2021), and optimised referral pathways from community and primary care (Sharpe et al, 2023).

Aside from coordinating clinical care, an important remit of a diabetes foot MDT is the regular review of local DRLEA's with the aim to reduce avoidable amputation and improve care processes. A tool to facilitate this process is the root cause analysis (RCA). The diabetic foot MDT in Sheffield, UK, performed an RCA of all amputations at the start of a comprehensive service review that aimed to reduce local DRLEA rates (Gandhi et al, 2015). They examined all minor and major amputations performed in Sheffield over a 12-month period with the aim of identifying areas of patient care that were suboptimal. They found that at least 20% of amputations were potentially avoidable with key process issues being delays in either referral from primary care or investigations and suboptimal antibiotic treatment. These issues were addressed and a reduction in major DRLEA of almost 50% was observed.

Although there is no current mechanism for root cause analysis results to feed into wider national policy, Diabetes UK recommends that findings are reported back to local MDTs and networks, including any areas of practice contributing to avoidable amputations (Diabetes, 2017).

National Diabetes Footcare Audit

Expanding to a larger scale the National Diabetes Foot Care Audit (NDFA) examines care processes and their relationship with diabetic foot outcomes at a national level with the aim of assessing factors associated with an increased risk of ulceration and poor ulcer outcomes. This national audit was introduced in 2014 to collect data from specialist diabetic foot care services in England and Wales on all newly occurring diabetic foot ulcers, including risk factors and patient outcomes. The aim is to minimise the burden of data collection for clinicians, who are required only to collect some limited baseline data at the first patient visit and then data on healing at 12 weeks with other data being collected from nationally available sources (e.g., the core National Diabetes Audit and Hospital Episode Statistics). A recently published report (NHS England, 2024) analysed 122,030 ulcer episodes between 2018–2023, and identified variables including patient and ulcer characteristics and care processes that were associated with being alive and ulcer free at 12 weeks. Time to first expert assessment was the only significant care process that was associated with being alive and ulcer free at 12 weeks and it was the fourth most significant variable, after ischaemia, ulcer area and ulcer depth. The audit identified that almost half of all patients whose first expert assessment was within 0–13 days of ulcer onset were alive and ulcer free at 12 weeks, compared with only a third when the ulcer was present for longer than 2 months at the time of presentation.

The NDFA found that the length of time to first expert assessment is associated with ulcer severity at presentation and that 75% of amputations occur in those patients presenting with severe ulceration (NHS England, 2017). Patients who self-refer into Specialist Foot Care Services have the most positive outcomes with 56.1% being alive and ulcer free at 12 weeks.

The NDFA has been pivotal in underlining the importance of early expert assessment to ensure positive ulcer outcomes. The data emphasise the importance of

educating primary care clinicians and patients on referral pathways to ensure timely referrals into Specialist Foot Care Services, ensuring prompt first expert assessment. Recommendations made by NDFA include ensuring specialist foot care services are accessible to all people with diabetic foot ulceration, and that healthcare providers arrange early expert assessments for all new ulcers.

Whole Systems Approaches

What happens when many of these improvements in care processes and others are combined with the aim of improving care at multiple parts of the patient journey? Whole systems approaches to the management of patients with diabetic foot disease seek to understand and optimise the whole patient journey from community surveillance through to inpatient management of complications and recurrence. Systems for diabetic foot care have been successfully redesigned in several areas of the UK around the podiatry team as leaders and co-ordinators of patient flow, leading to improvement in amputation rates in North West London (Palladino et al, 2022) and NHS Greater Glasgow and Clyde (Wylie, 2019). The Scottish Diabetes Foot Action Group has achieved nationally consistent patient education material, produced a simple foot risk stratification scheme for community staff training and determined standards for specialist podiatry care, which together have led to improvements in case ascertainment and major amputation rates across Scotland (Leese et al, 2011).

