22 September 2008

The economic impact of podiatric surgery

Report by Access Economics Pty Limited for

The Australasian College of Podiatric Surgeons

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FIGURES

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GLOSSARY OF ACRONYMS

ABS	Australian Bureau of Statistics
ACPS	Australasian College of Podiatric Surgeons
AOA	Australian Orthopaedic Association
AAOS	American Academy of Orthopaedic Surgeons
AIHW	Australian Institute of Health and Welfare
ALOS	Average length of stay
AMA	Australian Medical Association
AR-DRG	the Australian Refined Diagnosis Related Groups
ATO	Australian Taxation Office
AWE	Average weekly earnings
BoD	Burden of disease
CBA	Cost benefit analysis
CEA	Cost effectiveness analysis
DALY	Disability Adjusted Life Year
DoHA	Department of Health and Ageing
DWL	Deadweight Loss
GDP	Gross domestic product
ICD-10-AM	International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification
ICER	incremental cost effectiveness ratios
MBS	Medicare Benefits Schedule
MPJ	Metatarsophalangeal joint
NHCDC	National Hospital Cost Data Collection
OECD	Organization for Economic Cooperation and Development
RACS	Royal Australasian College of Surgeons
R&D	Research and development
US	United States
VSL	Value of statistical Life
VSLY	Value of a statistical life year
WHO	World Health Organization
WTA	Willingness to accept
WTP	Willingness to pay
YLD	Years of healthy life lost due to disability
YLL	Years of life lost due to premature mortality

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EXECUTIVE SUMMARY

The aim of this report was to estimate the potential economic impact of improving access to podiatric surgeons in the Australian health sector. As such, the report:

- provides a ‘snapshot’ of all foot and ankle surgery in Australia for 2008 and every decade to 2050;
- assesses the cost effectiveness and cost benefit of using podiatric surgeons to perform 95 different types foot and ankle surgeries compared to using orthopaedic surgeons; and
- provides a framework to design and assess any interventions.

Background

Surgical procedures performed on the foot and ankle are predominately carried out by orthopaedic surgeons and podiatric surgeons. In this report, the term orthopaedic surgeons also includes all other surgeons performing foot and ankle surgery, excluding podiatric surgeons. The number of foot and ankle surgical procedures performed in Australia in 2007 was almost 129,000, of which podiatric surgeons performed around 2,400, or just 1.9% of these surgical procedures.

This has occurred against a backdrop of considerable pressure on the health system, where wait times for orthopaedic surgeons, for example, are above the national average and where podiatric surgeons have capacity to further integrate into the framework of modern health care, which is characterised by multidisciplinary teams.

Further, a number of domestic and international clinical audits have demonstrated that surgery performed by podiatric surgeons has the same or better health outcomes as those performed by other surgeons.

Snapshot

Incidence rates in 2007 for 95 different types of foot and ankle surgery were applied to 2008 population projections to estimate the total number of foot and ankle surgical procedures in 2008. It is estimated in 2008 that:

- there will be 130,581 foot and ankle surgical procedures performed, of which 49.5% are for men and 50.5% for women; and
- the most frequently performed surgical procedures by category are for toenails (44%), foot and ankle trauma (21%), lesser toes (11%) and ankle surgery (10%).

The same incidence rates were applied to population projections for 2010, 2020, 2030, 2040 and 2050. Based on demographic changes, it is estimated that there will be around 1,900 additional foot and ankle surgical procedures required to be performed every year on average over the projection horizon.

These projections indicate that foot and ankle surgical procedures will increase to around 211,000 in 2050. This represents an increase of 61.9% between 2008 and 2050 (63.0% for males and 60.9% for females). The results of the projections to 2050 highlight demographic change and an increasing burden on health professionals to provide foot and ankle surgery in the years ahead.

Cost effectiveness analysis (CEA) and cost benefit analysis (CBA)

In comparison to orthopaedic surgeons, all 95 types of foot and ankle surgeries commonly performed by podiatric surgeons were found in the CEA to a) cost less (both in terms of direct health costs and indirect productivity losses) and b) avert more Disability-Adjusted Life Years (DALYs), and as such is considered 'dominant' (ie, cost saving with enhanced quality of life).

- Using a weighted average of costs for the 95 types of surgeries, the financial cost savings from podiatric surgery relative to orthopaedic surgery was estimated at $3,635 per procedure.
- Overall, it was estimated that 0.02 DALYs are averted per procedure by using podiatric surgeons (0.01 DALYs) instead of orthopaedic surgeons (0.03 DALYs).

The DALYs averted were converted to dollar values using the value of statistical life year (VSLY). In multiplying the DALYs averted (0.024) by the VSLY for 2008 ($266,843 based on Access Economics, 2008), it is estimated that podiatric surgery saves $6,364 in the gross value of the burden of disease (BoD) and $5,016 in the net value of the BoD.

- To calculate the net value of the BoD, the out of pocket hospital expenses and personal productivity losses incurred are netted out from the gross DALYs as they are included as part of the financial cost calculations in this report. This avoids double counting.

The total net benefit (in the CBA) from using podiatric surgeons in comparison to orthopaedic surgeons equals the costs saved plus the net dollar value of the DALYs averted, which is $8,651 (ie. $3,635 + $5,016).

Each of the 95 types of surgeries performed by podiatric surgeons were analysed individually. The results of each CEA and CBA are presented in Appendix C.

Modeling inputs and sensitivity analyses

The CEA and CBA modeling were done on a per procedure basis, with the key modeling inputs in the base case including direct health costs, indirect (productivity) costs and the burden of disease. Inputs were calculated separately for each of the 95 different types of foot and ankle surgery and the following overall costs were calculated as weighted averages.

Health costs were disaggregated by surgeon fees, fixed costs and variable costs for procedures performed in a hospital environment:

- Surgeons' fees of $986 and fixed costs of $9,859 per procedure were the same for both podiatric and all other surgeons combined.
- The variable costs per procedure for podiatric surgeons were $1,353 and $2,991 for all other surgeons combined. These costs were calculated on a per day basis at hospital and applied to the average length of stay.
    - It was estimated that podiatric patients were in hospital for 45% of the time of all patients in hospital for the same procedures.

Indirect productivity costs were calculated as the number of weeks absent from work while waiting for a) an initial appointment and b) surgery, multiplied by average weekly earnings ($1,174) and the probability of being employed given demographic factors (73.8%).

- The productivity losses from waiting for orthopaedic surgery were estimated at $3,307 and $1,681 for podiatric surgery.

The DALYs were based on the disability associated with the period that people with a foot or ankle condition requiring surgery were waiting for surgery. The average DALYs incurred by people waiting for podiatric surgery was 0.004 and was 0.028 for orthopaedic surgery.

- The DALYs also included the risk of developing further health complications (diabetic foot and falls) while waiting for surgery.

The key parameters driving the benefits from podiatric surgery comprised shorter hospital stays and shorter waiting times, which generated considerable flow-on effects. These flow-on effects include lower (variable) hospital costs, lower productivity losses, less burden of disease and lower risk of complications.

It is noted that there are some opportunity costs and related comparative advantage issues (ie, focusing on areas of greatest value add) from orthopaedic surgeons performing foot and ankle surgery instead of other surgery (eg, knee replacements). However, analysis of the additional benefits derived in this regard from utilising the existing podiatric surgical workforce is outside the scope of the study.

Sensitivity analyses were undertaken to check the robustness of the modeling, these included:

- changing podiatric surgeon fees to be 12% lower than those of orthopaedic surgeons;
- lengthening podiatric waiting times from 2 weeks to 5 weeks for the combined appointment and surgery waiting times; and
- excluding complications from the calculations.

As expected, lower surgeon fees increased cost effectiveness and net benefits. While longer waiting times and excluding complications reduced the cost effectiveness and net benefits, podiatric surgery was still dominant in comparison to orthopaedic surgery, (ie, remained cost saving with enhanced quality of life).

Assessment framework

The modeling presented in this report provides a framework that can be used to design and assess the effectiveness of an intervention approach or of individual procedures.

- The sensitivity analysis provides insight into which inputs generate the greatest benefits.
- Additionally, three commonly performed procedures (MBS items 49833, 49866, and 44359) are presented in this report as examples of the capability of assessing the cost effectiveness and net benefit of individual procedures.
  - All three procedures were dominant in comparison to orthopaedic surgery, with incremental costs savings of $2,117, $2,416 and $15,271 and net benefits of $5,341, $5,772 and $22,983 respectively.

Concluding remarks

This report is the first of its kind in Australia to provide a comprehensive economic assessment of foot and ankle surgery and podiatric surgeons. It draws together a number of datasets using advanced modeling techniques and clinical inputs. The report compares the cost effectiveness and net benefit of podiatric surgery on a per procedure basis, where those procedures are performed in a hospital environment. It also provides a robust framework for designing and assessing the potential impact of improving access to podiatric surgeons and thereby improving health outcomes for Australians while reducing health system costs.

The findings of this report support the greater utilisation of podiatric surgeons in the Australian health system. There are a number of potential benefits including substantial financial savings; decreased waiting time for elective foot surgery; increased productivity; improved prevention of co-morbidities; and quicker return to an improved quality of life.

