DFA Guides You Through

Forecasted savings to Australia with evidence-based diabetic foot care

Contained in the

Australian diabetes-related foot disease strategy 2018-2022

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Introduction

As we discussed in the previous "DFA Guides You Through", a robust estimation of the full burden of a disease is the backbone behind any good health campaign. We therefore discussed all statistics and estimates behind the current burden of diabetes-related foot disease (DFD). But that only shows what the burden is today – how about tomorrow?

While it is hard to predict the future, in our Australian diabetes-related foot disease strategy 2018-2022 we forecasted what can happen to this burden when we invest in implementing evidence-based care throughout Australia (1). We forecasted Australia would save each year:

- ***11,000 hospitalisations:*** *That's 400 Australians not needing to be in hospital tonight*
- ***2,000 amputations:*** *That's nearly 6 Australians not needing an amputation today*
- ***760 lives:*** *That's 2 Australians not dying because of DFD today*
- ***$550million:*** *That's $1.5million not being spent by Australian taxpayers on DFD today*

We know what you are probably thinking: where did this come from, how did they do this and are these forecasts accurate? So sit back and relax as it's time for another "DFA Guides You Through".

Our Methods

To put it simply we put our estimated current DFD burden findings in a large bowl, poured in the best Australian research that has investigated implementing evidence-based care, sprinkled in a little high-quality international research to fill the gaps, and whacked it in the DFA analysis oven.

To put that in a slightly more scientific context: we first used our findings from the current estimated burden of diabetes-related foot disease in Australia in 2017 as a baseline (1). We then identified the best available Australian studies on implementing evidence-based care for people with DFD from systematically searching the literature. In areas where Australian studies were missing we identified the best available international studies from similar areas. We averaged the findings from all these studies for DFD morbidity, mortality and costs. And finally, we combined these findings with our estimated current baseline burden estimates, to calculate the forecasted future savings for Australia.

Please note we have used the same definitions for DFD morbidity, mortality and costs in this document as in our earlier "DFA Guides you through".

With that, we presented what are, in our opinion, the best available forecasts for the DFD burden in Australia if evidence-based DFD care was implemented across Australia. We will now guide you through our forecast calculations in three parts: Morbidity; Mortality; and Costs.

We again welcome any Australian studies that you think we may have missed that would shed better light on any of our forecasts. Please feel free to email us those studies, or any other comments, if you think they would help: nationaloffice@diabeticfootaustralia.org

Our Findings

Let's get straight to it and reveal our forecasted savings, as presented in The Australian diabetes-related foot disease strategy 2018-2022. (1)

Table 2: Forecasted savings to the estimated burden of diabetes-related foot disease in Australia each day after systematic implementation of evidence-based care

Characteristic	Australia [a]	Per 100,000 [b]
Morbidity savings		
People now NOT in public hospital because of DFD [c]	400	1.5
People now NOT undergoing a diabetes-related amputation [d]	5.5	1 every 45 days
Mortality savings		
People now NOT dying from DFD [e]	2	1 every 115 days
Cost savings		
Estimated cost SAVINGS to public hospitals from DFD [f]	$350,000	$1,400
Estimated cost SAVINGS to all health systems from DFD [g]	$1.5million	$6,000

If you love detail, you can read the legend to this table here.

Part 1: Morbidity savings

The first part was calculating the forecasted morbidity savings to Australia if we implemented systematic evidence-based care across Australia. For this part, we concentrated on the potential savings to hospitalisations and amputations caused by DFD in Australia.

People now NOT in public hospital in Australia

To calculate our forecast on the number of DFD hospitalisations we could save each year (i.e. "now NOT" occurring anymore), we started with our current estimate of 27,600 public hospital admissions caused by DFD each year in Australia (1). We then systematically searched for Australian studies in

the area and identified only one population-based Australian study that investigated DFD hospitalisation rates before and after implementing evidence-based DFD care.