The Manchester Amputation Reduction Strategy was developed in response to local major amputation rates that were higher than the national average with high healthcare inequality. This strategy aimed to optimise the patient pathway at all levels from community foot screening to secondary care management and included the creation of clinical pathways and education packages for community nurses and podiatrists to assist the performance of vascular assessment, reducing the time to vascular investigation via podiatry initiation, reducing low risk podiatry workload (e.g., routine nail care) and improving access to MDFT's. The pilot project was performed in Salford and demonstrated a 42% reduction in major amputations compared to a 21% reduction in Greater Manchester (Sharpe et al, 2023).

After previously identifying high DRLEA rates, service redesign in one area of the South West of England in 2007 led to a reduction in major amputations and a peer-review assessment of foot care processes across the South West (Paisey et al, 2018). This identified ten key diabetic foot care processes including adequacy of community podiatry staffing, weekly MDFT clinics, inpatient diabetic foot care and foot checks, orthotic input, urgent vascular input and root cause analyses of major amputations. A clear negative association was shown between major amputations and the number of key diabetes foot care processes in place. Additionally, as the uptake of care processes improved from 2 to 10 during the observation period, a reduction in major amputations of almost 90% was observed (Fig. 1, Paisey et al (2018)).

System-wide approaches need to be responsive to the challenges within specific populations and employ innovative solutions to meet local needs. This is

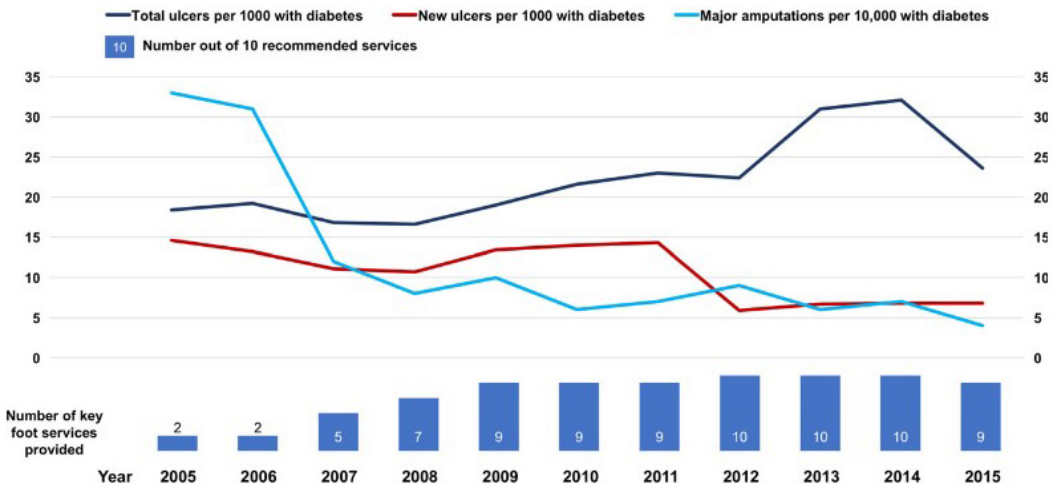

Fig. 1. Whole systems approach to reduce major DRLEA in the South West of England. Reprinted from (Paisey et al, 2018) [Wiley], available under the Creative Commons CC BY-NC-ND license (https://creativecommons.org/licenses/by-nc-nd/4.0/). DRLEA, diabetes-related lower extremity amputation.

exemplified by the Reducing Amputation in People with Diabetes (RAPID) care pathway developed by the University of the Highlands and Islands in Inverness and rolled out across the Scottish Highlands, meeting the needs of a widely geographically dispersed, largely rural population using video consultations to support existing face-to-face services (MacRury et al, 2018). Pathway reform, along with remote consulting and email advice, appears to be showing promise in reducing major amputation in this population (Main et al, 2021).

Whole system redesign has been effective in settings outside the UK, with a programme working with low-income communities in the USA successfully reducing their major amputation rate by 79% through a focus on community engagement, patient education and routine use of offloading (Patout et al, 2000).