Access Economics
22 September 2008

1. BACKGROUND

Access Economics was commissioned by the Australasian College of Podiatric Surgeons (ACPS) to undertake an economic impact analysis estimating the potential impact of improving access to podiatric surgeons in the Australian health sector.

The methodology builds on the very successful costing methodologies developed by Access Economics and applied in Australia and internationally, using data from a number of national datasets, epidemiological studies, census material, official population projections and other data sources.

This report is structured as follows.

- Chapter 2 describes the field of podiatrists, podiatric surgeons, and orthopaedic surgeons and focuses on the current waiting lists for surgery. Issues arising from recent legislative changes affecting podiatric surgeons are also briefly highlighted.
- Chapter 3 estimates and details the incidence and epidemiology of podiatric-type surgical events in Australia by age and gender for 2008, and for every decade from 2010 to 2050.
- Chapter 4 presents the financial costs in two parts:
  - the direct health system costs of foot and ankle surgery, disaggregated by the major cost components for 2008 and any costs that may be saved if podiatric surgeons rather than other surgeons providing these services; and
  - the productivity costs associated with waiting for foot and ankle surgery, disaggregated by major cost components for 2008.
- Chapter 5 estimates the loss of wellbeing that is incurred while waiting for foot and ankle surgery, measured in terms of disability adjusted life years (DALYs).
- Chapter 6 presents the costs and benefits of podiatric surgery using two methods:
  - a cost effectiveness evaluation: comparing the cost effectiveness of podiatric surgery (measured in dollars per DALY) with all other surgery; and
  - a cost benefit evaluation: that converts the DALY to a dollar value and then compares the net costs with net benefits, which is implicitly benchmarked against the break even point.

All monetary values expressed in this report are in Australian dollars unless otherwise stated.

2. INTRODUCTION

Foot pain has long been recognised as highly prevalent in older people, affecting approximately one in three people aged over 65 years (Hill et al, 2008), and at least one in five people in the general population (Menz et al, 2008). The provision of foot health services to manage foot pain and disability is primarily (not exclusively) the domain of the podiatry profession.[1] The provision of surgical treatment for conditions affecting the foot and ankle – the focus of this report – is generally the domain of two separate professional groups: podiatric surgeons and orthopaedic surgeons.

- In this report, the term 'orthopaedic surgeon' is taken to include all other surgeons, with the exception of podiatric surgeons, that also perform foot and ankle surgery.

2.1 PODIATRISTS

Podiatrists, assess, diagnose and treat disorders of the lower leg and foot that have resulted from developmental abnormalities, disease or injury. They also educate and promote health issues related to the prevention of such conditions (AIHW, 2006).

In Australia, podiatry is classified as an allied health profession, and is practiced by individuals licensed by their retrospective State Boards of Podiatry. In 2003 there were 2,361 podiatrists registered with the state/territory podiatrists boards, excluding the Northern Territory for which registration figures were not available (AIHW, 2006).

In Australia there exist two levels of professional accreditation and professional privilege; podiatrist and podiatric surgeon.

2.2 PODIATRIC SURGEONS

Podiatric surgeons are podiatrists who have completed extensive post-graduate medical and surgical training, which enables them to perform reconstructive surgery of the foot and ankle. Referral to podiatric surgeons is usually from podiatrists, or from general or specialist medical practitioners.

Podiatric surgeons have generally undertaken at least ten years of training before they have qualified for membership as a Fellow with the Australasian College of Podiatric Surgeons (ACPS).[2] Qualifications of podiatric surgeons are recognised by Australian State and Federal Governments as valid for performing foot surgery. Podiatric surgeons are included within both the Health Insurance Act and the National Health Act (Fellows of the ACPS).

Podiatric surgeons are allied health professionals and are not medical practitioners. In Australia, podiatric surgeons principally operate in private hospitals within a surgical team, which includes anaesthetists, medical practitioners, surgical assistants and nursing and hospital staff. Podiatric surgeons adhere strictly to the same hospital protocols as other

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[1] It is possible that some degree of foot health service provision is currently being met by other health care professionals, particularly general practitioners (Menz et al, 2008).

[2] The ACPS is the administrative authority for the training and accreditation of podiatrists in podiatric surgery, and its principal aim is to maintain and protect standards and public health and safety in the field of podiatric surgery.

surgical specialties. In 2005, there were 20 fellows of the ACPS and an additional 20 podiatric surgical trainees (ACPS, 2005).

The ACPS, is the national organisation that trains podiatric surgeons. It develops, implements and monitors guidelines for the practice of podiatric surgery and provides national standards and clinical practice protocols. The College is affiliated with the Australasian Podiatry Council, the national organisation and umbrella group of Australian Podiatry Associations in each State. The Australasian Podiatry Council prepares national policies and clinical practice guidelines for podiatrists.

2.3 ORTHOPAEDIC SURGEONS

Orthopaedic surgeons are traditionally medically trained surgeons who specialise in the provision of reconstructive bone and joint surgery. Orthopaedic surgeons are classified as medical practitioners. They focus on treating six key areas of the body, one area of which is foot and ankle surgery.[3]

To accredit orthopaedic surgeons in foot and ankle surgery requires an additional one to two years training, taking total training time to approximately 16 years. As at 31 December 2005, there were 875 active orthopaedic surgeons in Australia registered with the Royal Australasian College of Surgeons (RACS).[4] Within the Australian Orthopaedic Association (AOA), there are 107 orthopaedic surgeons who list foot and ankle surgery as an area of special interest.[5]

2.3.1 WAITING LIST TIMES

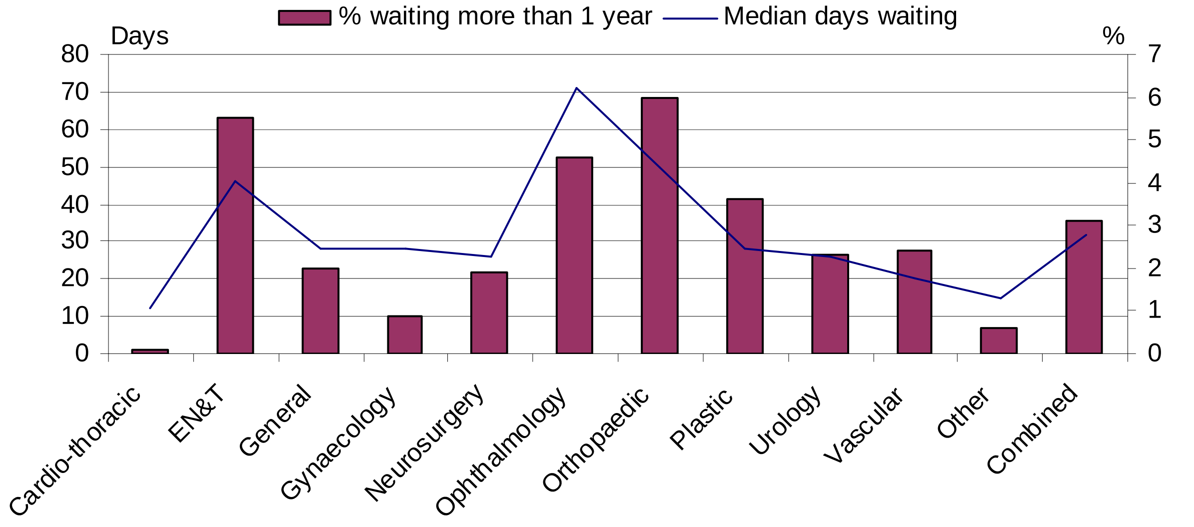
Currently in Australia there are long waiting lists for orthopaedic surgery in public hospitals. In terms of the percentage of people on waiting lists who had waited more than a year for surgery at the time of admission, orthopaedic surgery was highest (6.0%) of all surgical specialties in 2006-07 (AIHW, 2008). The percentage of people waiting more than a year for elective surgery and the associated median public hospital waiting times for elective surgery are shown in Figure 2-1.

[3] The American Academy of Orthopaedic Surgeons define the six regions as: shoulders; arms and elbows; hands and wrists; the spine and neck; hip, knee and leg; and the foot and ankle.

[4] Royal Australasian College of Surgeons (2008) Work Force Statistics December 2005.

[5] Australian Orthopaedic Association (2008), accessed at **http://www.aoa.org.au/surgeons.asp**

FIGURE 2-1: MEDIAN WAITING TIMES FOR ELECTIVE SURGERY



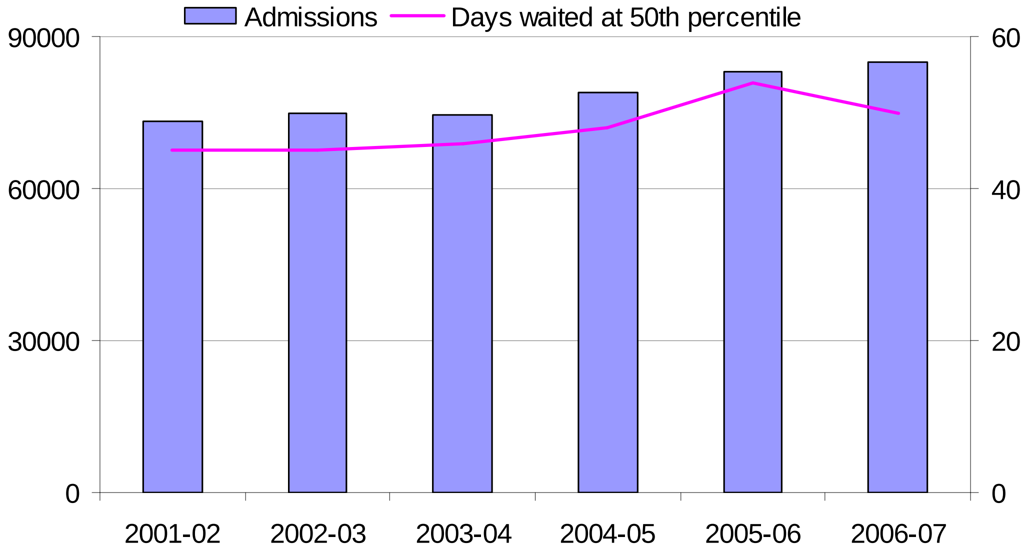
Although waiting lists may be considered a health care rationing mechanism,[6] waiting in queues for orthopaedic surgery increases the burden of disease. Long waiting periods for surgery increase the time that individuals spend with pain, suffering and reduced quality of life.

