Lower-limb amputation in New Zealand: temporal changes and the role of diabetes mellitus

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Lower-limb amputation is traumatic and life-altering for individual patients, and resource-intensive for the health system serving them. While some lower-limb amputations occur in healthy populations following accidents or other acute trauma, most arise from chronic conditions, including peripheral vascular disease and diabetes mellitus.1,2 The rate of lower-limb amputation (and temporal changes in the rate) has not been well-documented in New Zealand, nor has the contribution of diabetes to this rate been quantified at a national level.

We examined inpatient hospitalisation data for the period 2005–2016, and found that a total of 13,562 lower-limb amputations were conducted over this time period (crude rate: 26.6/100,000 New Zealanders in 2013 Census). This rate is comparable to other international contexts, such as Canada (22.9/100,000).1 By linking these amputation data to New Zealand’s Virtual Diabetes Register (VDR),3 we were able to determine that 58% (n=7,802) of these amputations were performed on patients with diabetes. Very few amputations were flagged as occurring due to lower-limb cancer (n=42) or trauma (n=156), leaving approximately 40% of all lower-limb amputations occurring among patients without documented diabetes, cancer or trauma. Vascular disease is likely to be a major contributor to this group of amputations, and also to the burden of amputation among the diabetic population. In a recent investigation, we found that the presence of peripheral vascular disease among patients with diabetes increased the risk of minor (below-ankle) amputation by more than seven times (adjusted hazard ratio [HR] 7.22, 95% CI 6.09–8.56) and the risk of major (through-or above-ankle) amputation by more than 12 times (HR 12.72, 95% CI 10.65–15.24) compared with those without peripheral vascular disease.4

When examining temporal changes in the rate of major and minor amputation across the total population, we found that the rate of major amputation appeared to reduce between 2005 and 2016—from 12/100,000 in 2005 to 8/100,000 in 2016 (Figure 1). Using Poisson regression, we determined that the rate of major amputation has dropped by 3.0% per year over this period (95% CI 2.2%–3.3%), but has remained relatively stable for minor amputation (0.7% increase/year, 95% CI 0.1%–1.4%). In combination, these observations may (or may not) suggest a gradual improvement in the prevention of major amputation via increased timely access to vascular and high-quality diabetic foot care services; however, this is speculative and further investigation is required to substantiate this theory.

While the rate of major amputation may appear to be reducing over time for the total population, this observation masks some substantial disparities between population sub-groups. In a recent analysis based on population-level patients with diabetes (using the VDR) we found that male patients with diabetes are nearly 40% more likely to undergo a major amputation than female patients (adjusted HR: 1.39, 95% CI 1.20–1.61), and nearly 80% more likely to undergo a minor amputation (1.77, 95% CI 1.56–2.00).4 This gender disparity is in keeping with other international contexts.5–9 The literature remains unclear regarding the
definitive driver(s) of this gender disparity, but plausible reasons include a reduced likelihood among males to seek timely diabetic foot care compared with females, and a higher risk of smoking and vascular disease among men.

Perhaps most troubling is the substantial disparity between Māori patients with diabetes and European/Other (non-Māori/Pacific/Asian) patients, where Māori are 65% more likely to undergo a major amputation (adjusted HR: 1.65, 95% CI 1.37–1.97). Similar findings were observed by Robinson et al in 2016. However, somewhat paradoxically, the risk of minor amputation is no greater among Māori patients than European/Other patients (1.06, 95% CI 0.90–1.25). Both Pacific and Asian patients with diabetes appear to have the lowest relative risk of amputation: for example, Pacific patients are 27% less likely than European/Other patients to undergo major amputation (0.73, 95% CI 0.55–0.95), while Asian patients are 57% less likely (0.43, 95% CI 0.29–0.65). The drivers of these disparities—particularly the contrast between Māori and Pacific populations, both of which make up a disproportionate share of the New Zealand population with diabetes—requires further deliberation and suitably sophisticated data analysis to account for how this trend is changing.

While it is pleasing to observe a marginal decline in the rate of major amputation over time, greater collective effort across the health sector is needed to further reduce this rate. In the vast majority of cases, lower-limb amputation is an entirely preventable event—a last-resort intervention that is the result of a chronic, systemic decline in peripheral function. The chronic nature of this decline provides ample opportunity for the prevention of limb loss: for instance, given that 80% of all diabetic amputations are preceded by a foot ulcer, primary care and outpatient foot care services must continue to be resourced to provide primordial prevention against the development of foot ulcers—as well as the efficacious treatment of current ulcers and the prevention of re-ulceration. Evidence suggests that an integrated approach across primary and secondary services that targets high-risk patients will yield the greatest outcome in this respect.

In summary, more than half (58%) of lower-limb amputations occurring in New Zealand between 2005–2016 occurred among patients with diabetes. While rates of major amputation appear to be marginally reducing over time, rates of minor amputation are holding steady around 15/100,000 New Zealanders. To further reduce these rates amidst increasing rates of diabetes, and to address troubling disparities within our population, the prevention (and treatment) of diabetic foot ulcers deserves continued and increasing resource allocation.
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Nil.

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