This study was an large observational study that investigated the annual incidence of DFD hospitalisation across Queensland from 2005 to 2010 (2). Although the study was observational, the authors reported significant changes in DFD care in Queensland during that period, including implementing a number of ambulatory evidence-based DFD strategies across nearly all Queensland regions in 2008 and 2009 (2). More precisely, the following strategies were implemented:

i. Best practice multi-disciplinary DFD clinical pathways
ii. Best practice multi-disciplinary DFD training and education
iii. Ambulatory multi-disciplinary DFD teams
iv. A core practice focus on DFD management for public podiatrists
v. Telehealth expert DFD support for DFD clinicians &
vi. Measuring systems to monitor key DFD clinical performance indicators (2, 3)

The study evaluated the impact of these strategies on DFD hospital admissions, DFD hospital bed day usage and diabetes-related amputations (see below section) trends between 2005 and 2010. To do this, the authors used the same hospital discharge data codes we discussed in the last "DFA Guides You Through" to identify DFD hospitalisation in each of those years (for diabetes-related peripheral neuropathy, PAD, foot ulcers, foot infections, Charcot, osteomyelitis and amputations) (2).

What they found was a 43% reduction in the annual incidence rates of DFD hospital admission and a 40% reduction in DFD hospital bed days used in 2010 compared to 2005 in people with diabetes (2). As this was the only Australian population-based study reporting DFD hospitalisation we could identify, we decided to use the more conservative 40% reduction to apply to our current estimates for Australian public hospital admissions. From this we calculated that 11,000 (40%) of the 27,600 public hospitalisations currently caused by DFD each year - or 400 (40%) of the 1,000 people in a public hospital each night because of DFD – could be prevented in the near future if evidence-based DFD care was systematically implemented across Australia.

People now <u>NOT</u> undergoing an amputation in Australia

To calculate our forecast on the numbers of diabetes-related amputations we could save (i.e. "now NOT" occurring anymore), we started with our current estimate of 4,400 diabetes-related amputations occurring in Australia each year (1).

From our search we identified three observational population-based Australian studies that investigated diabetes-related amputation rates before and after changes in evidence-based DFD care. The first was the same Queensland study discussed above (2), the second a study across Western Australia (4) and the third a study in the Western Australia region of Freemantle (5).

We discussed the methodology of the first study from Queensland in the section above, so we will jump straight to their findings for diabetes-related amputations (2). They found a 40% reduction in the annual incidence of total diabetes-related amputations in 2010 compared to 2005, which included a 45% reduction of major amputations and a 37% reduction in minor amputations (2).

The second study from Western Australia investigated the annual incidence of diabetes-related amputation across Western Australia from 2000 to 2010 (4). Again, although this study was observational, the authors noted a number of changes in DFD care during this period including:

i. Improved coordinated multi-disciplinary DFD care
ii. Improved best practice DFD clinical protocols and referral pathways
iii. Increased number of revascularisation procedures &
iv. Improved DFD patient education (4).

The authors very cleverly analysed linked data from Western Australia to evaluate a range of different amputation trends between 2000 and 2010. This means unlike similar studies, the authors could link a range of different data to the individual patient such as diabetes type, cardiovascular disease history and different amputation procedures, and tracked patients history back over 15 years. This allowed the authors to elegantly control some of these factors when they calculated their amputation incidence rates for different types of diabetes, amputation procedures and whether it was an initial or recurrent amputation. This makes this study one of the more robust studies of amputation rates in the world. However, like the Queensland study above, they used very similar generic hospital discharge codes to identify which patients had new amputation procedures (4).

They found a ~3% reduction per year in the annual incidence rate of total diabetes-related amputations, which included ~6% reduction per year for major amputations and ~1% in minors. Over the whole 11 year period this equated to ~30% reduction in total diabetes-related amputation incidence rates. They also found type 1 and type 2 diabetes populations had similar reductions (4).

The third study was part of the acclaimed Fremantle Diabetes Study and investigated the change in prevalence of total diabetes-related amputations over ~15 years in the region of Fremantle, Western Australia (5). The Fremantle study is arguably one of the best population-based studies of people with diagnosed diabetes in the world. This study carefully identified the majority of people with diagnosed diabetes in Fremantle and then examined them for a huge number of medical conditions, one of which was amputations. They did this for two separate cohorts: the first cohort (1993-1996) and the second cohort (2008-2011). They then monitored both cohorts annually for 5 years. The result was an enormous dataset. This meant when they compared the total diabetes-related amputations between the two cohorts, from different time periods, they were able to control for a huge range of medical conditions and other factors using some very complex modelling (5).