Extended waiting periods for surgery may also impose economic costs on society as individuals in queues may consume additional medical resources – such as pharmaceuticals, specialist, outpatient and primary care visits, allied health and possibly imaging services – as well as indirect costs such as extended periods of reduced productivity (at work and in the home) and, in some cases, additional need for informal care, mobility aids and income support.

In Australia, with a median waiting time for orthopaedic surgery of 50 days in 2006-07, and the number of admissions from waiting lists for the same period 85,091 (Figure 2-2), there may be substantial costs from extended waits for orthopaedic surgery. There is also possible scope to reduce costs while waiting through greater workforce substitution that is, better utilisation of podiatric surgeons for surgery on feet and ankles (Parliament of the Commonwealth of Australia, 2004; Productivity Commission, 2005).

[6] Waiting lists can be used to prioritise patients to ensure hospital resources are used efficiently and equitably.

FIGURE 2-2: WAITING TIME STATISTICS FOR ORTHOPAEDIC SURGEONS



Source: AIHW (2008)

2.4 'OPERATING' ENVIRONMENT

Podiatric surgery as a discipline exists in most western countries, including the United States (US) and United Kingdom (UK) and has existed in Australia since 1978. However, the utilisation of podiatric surgeons in the Australian health care sector is low compared with the US and UK. Against this backdrop, there is evidence in Australia of orthopaedic waiting times for elective foot and ankle surgery being above average waiting times for general elective surgery (Gilheany and Robinson, 2008).

Historically, there are two factors that have restricted the growth of podiatric surgery in Australia when compared to the development of podiatric surgery in other countries. Principally, the professional fees of medical practitioners providing foot surgery are rebated under the Australian Medicare system. Secondly, funding is provided by the Commonwealth and the States for the training of surgeons with a medical background. However, neither applies to podiatric surgeons.

No Medicare Benefits Schedule (MBS) item number applies to foot surgery performed by an accredited podiatrist (podiatric surgeon) (Department of Health and Ageing, 2005) although the *Health Legislation Amendment (Podiatric Surgery and Other Matters) Act 2004,* which came into effect in January 2005, amended the Health Insurance Act 1973 (HIA) by expanding the definition of 'professional attention' to include 'podiatric treatment by an accredited podiatrist'. In conjunction with the existing definition in the HIA for 'hospital treatment', this means that 'hospital treatment' now includes 'accommodation and nursing care provided for the purpose of permitting the provision of podiatric treatment by an accredited podiatrist'. This change enables payment of benefits for such treatment from health funds' hospital tables.

It is not mandatory for health funds to pay benefits from their hospital tables for the professional fees of accredited podiatrists. However, health funds can choose to pay benefits for such professional fees.

At present there are fewer than ten out of approximately 540 private hospitals and private day hospital facilities in Australia that have granted podiatric surgeons admitting rights (Parliament of Commonwealth of Australia, 2004).

3. INCIDENCE AND EPIDEMIOLOGY

3.1 MEASURING FOOT AND ANKLE SURGERY

In estimating the impact of podiatric surgeons on surgery waiting list times, it is important to itemise the types of surgery that podiatric surgeons would perform. In general, podiatric surgeons perform surgery on the foot and ankle. A list of specific surgical items is detailed below.

3.1.1 DEFINITIONS OF FOOT AND ANKLE SURGERY USED IN THIS REPORT

The individual foot and ankle surgical procedures are defined according to their Medicare item listing.[7] There are 95 different surgical procedures listed under Medicare that have been identified for podiatric surgeons. These 95 items (presented in full in Appendix A) are based on Menz et al (2008) and are classified into the following 12 main categories for ease of interpretation and for presentational purposes.

1. **toenail**: wedge resection, partial resection and total removal of toenails (Medicare item numbers 44136, 47904, 47906, 47912, 47915, 47916, 47918);

2. **foot and ankle trauma**: including treatment of dislocations and fractures of the ankle, tarsals, metatarsals and phalanges (Medicare item numbers 47063, 47066, 47069, 47072, 47594, 47597, 47600, 47603, 47606, 47609, 47612, 47615, 47618, 47621, 47624, 47627, 47630, 47633, 47636, 47639, 47642, 47645, 47648, 47651, 47654, 47657, 47663, 47666, 47672, 47678);

3. **lesser toes**: including primary and secondary repair of flexor and extensor tendons, tenotomy, correction of clawtoes, hammertoes and hyperextension deformity (Medicare item numbers 49800, 49803, 49806, 49809, 49812, 49848, 49851 and 50345);

4. **ankle**: including diagnostic arthroscopy, arthroscopic surgery, ligamentous stabilisation, arthrodesis, total joint replacement and Achilles tendon procedures (Medicare item numbers 49700, 49703, 49706, 49709, 49712, 49715, 49718, 49721, 49724, 49727 and 50312);

5. **first metatarsophalangeal joint (1st MPJ)**: including excisional arthroplasty, osteotomy, adductor hallucis tendon transfer, prosthetic arthroplasty and arthrodesis for either hallux valgus or hallux rigidus (Medicare item numbers 49821, 49824, 49827, 49830, 49833, 49836, 49837, 49838, 49839, 49842, 49845, 49857, 49860 and 49863);

6. **neuroma**: neurectomy for plantar digital neuritis (Medicare item number 49866);

7. **amputations**: digital, transmetatarsal, Syme (Medicare item numbers 44338, 44342, 44346, 44350, 44354, 44358, 44359, 44361, 44364);

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[7] Foot and ankle surgery in Australia is heavily subsidised by Medicare, a universal healthcare system financed through income tax and an income-related Medicare levy. Governed by the Australian Health Care Agreements between the Commonwealth and the states and territories, Medicare covers the full cost of procedures performed by public surgeons in public hospitals, and 75% of the scheduled fee for procedures performed by private surgeons.

8. **clubfoot**: including posterior release, medial release or combined postero-medial release (Medicare item numbers 50315, 50318, 50321, 50324, 50327, 50339 and 50342);

9. **heel**: including excision of calcaneal spur and plantar fasciotomy (Medicare item numbers 49818 and 49854);

10. **rearfoot**: including triple arthrodesis and subtalar joint arthrodesis (Medicare item numbers 49815 and 50118);

11. **lesser metatarsophalangeal joints**: synovectomy of metatarsophalangeal joints (Medicar+e item numbers 49860 and 49863); and

12. **tarsal coalition and congenital vertical talus**: (Medicare item numbers 50333 and 50336).

MBS item numbers for procedures that could not be isolated to the foot and ankle (such as excision of soft tissue tumours, treatment of burns, 'generic' surgical items and multilevel orthopaedic surgery) were excluded. For example, item 48403 (phalanx or metatarsal osteotomy or ostectomy with internal fixation) is predominantly used for foot surgery but may also apply to hand surgery, so was excluded from the analysis (Menz et al 2008).

3.2 ESTIMATING INCIDENCE

The study utilises incidence in its approach to cost measurement as this is most appropriate for cost effectiveness analysis (CEA) and cost benefit analysis (CBA). Incidence approaches measure the number of new cases of a given condition (in this case specialist treatment of foot, ankle and lower limb conditions which warrant surgical intervention) in a base period (in this case calendar year 2008) and the costs associated with treatment, as well as other financial and non-financial costs (eg, productivity losses, loss of quality of life) over the person's lifetime, due to the condition.

Incidence is also more appropriate in this case since the main data sources relate to surgical episodes. As such, it is important to note that the same person may have more than one episode of care in a given year. The alternative, a prevalence approach, would measure the number of people treated in a given year, or the number of people who have an associated relevant podiatric condition.

3.2.1 SOURCE DATA

This report provides a comprehensive estimation of the total incidence of foot and ankle surgery across Australia undertaken in 2008. The estimates are based on three key data sources, which comprise: Medicare procedural items, casemix data and survey data on the procedures performed specifically by podiatric surgeons in Australia. These reference materials presented data based on three unique identifier codes:

- the MBS procedure codes,
- the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM) codes; and
- the Australian Refined Diagnosis Related Groups (AR-DRG) codes.

3.2.2 CONCORDANCE BETWEEN IDENTIFIER CODES

The presence of the different identifier codes required a concordance procedure to map surgical items across datasets. The MBS procedure codes were set as the standard and the other identifier codes (ICD-10-AM, and AR-DRG codes) were mapped to the MBS procedure codes.