Novel and Advanced Therapies

An alternative approach to optimising the organisation of care in order to reduce amputations is to make improvements to the quality of diabetic foot care. There have been a number of innovations and improvements in the management of diabetic foot disease in the last few years, which have the potential to reduce lower extremity amputation. However, it is essential that complex and novel techniques do not distract from excellent basic wound care. Rather, they should be viewed as complementary adjuncts to meticulous wound debridement, wound cleansing, and careful timely application of the most appropriate wound dressings. This ensures that the best period for wound granulation and epithelialisation in the weeks following stenting or bypass surgery is capitalised upon and not squandered through delays in planning wound debridement and reconstruction.

Negative Pressure Wound Therapy

Negative pressure wound therapy (NPWT) is an established advanced therapy approved by NICE for use after surgical debridement in diabetic foot disease (NICE, 2019). It has been shown to increase healing in the postoperative setting, and thus has the potential to reduce amputation (Armstrong et al, 2005). Systems have been developed combining wound irrigation with NPWT to mitigate the effect of wound colonisation (Wu et al, 2022); however, this is not a substitute for adequate wound debridement and published results are mixed. For example, a study comparing NPWT with and without saline irrigation in complex foot wounds, did not find improved time to wound healing or reduction in the number of surgeries when comparing those with irrigation to those without (Davis et al, 2020). A study of 75 patients with complex foot and ankle wounds requiring flap reconstruction found improved outcomes with antibiotic-containing irrigation fluid combined with NPWT as compared to NPWT alone prior to surgery (Gao et al, 2019). Preoperative irrigation and vacuum sealing drainage with antibiotic-containing drainage fluid of foot and ankle wounds improves the outcome of reconstructive skin flap surgery (Gao et al, 2019).

Biological Dressings and Dermal Substitutes

The development of biological dressings and advanced therapies has gained increasing interest in the management of diabetic foot ulcers (Holl et al, 2021). Cell-based therapies, which involve the application of cells with regenerative potential (primarily stem and progenitor cells to a wound), are still considered experimental and clinical trials are ongoing. Increased levels of microvascular blood flow within DFUs treated with topically active dermal substitutes have been reported (Newton et al, 2002). Other experimental therapies include autologous platelet-rich plasma (PRP), as well as recombinant human growth factor therapies.

Acellular dermal matrix (ADM) products are more established and have been developed from a variety of sources, including human acellular dermal matrix (HADM), porcine acellular dermal matrix (PADM) and bovine acellular dermal matrix (BADM) tissue. There are also entirely synthetic ADMs available, which are gaining in popularity. These are made of materials such as polyurethane (Lane et al, 2024). Biodegradable Temporising matrix in the reconstruction of complex wounds: A systematic review and meta-analysis.

All ADM materials aim to mimic the host extracellular matrix and act as a scaffold to promote host tissue growth (Janis and Nahabedian, 2012). In the presence of adequate blood supply, they can be combined with NPWT to create a more robust wound bed to subsequently accept a split thickness skin graft in areas that might not previously have been considered suitable for grafting due to poor recipient surfaces or the risk of subsequent shear. Examples include small areas of exposed bone or tendon, or weight bearing surfaces. The synthetic ADMs also appear to be more resistant to infection and breakdown than biological ADMs and have shown promising early results in diabetic foot wound care with low re-ulceration and infection rates reported (Kuang et al, 2022).

Topical Wound Oxygen Therapy

Topical wound oxygen therapy (TWO_2) increases oxygen supply to the hypoxic wound surface and has been used in clinical practice to treat chronic wounds for over 50 years. A recent multicentre placebo-controlled trial of TWO_2 found >4.5 times likelihood of complete healing of diabetic foot ulcers at 12 weeks compared to sham treatment (Frykberg et al, 2020). A meta-analysis of TWO_2 has reported a risk ratio of complete healing at 12 weeks with TWO_2 of 1.59 (Carter et al, 2023). These data suggest that TWO_2 is a treatment option for people with diabetic foot ulcers failing to heal with standard care and thus has the potential to reduce amputation.