What they found was that the risk of total diabetes-related amputations in the second time period (2008-2011) was reduced by 72% when compared to the first time period (1993-1996), even after controlling for a huge range of medical, sociodemographic, economic, ethnic, diabetes management and past hospitalisation management factors (5). Therefore, the authors attributed this reduction in risk to factors they couldn't control. They suggest these factors were most likely to have been DFD service changes that occurred between the two periods including:

i. Increased access for patients at-risk of DFD to podiatrists via Medicare rebates
ii. Increased access for patients with DFD to multi-disciplinary DFD teams as more become available in the region
iii. Increased access to improved appropriate footwear and offloading device modalities (5).

So from these three studies reporting 30%, 40% and 72% reductions in amputation rates in diabetes populations, we simply decided to calculate a mean (~45%) reduction to use in our forecasts. We acknowledge these rates have been calculated and reported subtly differently, but consider 45% is a good combined informed estimate.

From this we calculated that ~2,000 (45%) of the 4,400 total diabetes-related amputations each year - or ~5.5 (45%) of the 12 total diabetes-related amputations each night - could be prevented if evidence-based DFD care was systematically implemented across Australia.

Part 2: Mortality savings

People now <u>NOT</u> dying in Australia

Part 2 involved calculating the forecasted mortality savings to Australia if we implemented systematic evidence-based care across Australia. To calculate our mortality savings forecast (i.e. "now NOT" occurring anymore), we started with our current estimate of 1,700 DFD-related deaths occurring in Australia each year (1). We searched for Australian studies in the area and were unable to identify an Australian population-based study that investigated DFD-related deaths before and after implementing evidence-based DFD care. Therefore, we looked for similar international studies and identified (via a global systematic review on mortality rates in DFD (6)) one very high quality study that looked at DFD 5-year mortality rates before and after aggressive treatment (7).

This study was an intervention study that investigated the 5-year mortality rates of two cohorts of very similar patients with DFD attending a multi-disciplinary DFD service in Scotland (7). The first cohort received standard care in 1995-1999 and the second cohort received standard care and aggressive management in 2001-2004; both cohorts were then followed for 5-years. The authors state that the aggressive management included:

i. Increased screening of all new DFD patients for known cardiovascular risk factors,
ii. Increased cardiovascular management with antiplatelet therapy, statin therapy, and ACE inhibitors or angiotensin receptor blockers, &
iii. Increased DFD surveillance and treatment (7).

They then followed all patients to identify if they had died and the cause of death for both cohorts. They found a 45% reduction in the 5-year mortality rates in the second cohort (26.8%) compared with the first (48.0%). Interestingly they also found similar reductions in both neuropathic and neuro-ischaemic/ischaemic DFD subgroups, and that amputation procedures did not impact on these findings. The authors concluded that multi-disciplinary DFD services are best placed to provide regular aggressive DFD and cardiovascular management to reduce mortality in patients with DFD (7).

As this was the best evidence available for a population similar to that in Australia we decided to use this 45% reduction to apply to our current estimates. From this we calculated that 760 (45%) of the 1,700 deaths resulting from DFD each year - or ~2 (45%) of the 4 people dying today as a result of DFD - could be prevented if aggressive evidence-based DFD care was systematically implemented across Australia.

Part 3: Cost savings

Cost SAVINGS in Australia

The final part of our forecasts concerned calculating the estimated costs savings to Australia if we implemented systematic evidence-based care across Australia. To calculate our costs savings forecasts (i.e. “now NOT” occurring anymore), we started with our current estimates of $350million being directly spent on DFD management in Australia public hospitals, and $1.6billion directly spent across the whole Australian health system, each year (1).

We then searched for Australian population-based studies in this area and identified one applicable study (8). This study was a cost-effectiveness analysis of optimal evidence-based DFD care compared with usual care in Australia. The study used data from the best available Australian DFD studies and experts, such as many of the studies featured in this DFA Guides You Through, along with real-life Australian costs to evaluate the costs and outcomes of optimal evidence-based DFD care versus usual care (8). Optimal evidence-based care was defined following the management recommendations in the NHMRC Australian DFD guidelines, including 100% provision of:

i. Initial evidence-based assessment in all people with, or at risk of, DFD
ii. Debridement of callus and ulcers in all people with, or at risk of, DFD
iii. Appropriate dressings in all people with DFD

iv. Appropriate footwear and pressure offloading devices in all people with, or at risk of, DFD
v. Antibiotic management for all people with DFD-related infection
vi. Weekly multi-disciplinary care for all people with DFD or bi-monthly podiatry care for all people at-risk of DFU (8, 9)

The authors then used a sophisticated health economic model, called a Markov model, to simulate what would happen when 10,000 patients were managed in both systems (optimal care and usual care). What they found was, depending on the patients' age, that patients receiving optimal evidence-based DFD care would cost 56-64% less ($9,000-$12,000) than usual care over 5-years after factoring all costs. When the authors translated this to the estimated population with, or at-risk of, DFD in Australia they found this equated to a $2.7billion saving in direct costs on DFD management across Australia over 5-years or $550million per year (8).