The results of the concordance mapping were presented to clinicians for expert review and finalisation. A summary of the data mapping is presented in Appendix B. The concordance mapping was used in the process of estimating both incidence and financial (direct health and indirect productivity) costs.

3.2.2.1 MEDICARE DATA

Data pertaining to foot and ankle surgical procedures for the financial year 2004-05 (see Sections 3.2.2.2 and 3.3.1) and calendar year 2007 were extracted from the MBS database.[8] Surgical activity in Australia is continuously tracked by the MBS database, which records all services performed by registered providers that qualify for a Medicare benefit, with the exception of:

- services provided by hospital doctors to public patients in public hospitals;
- services that qualify for a benefit under the Department of Veterans' Affairs, Work Cover or the Transport Accident Commission, and
- medical services provided by surgeons not recognised under Medicare (such as podiatric surgeons).

The MBS database provides a rich source of data on foot and ankle surgery that are disaggregated by cost,[9] condition, age and gender.

3.2.2.2 CASEMIX

Separations data relating to foot and ankle procedures in public hospitals have been sourced from the Department of Health and Ageing and AIHW, and are based on casemix data for the year 2004-05. This is the most recent casemix dataset publicly available that is disaggregated by the number of separations for each procedure (ICD-10-AM[10] 4th ed.), average length of stay and, importantly, by hospital type for Australia.

The ICD-10-AM was developed in Australia by the National Centre for Classification in Health, with an Australian clinical procedure classification based on the MBS (AIHW, 2008b).

The casemix data are used to provide detail on the number of procedures of foot and ankle surgery in public hospitals. Although these data are not disaggregated by age or gender, they

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[8] Sourced from Medicare Australia's *MBS Item by Patient Demographics Reports, t*hese reports produce patient age range and gender, per capita and percentage statistics on an item in the Medicare Benefits Schedule: https://www.medicareaustralia.gov.au/statistics/mbs_item.shtml.

[9] Additional private hospital costs (such as theatre fees) are not covered by Medicare, and are generally met by private health insurance.

[10] ICD-10 AM refers to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification, http://www.health.gov.au/internet/main/publishing.nsf/Content/health-casemix-glossary1.htm

also provide information on procedures in private hospital and day surgery as a supplement to the Medicare data.

3.2.2.3 PODIATRIC SURGERY

While data from Medicare (and casemix) provide numbers on private procedures, it is not possible to identify from the data the number of procedures performed by podiatric surgeons. As such, the number and type of surgical procedures performed by podiatric surgeons are sourced from a clinical audit undertaken by Butterworth et al (2008). This report provides a near national dataset on foot and ankle surgery performed in Australia by podiatric surgeons for 2007.[11]

3.2.3 POPULATION DATA

For this report, the age-specific incidence rates by condition have been applied to ABS mid-case (Series B) population projections (ABS, 2003), adjusted to reflect revisions in December 2007 to actual population numbers, in order to estimate future incidence of the various conditions in terms of the number of procedures.

The updated population projections allow calculations for the incidence of foot and ankle surgical events by age, gender and condition, for the year 2008 and projections for 2010, 2020, 2030, 2040 and 2050.

3.3 INCIDENCE

One of the first steps in calculating incidence is estimating the incidence rates of the conditions of interest. In this case incidence data for foot and ankle surgical events were stratified by gender, age and MBS procedural item. In addition, these data were aggregated into the 12 key categories listed in Section 3.1.1. The calculation of the incidence rates also allows for incidence data to be calculated for 2008 as the base year using the population data.

3.3.1 STANDARDISING INCIDENCE

The 2004-05 Casemix data were mapped to 2004-05 MBS data. The ratio of public to private procedures in 2004-05 was then applied to the 2007 MBS data to generate a relative Casemix data set for 2007. Next, the MBS data, Casemix data and podiatric surgery data for 2007 were converted to incidence rates using the population data above. These incidence rates were then applied to 2008 population statistics to estimate the total number of foot and ankle surgical procedures in 2008.

3.3.2 INCIDENCE BY AGE AND GENDER

Using the data sources and methods described above, it is estimated that almost 131,000 foot and ankle surgical procedures will be required in 2008. This total comprises 94,741 private procedures based on the MBS dataset, 33,409 public procedures based on casemix data and 2,432 private procedures based on the data for podiatric surgeons. Given the MBS dataset represents a significant portion of the total surgery performed (72.6%) and also provides a breakdown by age and gender, this same age-gender distribution was applied to the other two

[11] There are currently 12 (of the 20) registered podiatric surgeons performing operations in Australia. While the data in Butterworth et al (2008) covers 9 of those 12 surgeons, it does cover around 95% of all surgery performed by podiatric surgeons in 2007.

data sets in the absence of their own. Table 3-1 details the total incidence of foot and ankle surgery by age and gender.

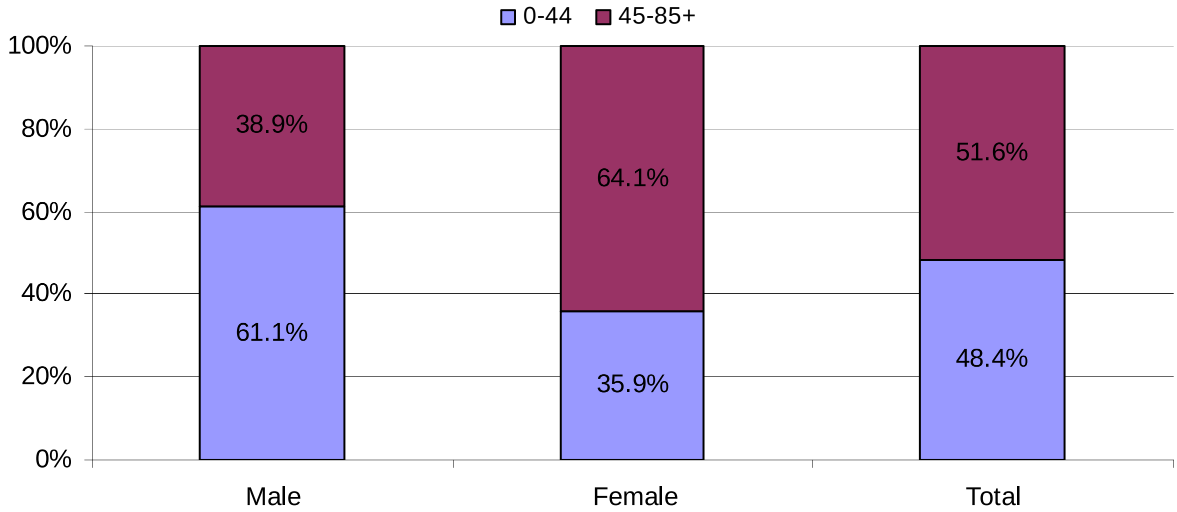
TABLE 3-1: FOOT AND ANKLE SURGERY, INCIDENCE (RATES AND PROCEDURES) BY AGE AND GENDER, AUSTRALIA, 2008

	Male		Female		Total	
Age	%	No	%	No	%	No
0-4	0.1%	578	0.0%	304	0.1%	882
5-14	0.6%	8,104	0.4%	4,844	0.5%	12,947
15-24	1.1%	17,268	0.5%	7,330	0.8%	24,598
25-34	0.5%	7,045	0.3%	4,859	0.4%	11,904
35-44	0.4%	6,509	0.4%	6,329	0.4%	12,838
45-54	0.5%	7,480	0.7%	10,082	0.6%	17,562
55-64	0.7%	8,189	1.2%	14,991	0.9%	23,181
65-74	0.8%	5,726	1.3%	10,195	1.0%	15,921
75-84	0.7%	3,277	1.0%	5,436	0.9%	8,712
>=85	0.4%	520	0.6%	1,515	0.5%	2,035
Total	**0.6%**	**64,696**	**0.6%**	**65,885**	**0.6%**	**130,581**

Source: MBS database, Casemix, Butterworth et al (2008) and Access Economics.

The incidence of surgery shows pronounced age-gender differences. While the total number of surgical procedures for 2008 is split equally between males and females, it is estimated 61.1% of surgery in males occurs before 44 years of age, where as 64.1% of females have surgery when they are 45 years of age or older (Figure 3-1).

FIGURE 3-1: FOOT AND ANKLE SURGERY, % OF TOTAL BY GENDER AND AGE RANGE 0-44 YEARS AND 45-85+ YEARS, AUSTRALIA, 2008



Source: MBS database, Casemix, Butterworth et al (2008) and Access Economics.

3.3.3 INCIDENCE BY CONDITION

The analysis suggests that the single leading category requiring foot or ankle surgery relates to toenail surgery. It is estimated that this category accounts for 53.6% of all podiatric surgery in 2008. In this category is MBS item 47915 'Ingrowing nail of toe, wedge resection for, including removal of segment of nail, ungual fold and portion of the nail bed', on its own accounts for 28.4% of all procedures. Table 3-2 details incidence numbers of foot and ankle surgical events by age, gender and category.