Deep Venous Arterialisation

Deep venous arterialisation (DVA) is an emerging technique showing promise for patients with chronic limb threatening ischaemia (CLTI) who lack standard revascularisation options and thus frequently face major amputation. The procedure, initially described in 1977 (Sheil, 1977) increases tissue oxygenation by creating an arteriovenous fistula between a proximal arterial inflow and distal deep venous target, thus arterialising the recipient vein in order to improve blood supply to the affected limb (Yan et al, 2022). DVA has been described using percutaneous, open and hybrid approaches and has generally been performed in people with lower limb ulceration and distal peripheral arterial disease, which is not amenable to endovascular or conventional arterial bypass procedures, one of the most common causes of major lower extremity amputation in people with diabetes. In a study in which 77% patients had diabetes, lower limb ulceration and no option for arterial revascularisation. The percutaneous transcatheter technique has been reported a 6-month amputation-free survival of 66% and complete healing of 25% (Shishehbor et al, 2023). The open technique involves anastomosing a harvested long saphenous vein proximally to the below-knee popliteal artery and distally to the posterior tibial vein followed by disruption of the valves in the deep veins of the foot to allow arterial blood flow into the foot via the graft and also shows potential for limb salvage.

In a recent meta-analysis in view 67% had diabetes and 88% ulceration, DVA has reported a 1-year limb salvage rate of 79% (Yan et al, 2022).

DVA has the potential to change the landscape for patients with diabetic arterial and foot disease and offer a potential life-changing option by avoiding major lower limb amputation, thus improving the quality of life for patients and bringing associated economic benefits.

Free Tissue Transfer

In a small number of cases where the above techniques, skin grafts or local flaps are insufficient, free tissue transfer techniques are appropriate to resurface critical foot and ankle defects with a composite block of tissue from elsewhere. While this is complex surgery requiring a reasonably fit patient and adequate blood supply, careful patient selection and planning can successfully salvage limbs that would otherwise be amputated (Chang et al, 2019). A recent study of patients' experiences of such surgery reported positive outcomes (Goodall et al, 2024).

Trends in Diabetes-Related Amputations in the UK and Beyond

So, has the implementation of the measures described above led to a sustained reduction in DRLEA? Population-based study of countries or regions in which LEA was examined in the same population over time has shown a consistent decrease in the rates of DRLEA from the 1980s to 2010 among diverse areas (Harding et al, 2019).

Similarly, the Freemantle Diabetes Study, an observational study of cohorts of patients with diabetes from Western Australia, demonstrated a 40% reduction in major and minor amputation between the cohorts recruited in 2008–2011 and those from 1993–1996 (Hamilton et al, 2023).

However, more recent nationally representative USA data show that while in adults without diabetes non-traumatic lower limb amputation rates reduced by 22% from 2000 to 2015, in adults with diabetes, a 43% reduction in DRLEA from 2000 to 2009 was followed by a 50% increase from 2009 to 2015. The increase was predominantly driven by a 62% increase in minor amputations, while there was also a 29% increase in major LEA that was most apparent in men, the young and middle-aged (Geiss et al, 2019). Centers for Disease (CDC) data from the USA is consistent with these findings, again showing a rise in DRLEA starting in 2010, which is most marked in the young and middle-aged.

In the UK, the most recent National Diabetes Foot Care report shows that major DRLEA rates are stable, but minor amputations have increased from 2012 to 2020 (NHS England, 2024).

Headwinds & Solutions

Why is the incidence of DRLEA not continuing to improve and what can be done to address this? One contributor is that the 'low hanging fruit' have now been picked. The NDFA report 2018–2023 showed that 91% of NHS Trusts in England and Wales report that they have a dedicated multidisciplinary diabetes foot care service, 98% have a referral pathway to the MDFT, and 95% state that the pathway is designed to ensure that all people with diabetes presenting with a new active foot problem can be assessed within 14 days (NHS England, 2024). However, the annual report finds variability across England and Wales in the proportion of people actually having a first expert assessment (FEA) within 2 weeks, with no clear trend toward an increase in this proportion from 2018 to 2023. Thus, a focus on reducing the time to FEA and increasing self-referral with new diabetic foot problems should be major targets to reduce future amputations. The key to the first of these two goals is working with primary care teams to ensure awareness of the importance of early referral, developing and sharing referral pathways and creating clinical capacity (and the awareness of this) in diabetic foot care teams for new referrals. Patient education is the key to increasing self-referral, both in secondary care (healed patients) and community foot protection teams, so that patients are aware of the ability and mechanisms of self-referral. Foot care teams can now easily assess the response to such efforts thanks to the NDFA. The UK national diabetic