As optimal care in this study's model required 100% adherence, we decided to be a little more conservative and suggest 60% adherence would be slightly more realistic. Therefore, to be more realistic we re-estimated these savings to be more the order of ~35% cost savings with the implementation of evidence-based care (i.e. ~56-64% savings x 60% adherence).

From this we calculated that $122million (35%) of the $350million spent on public hospitalisations currently caused by DFD each year - or $350,000 (35%) of the $1million spent in a public hospital each night because of DFD - could be prevent if evidence-based DFD care was systematically implemented across Australia. And for the whole Australian health system we calculated that $550million (35%) of the $1.6billion that is currently spent now directly managing DFD each year - or $1.5million (35%) of the $4.3million spent on DFD in our health system each day - could be prevented.

Conclusions

In summary, our best forecasts estimate that an investment in systematic evidence-based DFD care in Australia could net significant annual national health and economic savings of:

- 11,000 hospital admissions (including 140,000 occupied hospital bed days)
- 2,000 amputations
- 760 lives
- $550million

What we haven't told you yet, is that we again calculated the averages of these national forecasts per every 100,000 people in Australia (See Table 2) (1). So the forecast estimates per 100,000 people in Australia each year could net significant annual national health and economic savings of:

- 45 hospitalisations (including 570 occupied hospital bed days)
- 8 amputations
- 3 lives
- $2.25million

We did this because we want you to be able to quickly forecast the health and economic savings of implementing evidence-based care in your local region using the best available evidence when you need too. For example, if you were in Albury (~50,000 population; you would multiply the "per 100,000 estimates" by 0.5), Geelong (~190,000 population; multiply by 1.9) or Perth (~2million population; multiply by 20). However, please cautiously note that such forecasts will only be a guide and that the local socio-demographic and service profiles of your region will also impact on the accuracy of these forecasts.

In this "DFA Guides You Through" document we have described the best available forecasts, which we are aware of, on what would happen if Australia systematically implemented evidence-based DD across Australia. This included using the best available estimates of the current Australian DFD burden, the best available Australian and international studies that have evaluated implementing evidence-based DFD care, and the calculation of the impact reported from these studies on the current DFD burden estimates. We have tried to be as simplistic and conservative with our estimates as possible so as not to over-complicate nor over-state the forecasted savings to Australia.

For clinicians, we hope this document gives you a much greater insight into the real health and economic benefits of practicing according to (inter)national guideline-recommended evidence-based DFD care. Put simply: making the evidence-based choice saves your patients' (and your nation's) limbs, lives and wallets.

For researchers, we hope this document initially enables you easy access to references on the studies demonstrating reductions to the Australian DFD burden, but more importantly, inspires you to research innovative population-based solutions that continue to bring us closer to ending avoidable amputations in a generation.

For policy makers, we hope this document makes your next evidence-based decision on whether it's a good idea to implement best practice DFD services in your region or nation a very, very simple one. If you still need more help perhaps this quote from the health economic expert authors in the Australian cost-effectiveness analysis will assist: "(our) probabilistic sensitivity analysis also showed that the probability that optimal care is cost-effective is always higher than that of usual care".

We are biased, but we suggest what these forecasts really show is that a little upfront investment in evidence-based DFD care is one of the last "sure fire bets" remaining that will return big health and economic returns in Australia.

In conclusion, for everyone, we hope you enjoyed your guide through the forecasted savings with the evidence-based diabetic foot care across Australia. For those who cannot wait until our next "DFA Guides You Through" overview, remember that we publish various "latest research" posts every month on our website (https://www.diabeticfootaustralia.org/for-researchers/latest-research/). Keep a sharp eye out on our social media to read when a new one is posted online.

And with that we continually look forward to hearing about your progress as we continue working towards our national goal of ending avoidable amputations in a generation together.

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