TABLE 3-2: FOOT AND ANKLE SURGERY, INCIDENCE (PROCEDURES AND % OF TOTAL) BY CAUSE AND HOSPITAL TYPE,* AUSTRALIA, 2008

Category		Male		Female		Total			
No	Description	Private	Public	Private	Public	Private	Public	Total	%
1	Toenail	30,915	2,984	21,727	2,114	52,641	5,097	57,739	44.2%
2	Foot and ankle trauma	7,227	6,537	7,460	6,226	14,687	12,763	27,450	21.0%
3	Lesser toes	2,385	1,060	7,617	2,854	10,002	3,914	13,916	10.7%
4	Ankle	5,177	2,291	3,764	1,591	8,941	3,882	12,822	9.8%
5	First metatarsophalangeal joint	1,713	382	4,905	1,748	6,618	2,130	8,748	6.7%
6	Neuroma	378	78	1,111	303	1,488	381	1,869	1.4%
7	Amputations	515	1,800	479	2,394	994	4,194	5,188	4.0%
8	Clubfoot	93	253	59	165	152	418	570	0.4%
9	Heel	195	130	321	207	517	337	854	0.7%
10	Rear foot	226	97	303	95	529	192	721	0.6%
11	Lesser metatarsophalangeal joints	147	0	354	0	501	0	501	0.4%
12	Tarsal coalition and congenital vertical talus	58	57	45	43	103	100	204	0.2%
	Total	**49,028**	**15,668**	**48,145**	**17,741**	**97,173**	**33,409**	**130,581**	**100.0%**

* Procedures performed by podiatric surgeons have been added to those performed in the private sector.
Source: MBS database, Casemix, Butterworth et al (2008) and Access Economics.

These results are similar to findings internationally (Helm and Ravi, 2003) and are reflective of the most common areas of surgery detailed in Kilmartin (2002), which listed the top four as:

- hallux valgus and hallux rigidus surgery;
- forefoot reconstruction;
- lesser metatarsal osteotomy for plantar corns and metatarsalgia; and
- lesser digit correction.

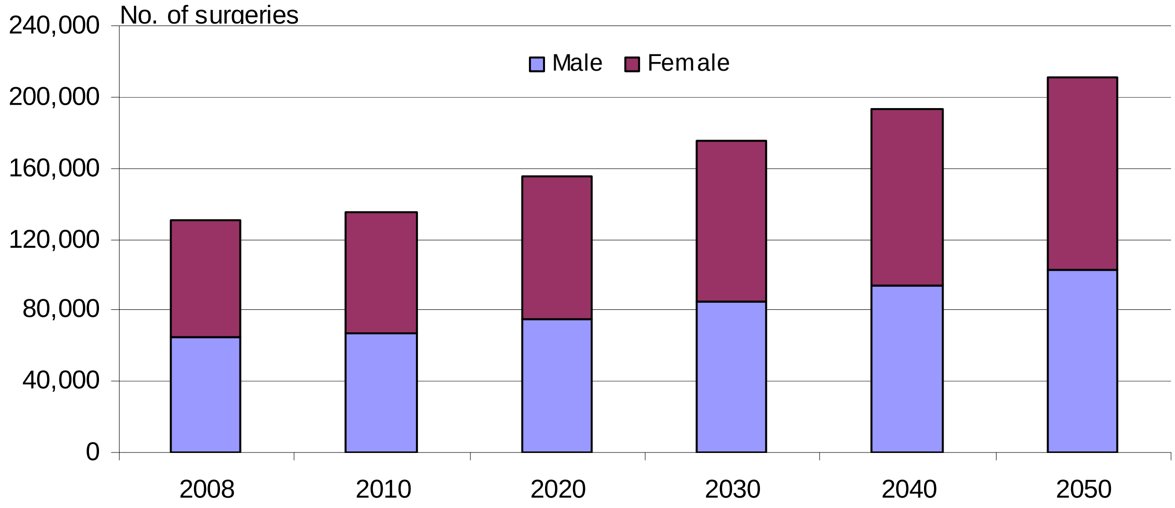
Additionally, Menz et al (2008) reported that age differences in the types of foot and ankle surgery undertaken were also consistent with the known incidence and prevalence of specific foot conditions. Surgical treatment for congenital conditions such as clubfoot, vertical talus, tarsal coalition and equino-valgus associated with cerebral palsy were, as expected, found to be almost exclusively represented in those aged less than 10 years, whereas amputations and treatment for chronic arthritic disorders of the forefoot and rearfoot were found to be over-represented in those aged 55 years and over.

The age distribution of procedures for foot and ankle trauma exhibited a bimodal distribution, with one peak for the 15 to 24 age-group (with an over-representation of males), and a second peak for people aged over 55 years (with an over-representation of females). Although the underlying mechanism for the trauma requiring surgery could not be ascertained from the database, it was hypothesised that the first peak was likely to primarily represent sporting injuries and occupational foot and ankle trauma in young men, while the second peak may have been related to osteoporotic fractures associated with accidental falls in older women.

3.4 PROJECTIONS OF INCIDENCE TO 2050

The age and gender incidence rates from Section 3.3.2 were applied to population projections to estimate the number of foot and ankle surgical events required in 2008 and in every decade to 2050 (Figure 3-2). Based on demographic changes, it is estimated that there will be around 1,900 additional foot and ankle surgical procedures required to be performed every year on average over the projection horizon. These projections indicate that foot and ankle surgery will increase to around 211,000 procedures in 2050. This represents an increase of 61.9% between 2008 and 2050 (63.0% for males and 60.9% for females).

FIGURE 3-2: FOOT AND ANKLE SURGERY, INCIDENCE (NUMBERS) BY GENDER, AUSTRALIA, 2008-2050



Source: MBS database, Casemix, Butterworth et al (2008) and Access Economics.

These estimates imply a significant impact on the future demand for foot and ankle surgical services. This comes at a time when 'Australia is experiencing workforce shortages across a number of health professions despite a significant and growing reliance on overseas trained health workers. The shortages are even more acute in rural and remote areas and in certain special needs sectors' (Productivity Commission, 2005).

The projections in this report are not inconsistent with the findings from the Productivity Commission (2005). It noted that expenditure on health care in 2005 was already 9.7% of GDP and that demand and supply pressures, collectively, would have very significant impacts on health care spending. Indeed, by 2044-45, it estimated that such spending could account for at least 16% of GDP, with government outlays equivalent to about 10% of GDP.

- With 70% of health expenditure financed by Government, this will have major implications for future Government budgets. The Treasury's second *InterGenerational Report* in 2007 highlighted that, unless there is greater reliance on private financing mechanisms, health and aged care spending will turn the Australian Government budget surplus to a deficit of 3½% of GDP by the mid 2040s. Particularly for allied health episodes of care such as podiatry where future growth in expected services is driven strongly by demographic change, it is thus important that policy settings encourage private sector participation, including through private health insurance coverage, in order to reduce future reliance on public hospitals and workforce.

Currently, although health workforce arrangements have evolved in response to changing health care needs, including through greater reliance on multidisciplinary care, the skills of many health workers are not being used to full advantage. To a large extent this is because of various systemic impediments that prevent their competencies being fully developed, assessed, recognised and utilised (Productivity Commission, 2005).

Similarly, in the Final Report of the Queensland Health System Review, it was noted that quality health services depend on sufficient numbers of competent, skilled clinicians being available at the front line. Patients expect to be treated by staff who are highly skilled and trained, dedicated to patient care and working in safe and supportive environments.

While Queensland Health has managed to grow its workforce in numbers, clinical staff report unsustainable workload levels and Queensland continues to have the lowest number of health professionals per capita of any state or territory except Tasmania.

Increasing clinician numbers is a challenging task, and Queensland Health identified the following significant challenges (which are not unique to Queensland):

- an ageing clinical workforce with major implications as the most senior and experienced clinicians begin to retire in coming years;
- reduction in working hours – across the clinical spectrum - requiring more staff (with attendant ancillary costs) to provide the same level of service; and
- inadequate local supply of doctors and significant attrition rates of doctors employed in public hospitals, driving reliance on overseas trained doctors with special purpose registration to sustain workforce growth – likely to be felt for at least fifteen years.

4. FINANCIAL COSTS

The financial costs to society of foot and ankle surgery and from waiting for such surgery can be broken down into two broad classifications: direct (health system) costs and indirect (productivity) costs.

- **Direct health system costs**: capture Australian health system expenditures on foot and ankle surgery and the types of costs that may be saved if podiatric surgeons rather than orthopaedic surgeons are able to provide these services in hospitals.
- **Indirect productivity costs**: measure the lost production of patients waiting for surgery using a human capital approach. Associated ‘deadweight losses’ of raising additional taxation revenues to cover these productivity losses are also estimated.
  - Although forgone taxation is a transfer, not a real cost (so should not be included in the estimation of total costs) it is still worthwhile to estimate as it helps understand how the total costs and benefits are shared between the taxpayer, the individual and others in society.

It is possible to make total economic cost savings through greater access to surgical staff (that is, shorter waiting periods for surgery), shorter average length of stays in hospital and lower surgeon fees. Each of these or a combination of these would result in lower financial costs and/or the avoidance of indirect economic costs associated with the loss of wellbeing (detailed in Chapter 5).

4.1 DIRECT HEALTH SYSTEM COSTS

Direct health system costs are applied as two components in the modeling:

- surgeon fees; and
- health system treatment costs (net of surgeon fees).