foot care report (NHS England, 2024) demonstrates a clear association between deprivation and both minor and major amputations with rates of major amputation almost doubling from the least deprived to the most deprived quintiles. This link has also been shown by studies in the UK (Hurst et al, 2020) and the USA (Fanaroff et al, 2021). Socioeconomic status is associated with an unfortunate combination of increased cardiovascular risk factors, reduced uptake of care process and poorer biomedical outcomes. People living with diabetes and greater socio-economic deprivation have higher blood pressure, are more likely to smoke and have proteinuria than those with lower levels of deprivation (Chaturvedi et al, 1998). People with Type 1 diabetes in the highest vs the lowest quintile of deprivation have poorer glucose control (Innes et al, 2022) and a 5-year reduction in life without diabetes complications (Höhn et al, 2022). However, the uptake of diabetes technologies and structured education and completion of the UK's 8 key diabetes care processes is lower in people with greater socio-economic deprivation (Fallon et al, 2022; NHS England, 2020). These data suggest that to continue reducing amputation rates, efforts and resources should be targeted at the most deprived populations. A good example of this is the Manchester Amputation Reduction Strategy project (Sharpe et al, 2023) and the adoption of such whole systems approaches in other areas of high socio-economic deprivation should be encouraged. These data also raise the question as to whether amputation rates should be standardised not just for age and ethnicity as is done currently, but also for deprivation.

The other population demographic that is likely to require further resource input to reduce amputation is younger people with diabetes. People with Type 2 diabetes diagnosed at a younger age are more obese, more insulin resistant and more likely to be of Indian or Asian ethnicity compared to people developing Type 2 diabetes later in life (Lin et al, 2024). During follow up, glucose control is poorer, and at any given age, the incidence of microvascular complications and mortality is higher in those developing diabetes at a younger age (Lin et al, 2024). There is thus a need to control hyperglycaemia and manage cardiovascular risk factors (blood pressure (BP), lipids) more aggressively in people developing Type 2 diabetes at a younger age, in addition to ensuring screening for microvascular complications is optimised. As the majority of such patients are managed within primary care, this could be achieved using an incentivised payment based on agreed indicators, e.g., the Quality and Outcomes Framework in the UK.

Conclusion

In order to continue previous improvements in amputation rates, evidence-based interventions should be implemented, including diabetes foot multidisciplinary teams, reducing time to FEA, root cause analysis for all amputations and whole systems approaches to improve patient pathways. Appropriate patients should be offered advanced dressings and plastic and vascular surgery interventions to improve limb salvage rates. Increasing self-referral through patient education and ensuring new diabetic foot problems receive a first expert assessment within 2 weeks are key,

as is targeting hard-to-reach groups at high risk of amputation, including younger and more deprived populations.

Key Points

- Major amputation is the greatest fear in people with diabetes and a foot complication.
- Diabetes-related amputations can be reduced by establishing diabetic foot multidisciplinary teams, reducing the time from presentation to expert assessment and whole systems approaches.
- The implementation of these interventions has reduced diabetes-amputation rates, but more recently, rates have either stagnated (UK) or increased (USA).
- Amputation rates have stagnated due to a rise in amputation in younger patients and diminishing returns from the roll-out of diabetic foot MDT services.
- Further reduction in amputation rates will require renewed focus on younger patients and those with multiple indices of deprivation.

Availability of Data and Materials

All the data of this study are included in this article.

Author Contributions

MAbd, MAbo, WA, AB, RB, HD, NI, IN, ES and SA contributed to literature review and drafting the manuscript. SJL also contributed to the writing, collated and completed final editing of the manuscript. All authors made substantial contributions to conception. All authors contributed to revising the manuscript critically for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

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Conflict of Interest

The authors declare no conflict of interest.

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