The separation of surgeon fees from other health system treatment costs is useful for modeling purposes as it allows for scenario analysis based on international research (Harris et al, 1997) that highlights the differentiation between orthopaedic and podiatric surgeon fees.

4.1.1 SURGEON FEES

MBS Data

2008-MBS standard fee amounts were obtained for the complete set of the 95 foot and ankle surgical items from Medicare Australia’s *MBS Item by Patient Demographics Reports*. For modeling purposes, a weighted average fee was calculated for each of the 12 key categories and an overall total. The calculated weighted average MBS fees are presented in Table 4-1.

TABLE 4-1: FOOT AND ANKLE SURGERY, MBS FEES ($), WEIGHTED AVERAGE FOR EACH CATEGORY, AUSTRALIA, 2008

Category			MBS Benefit, $	
No	Description	MBS Fee, $	75%	85%
1	Toenail	117.62	88.22	99.98
2	Foot and ankle trauma	217.39	163.04	184.78
3	Lesser toes	207.82	155.86	176.64
4	Ankle	495.32	371.49	421.02
5	First metatarsophalangeal joint	524.30	393.23	445.66
6	Neuroma	271.90	203.93	231.12
7	Amputations	177.84	133.38	151.16
8	Clubfoot	352.72	264.54	299.81
9	Heel	325.36	244.02	276.56
10	Rear foot	517.20	387.90	439.62
11	Lesser metatarsophalangeal joints	285.84	214.38	242.97
12	Tarsal coalition and congenital vertical talus	565.13	423.84	480.36
	Total weighted average	**207.68**	**155.76**	**176.53**

Source: MBS Online (2008)[12] and Access Economics.

An MBS rebate of between 75% and 85% for standard fees applies to each of the 95 MBS items for foot and ankle surgery. Additional hospital costs (such as theatre fees) are not covered by Medicare, and are generally met by the public system in public hospitals and private health insurance in private hospitals.[13] Data on these costs are available from the casemix dataset and detailed in Section 4.1.2.

AMA Fees

While the MBS data provides information on standard fees, private procedures usually attract a higher rate for the same services. The Australian Medical Association (AMA) publishes the 'List of Medical Services and Fees' for equivalent services (AMA, 2006). The calculated weighted average for the equivalent private fees are presented Table 4-2. The 2007 listed private fees were inflated to 2008 prices based on average trends in health inflation data (AIHW, 2007). The difference between the private fee and the MBS rebate amount (detailed above) is the gap payment required to be paid by patients.

[12] Available at: **http://www9.health.gov.au/mbs/search.cfm**.

[13] As noted earlier, all MBS fees are for foot and ankle surgery performed by medical officers recognised under Medicare.

TABLE 4-2: FOOT AND ANKLE SURGERY, AMA FEES ($), WEIGHTED AVERAGE FOR EACH CATEGORY, AUSTRALIA, 2008

Category		Weighted average, $		
No	Description	MBS rebate (75%)	Gap	Private Fee
1	Toenail	88.22	225.70	313.92
2	Foot and ankle trauma	163.04	382.46	545.50
3	Lesser toes	155.86	507.22	663.08
4	Ankle	371.49	873.70	1,245.20
5	First metatarsophalangeal joint	393.23	931.60	1,324.82
6	Neuroma	203.93	481.08	685.00
7	Amputations	133.38	299.57	432.94
8	Clubfoot	264.54	1,535.16	1,799.70
9	Heel	244.02	573.91	817.93
10	Rear foot	387.90	916.34	1,304.24
11	Lesser metatarsophalangeal joints	214.38	507.83	722.21
12	Tarsal coalition and congenital vertical talus	423.84	920.49	1,344.34
	Total weighted average	**155.76**	**397.39**	**553.16**

Source: MBS online (2008), Australian Medical Association (2006) and Access Economics

In practice, public and private sector surgeons performing these procedures may be paid according to various payment arrangements (such as an annual salary or other means that are not 'fee-for-service'). For modeling purposes, we have applied a unit cost to each case of surgery based on the fee-for-service information above. This approach ensures consistency and allows for comparability.

4.1.2 HOSPITAL COSTS

Estimates for health system expenditure are derived in Australia by the Australian Government Department of Health and Ageing as part of the National Hospital Cost Data Collection (NHCDC). The NHCDC involves the ongoing annual collection of hospital data from a sample of public acute care hospitals throughout Australia. Its purpose is to produce national cost weights for AR-DRGs and other statistics relevant to health service costing and planning.

The NHCDC has evolved from the principles of casemix hospital product costing. The objective of Casemix is to provide the health care industry with a nationally consistent method of classifying all types of patients, their treatment and associated costs. Principal goals of the NHCDC are to:

- produce robust estimates of hospital costs and casemix relativities;
- provide continual refinement in the costing of hospital products;
- provide a platform for inter and intra state comparison of hospital costs;
- promote a framework for national hospital costing standards;
- encourage hospitals to examine their cost structures and produce costing information;
- develop an effective hospital costing infrastructure at Commonwealth, State and local levels; and
- provide data to inform the ongoing refinement of casemix classifications.

The 95 MBS procedural items for foot and ankle surgery were matched to the corresponding AR-DRG item listed in the NHCDC based on the concordance methodology detailed in Section 3.2.2. Expenditure items were obtained for the 'total cost per AR-DRG', disaggregated by direct and overhead costs. Direct and overhead expenditure items in the cost collection data comprise average cost per AR-DRG for:

- Ward Medical (direct and overhead);

- Ward Nursing (direct and overhead);
- Non-clinical salaries;
- Pathology (direct and overhead);
- Imaging (direct and overhead);
- Allied (direct and overhead);
- Pharmacy (direct and overhead);
- Critical care (direct and overhead);
- Operating rooms (direct and overhead);
- Emergency departments (direct and overhead);
- Supplies (direct and overhead);
- Special procedures suites (direct and overhead);
- Prostheses;
- On-costs;
- Hotel; and
- Depreciation.

In relation to **public expenditure**, the current Round 11 cost data collection was based on a sample of 226 public hospitals and covers the financial year 2006-07 (DoHA, 2008). **Private expenditure** was not in Round 11 and the most recent NHCDC data available on private hospitals are presented in the Round 7 cost data collection (DoHA 2004).[14] This round was based on a sample of 113 private hospitals (and 204 public hospitals). Both public and private expenditure data were inflated to 2008 prices based on 3.1% average per annum health inflation (AIHW, 2007). The weighted average costs based on these data were estimated for the 12 key categories (Table 4-3) by public and private procedure.

TABLE 4-3: FOOT AND ANKLE SURGERY: HOSPITAL EXPENDITURE, AVERAGE WEIGHTED COST, AUSTRALIA, 2008

Category		Hospital costs - Weighted average, $		
No	Description	Direct*	Overhead	Total
1	Toenail	2,522.44	1,127.33	3,649.77
2	Foot and ankle trauma	5,356.22	2,037.12	7,393.34
3	Lesser toes	2,920.37	954.73	3,875.10
4	Ankle	2,850.85	942.75	3,793.60
5	First metatarsophalangeal joint	2,826.71	937.45	3,764.16
6	Neuroma	3,704.25	1,120.83	4,825.08
7	Amputations	28,422.12	8,342.91	36,765.03
8	Clubfoot	3,731.82	1,125.44	4,857.26
9	Heel	3,172.58	1,003.55	4,176.13
10	Rear foot	2,884.03	947.97	3,832.00
11	Lesser metatarsophalangeal joints	2,060.46	811.11	2,871.57
12	Tarsal coalition and congenital vertical talus	3,358.69	1,041.89	4,400.58
	Total weighted average	**10,844.13**	**2,991.25**	**13,835.38**

* Inclusive of surgeon fees.
Source: (DoHA, 2008), (DoHA 2004), (ABS, 2008) and Access Economics.

[14] Private sector cost data is expected to be released by DoHA in late August/early September 2008.

4.2 INDIRECT PRODUCTIVITY COSTS

Indirect costs are all those that are not 'direct' health system costs (Section 4.1) nor intangible costs – the loss of health and wellbeing (Chapter 5). It is also important to make the economic distinction between real and transfer costs to avoid double counting.

- **Real costs** use up real resources, such as capital or labour, or reduce the economy's overall capacity to produce goods and services.
- **Transfer payments** involve payments from one economic agent to another that do not use up real resources, for example, a disability support pension, or taxation revenue.
  - Transfer costs are important when adopting a whole-of-economy analysis of the impact of a particular health condition.

In this analysis, while there may be a number of indirect costs, the focus is on productivity losses. A condition in need of foot and ankle surgery can have an impact on a person's capacity to work. They may work less than they otherwise would during the period they are waiting for surgery and this loss in productivity represents a real cost to the economy.

Access Economics measures the lost earnings and production due to health conditions using a 'human capital' approach. The lower end of such estimates includes only the 'friction' period until the worker can be replaced, which would be highly dependent on labour market conditions and unemployment/underemployment levels. In an economy operating at near full capacity, as Australia is at present,[15] a better estimate measures the cost of permanent and temporary work absences based on Average Weekly Earnings (AWE) for the period of the lower employment, participation or absenteeism.[16]

In this case, it is likely that, in the absence of the condition, those people waiting for surgery would participate in the labour force at the same rate as the general population and earn the same AWE. The implicit and probable economic assumption is that the numbers of such people would not be of sufficient magnitude to substantially influence the overall clearing of the Australian labour market.

While musculoskeletal injuries are well known, foot and ankle injuries are not as frequently described as back and hand injuries (Grimm and Fallat,1999). Nevertheless, data sources have been identified from which such productivity costs can be estimated in Australia.

Grimm and Fallat (1999) found that foot and ankle injuries accounted restricted workers for between 20.5 days and 21.4 days on average. Courtney et al (2002) separately identified that fractures of the ankle and foot account for 55 and 42 absentee days, respectively. They found that fractures had substantially higher disability durations than other workplace injuries. That is, impairment of the entire foot or ankle has a prolonged disability which must bear a worker's weight. Fractures as a class of injury are particularly problematic because once they have occurred, the recuperation time is relatively fixed and somewhat less likely to be shortened by traditional return to work efforts than some other types of injuries.

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[15] The International Monetary Fund (2008) summarises: 'Sound macroeconomic policies and structural reforms have delivered a prolonged expansion, but recently the economy's productive capacity has become increasingly stretched. The commodity driven boom has pushed up against capacity constraints, with unemployment falling to the lowest rate since the mid-1970s and capacity utilization rising to historic highs.'

[16] This methodology has also been used in other international studies which measure the indirect (productivity) costs of foot and ankle injuries, for example see Crumps et al (2007).

4.2.1 ABSENTEEISM CALCULATED (AVERAGE DAYS LOST PER PROCEDURE)

The findings from Courtney et al (2002) were used to estimate the number of absentee days attributable to each of the 95 MBS items. A 'league table' was constructed based on the burden of disease for each condition requiring foot and ankle surgery. The table lists these conditions by highest to lowest according to their burden of disease as defined in Mathers et al (1999). A relative weighting is then applied to each to determine the number of days absent because of the condition.

Specifically, ankle fractures were set to an index = 100, equivalent to a disability weight of 0.196, and the number of days absent of 55. Using this index, the relative number of days absent was calculated according to the disability weight of each podiatric condition requiring surgery – that is, the relativity to 100 multiplied by the 55 days.

As a cross-check, 'fractures - foot bones' had a disability weight of 0.077, equating to an index of 39.3 or 21.6 days absent. This is consistent with the findings of between 20.5 days and 21.4 days absent for foot and ankle injuries from Grimm and Fallat (1999). A summary of the weighted calculations for the 12 key categories is presented in Table 4-4.

TABLE 4-4: ABSENTEE DAYS RESULTING FROM FOOT AND ANKLE CONDITIONS THAT REQUIRE SURGERY, AUSTRALIA, 2008

Category		Weighted averages	
No	Description	Disability weights	Days absent
1	Toenail	0.064	18
2	Foot and ankle trauma	0.143	40
3	Lesser toes	0.098	28
4	Ankle	0.086	24
5	First metatarsophalangeal joint	0.079	22
6	Neuroma	0.064	18
7	Amputations	0.222	62
8	Clubfoot	0.060	17
9	Heel	0.060	17
10	Rear foot	0.210	59
11	Lesser metatarsophalangeal joints	0.210	59
12	Tarsal coalition and congenital vertical talus	0.210	59
	Total weighted average	**0.095**	**27**

Source: Mathers et al (1999), Grimm and Fallat (1999), Courtney et al (2002) and Access Economics.

4.2.2 PRODUCTIVITY LOSSES CALCULATED

AWE for Australia in 2008 is $1,174.10 (ABS, 2008a), the participation rate is 66.3% (ABS, 2008b) and the unemployment rate is 4.2% (ABS, 2008b). This implies that 62.6% of the population is in paid employment (66.3%*(1-4.2%). While the remaining 37.4% are not in employment, their time is valued at 30% of the AWE, a crude estimate of the value of unpaid household production. As such, this approach takes into account employment status.

The productivity loss from foot and ankle conditions needing surgery is calculated as the days absent from work multiplied by the combined AWE of those employed and unemployed divided by 5 working days. This equates to number of days absent*(62.6%+(37.4%*30%))*(AWE/5 working days per week). The results of these calculations are presented in Table 4-5.

TABLE 4-5: PRODUCTIVITY COSTS FROM WAITING FOR FOOT AND ANKLE CONDITIONS THAT REQUIRE SURGERY, BY MAIN CATEGORY, AUSTRALIA, 2008

Category		Weighted averages	
No	Description	Days absent	Productivity Cost
1	Toenail	18	3,112
2	Foot and ankle trauma	40	6,934
3	Lesser toes	28	4,786
4	Ankle	24	4,190
5	First metatarsophalangeal joint	22	3,852
6	Neuroma	18	3,131
7	Amputations	62	10,794
8	Clubfoot	17	2,917
9	Heel	17	2,917
10	Rear foot	59	10,211
11	Lesser metatarsophalangeal joints	59	10,211
12	Tarsal coalition and congenital vertical talus	59	10,211
	Total weighted average	**27**	**4,630**

4.2.3 TAXATION REVENUE FORGONE

Lower earnings due to absenteeism will also have an effect on taxation revenue collected by the Australian Government. As well as forgone income (personal) taxation, there will also be a fall in indirect (consumption) tax, as those with lower incomes spend less on the consumption of goods and services. As such, the indirect tax forgone is estimated as a product of the forgone consumption and the average indirect tax rate.

While the taxation rate for individual income in Australia is between is between 15% - 45% (ATO, 2008) depending on income levels, the average tax rate for Australia is calculated as the ratio between total household income and taxes on income for households, which was 21.2% in the March quarter 2008 (Access Economics, 2008a).

Additionally, the average indirect tax rate has been calculated at 15.5% (Access Economics, 2008a), which includes taxes such as the GST and excise tax. Given the household saving ratio was -3.3% of household disposable income in 2008 (ABS, 2008c), it is assumed that 100% of disposable income is consumed for modeling purposes, that is, there are no savings nor dis-savings.

The estimated taxation forgone due to foot and ankle conditions awaiting surgery is presented in Table 4-6 by the 12 main categories.

TABLE 4-6: TAXATION REVENUE FORGONE, BY CATEGORY, AUSTRALIA, 2008

Category		Taxation revenue forgone, $		
No	Description	Personal	Consumption	Total
1	Toenail	660	380	1,040
2	Foot and ankle trauma	1,470	847	2,317
3	Lesser toes	1,015	585	1,600
4	Ankle	888	512	1,400
5	First metatarsophalangeal joint	817	471	1,287
6	Neuroma	664	383	1,047
7	Amputations	2,288	1,319	3,608
8	Clubfoot	618	357	975
9	Heel	618	357	975
10	Rear foot	2,165	1,248	3,413
11	Lesser metatarsophalangeal joints	2,165	1,248	3,413
12	Tarsal coalition and congenital vertical talus	2,165	1,248	3,413
	Total weighted average	**982**	**566**	**1,547**

Source: Access Economics (2008).

4.2.4 DEADWEIGHT LOSSES

Lost taxation revenue is considered a transfer payment, rather than an economic cost per se. However, raising additional taxation revenues does impose real efficiency costs on the Australian economy, known as **deadweight losses (DWLs)**. In relation to foot and ankle conditions awaiting surgery, these DWLs arise from the need to raise additional taxes to cover the impact from reduced earnings (and, hence, lower taxation) due to absenteeism.

The need to raise additional taxation to cover revenue losses, results in a distortionary impact of taxes on workers' labour and consumption choices. Internationally, it has been reported that these distortionary impacts are estimated to be in the range between 9%-16% and 50% (Browning, 1987; Ballard et al, 1985; Stuart, 1984).

In Australia, the administration of the taxation system costs around 1.25% of revenue raised (derived from total amounts spent and revenue raised, relative to Commonwealth department running costs). Even larger deadweight losses arise from the distortionary impact of taxes on workers' work and consumption choices. These distortionary impacts are estimated to be 27.5% of each tax dollar collected (Lattimore, 1997 and used in Productivity Commission, 2003:6.15-6.16, with rationale). As such, the overall DWL used in this report for Australia is 28.75%. This is applied to the estimated taxation forgone to estimate the DWL for foot and ankle conditions awaiting surgery (Table 4-7).

TABLE 4-7: DWL FROM TAXATION REVENUE FORGONE BY CATEGORY, AUSTRALIA, 2008

Category		Weighted averages, $	
No	Description	Taxation forgone	DWL
1	Toenail	1,040	299
2	Foot and ankle trauma	2,317	666
3	Lesser toes	1,600	460
4	Ankle	1,400	403
5	First metatarsophalangeal joint	1,287	370
6	Neuroma	1,047	301
7	Amputations	3,608	1,037
8	Clubfoot	975	280
9	Heel	975	280
10	Rear foot	3,413	981
11	Lesser metatarsophalangeal joints	3,413	981
12	Tarsal coalition and congenital vertical talus	3,413	981
	Total weighted average	**1,547**	**445**

Source: Access Economics (2008). Browning (1987); Ballard et al (1985); Stuart (1984) Lattimore (1997) and Productivity Commission (2003).

5. BURDEN OF DISEASE

Orthopaedic waiting times for surgery have been identified as a key priority by Australian and state/territory governments with elective surgery receiving a funding boost to treat additional patients (Minister for Health and Ageing, 2008). There is a growing public concern and evidence of adverse health outcomes result from access and waiting list issues (see for example Access Economics, 2007).

To those experiencing foot or ankle problems requiring surgery, the loss of quality of life, loss of leisure and disability are often as or more important than the health system costs or other financial losses. This chapter estimates the value of the burden suffered during the duration of the waiting period for foot and ankle conditions requiring surgery.

5.1 MEASURING BURDEN

In the last decade a non-financial approach to valuing human life has been derived, where loss of wellbeing and premature mortality – called the ‘burden of disease and injury’ – are measured in terms of Disability-Adjusted Life Years, or DALYs. This approach was developed by World Health Organization (WHO), the World Bank and Harvard University for a study that provided a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990, projected to 2020 (Murray and Lopez, 1996). Methods and data sources are detailed further in Murray et al (2001) and the WHO continues to revisit the estimates for later years.

A DALY of 0 represents a year of perfect health, while a DALY of 1 represents death. Other health states are attributed values between 0 and 1 as assessed by experts on the basis of literature and other evidence of the quality of life in relative health states. For example, the disability weight of 0.18 for a broken wrist can be interpreted as losing 18% of a year of healthy life because of the inflicted injury. Total DALYs lost from a condition are the sum of the Year(s) of healthy life Lost due to Disability (YLDs).

The DALY approach has been successful in avoiding the subjectivity of individual valuation and is capable of overcoming the problem of comparability between individuals and between nations, although some nations have subsequently adopted variations in weighting systems, for example age-weighting for older people. This report treats the value of a life year as equal throughout the lifespan.

For public policy making, it is often also desirable to apply a monetary conversion to ascertain the cost of an injury, disease or fatality or the value of a preventive health intervention, for example, in cost benefit analysis. Such financial conversions tend to utilise ‘willingness to pay’ or risk-based labour market studies as described in the next section.

5.2 VALUING LIFE AND HEALTH

The burden of disease as measured in DALYs can be converted into a dollar figure using an estimate of the **Value of a ‘Statistical’ Life (VSL**). As the name suggests, the VSL is an estimate of the value society places on an anonymous life. Since Schelling’s (1968) discussion of the economics of life saving, the economic literature has focused on **willingness to pay** (WTP) – or, conversely, willingness to accept (WTA) – measures of mortality and morbidity, in order to develop VSL estimates.

These estimates may be derived from observing people’s choices in situations where they rank or trade off various states of wellbeing (loss or gain) either against each other or for dollar amounts eg, stated choice models of people's WTP for interventions that enhance health or WTA poorer health outcomes or the risk of such states. Alternatively, risk studies use evidence of market trade-offs between risk and money, including numerous labour market and other studies (such as installing smoke detectors, wearing seatbelts or bike helmets and so on).

The extensive literature in this field mostly uses econometric analysis to value mortality risk and the 'hedonic wage' by estimating compensating differentials for on-the-job risk exposure in labour markets, in other words, determining what dollar amount would be accepted by an individual to induce him/her to increase the probability of death or morbidity by a particular percentage. Viscusi and Aldy (2002), in a summary of mortality studies, find the VSL ranges between US$4 million and US$9 million with a median of US$7 million (in year 2000 US dollars), similar but marginally higher than the VSL derived from studies of US product and housing markets. They also review a parallel literature on the implicit value of the risk of non-fatal injuries.

Weaknesses in the WTP approach, as with human capital approaches to valuing life and wellbeing, are that there can be substantial variation between individuals. Extraneous influences in labour markets such as imperfect information, income/wealth or power asymmetries can cause difficulty in correctly perceiving the risk or in negotiating an acceptably higher wage in wage-risk trade off studies, for example.

As DALYs are enumerated in years of life rather than in whole lives it is necessary to calculate the **Value of a 'Statistical' Life Year (VSLY)** based on the VSL. This is done using the formula:[17]

$$VSLY = VSL / \Sigma_{i=0,\ldots,n-1}(1+r)^i$$

Where: n = years of remaining life, and
r = discount rate.

Choosing an appropriate discount rate for present valuations in cost analysis is a subject of some debate, and can vary depending on which future income or cost stream is being considered. In this case, the discount rate (*r*) represents a positive time preference for healthy life now.

In reviewing the literature, Access Economics (2008) found the most common rate used to discount healthy life was 3% – both in Australia (eg, Mathers et al, 1999; Begg et al, 2007, both AIHW) and overseas (eg, perhaps the most eminent being Nordhaus, 2002 (Yale); Murphy and Topel, 2005 (University of Chicago); Cutler and Richardson, 1998 (Harvard); WHO, 2002; Aldy and Viscusi, 2006). This report assumes a discount rate for future streams of health in Australia of 3%. Further it is assumed that on average people have 40 years of life remaining (the average from the meta-analysis of wage-risk studies).

Based on an extensive review of international literature, Access Economics (2008) recommends a VSL of $6.0 million (with $8.1 million as an upper bound and $3.7 million as a lower bound due to the great variability across studies). Using a real discount rate of 3% (which aligns generally with discount rates used in Australian and international studies discounting healthy life and the current AIHW practices) over an estimated 40 years remaining

[17] The formula is derived from the definition:
VSL = ΣVSLYi/(1+r)^i where i=0,1,2….n
where VSLY is assumed to be constant (i.e. no variation with age).

life expectancy, this equates to an average VSLY in 2006 dollars of $252,014. Inflating the 2006 VSLY value to 2008 dollars by multiplying it by two years of inflation (2.9% in each year, from the Access Economics Macroeconomic model) results in a base case of $266,843 with lower and upper bounds of $164,553 and $360,238.

5.3 ESTIMATING THE BURDEN OF DISEASE FROM FOOT AND ANKLE CONDITIONS

5.3.1 DISABILITY WEIGHTS

The years of healthy life lost due to disability (YLD) is estimated based on the 'implicit disability weights' presented in Mathers et al (1999). A selection of these AIHW disability weights were identified that most closely reflected the foot and ankle conditions that are examined in this report. In some cases, consistent with methods used in Mathers et al (1999), a proxy condition was used to reflect an appropriate disability weight for a particular item where an exact match was not available. The assistance of expert clinicians in the field was sought to ensure that the most appropriate weights were applied to each of the 95 items under review.

The disability weight importantly applies to the burden of disease experienced before each surgery for each foot and ankle condition. Table 5-1 presents the AIHW listed conditions that were used to define the disabilities weights for foot and ankle surgery.

TABLE 5-1: LEAGUE TABLE OF SELECTED AIHW DISABILITY WEIGHTS, AUSTRALIA

No	Category Disease category, subcategory, or sequele	Disability weight	Comment
1	Rheumatoid arthristis - Severe	0.940	Dutch Weight
2	Adverse effects of drugs in treatment	0.453	Average weight across all injury sequelae
3	Adverse effects of medical treatment	0.433	Average weight across all injury sequelae
4	Osteoarthritis grade 3-4 - symptomatic	0.420	Dutch Weight
5	Surgical and medical misadventure	0.380	Average weight across all injury sequelae
6	Rheumatoid arthristis - Moderate	0.370	Dutch Weight
7	Amputations - Foot	0.300	GBD Weight
8	Amputations - Leg	0.300	GBD Weight
9	Diabetic Foot (Type 1 & 2)	0.222	GBD Weight
10	Rheumatoid arthristis - Mild	0.210	Dutch Weight
11	Internal injuries	0.208	GBD Weight
12	Fractures - Ankle	0.196	GBD Weight
13	Cerebal Palsy without intellectual disability	0.170	Dutch Weight
14	Falls	0.141	Average weight across all injury sequelae
15	Osteoarthritis grade 2 - symptomatic	0.140	Dutch Weight
16	Osteoarthritis grade 3-4 - asymptomatic	0.140	Dutch Weight
17	Sports injuries	0.118	Average weight across all injury sequelae
18	Amputations - Toe	0.102	GBD Weight
19	Fractures - Foot bones	0.077	GBD Weight
20	Other dislocations	0.074	GBD Weight for shoulder, elbow or hip dislocation
21	Injured Nerves (short- and long-term)	0.064	GBD Weight
22	Ingrown toenail	0.064	GBD Weight for sprains
23	Other Musculoskeletal disorders: Recent non-chronic episodes	0.060	Dutch Weight for lower back pain
24	Other Musculoskeletal disorders: Chronic conditions	0.060	Dutch Weight for lower back pain
25	Osteoarthritis grade 2 - asymptomatic	0.010	Dutch Weight

GBD= Global Burden of Disease.
Source: Mathers et al (1999).

Table 5-2 shows the weighted average disability weight for each of the 12 main categories considered in this report.

TABLE 5-2: FOOT AND ANKLE CONDITIONS, DISABILITY WEIGHTS BY CATEGORY, WEIGHTED AVERAGES, AUSTRALIA

Category		Weighted averages
No	Description	Disability weights
1	Toenail	0.064
2	Foot and ankle trauma	0.143
3	Lesser toes	0.098
4	Ankle	0.086
5	First metatarsophalangeal joint	0.079
6	Neuroma	0.064
7	Amputations	0.222
8	Clubfoot	0.060
9	Heel	0.060
10	Rear foot	0.210
11	Lesser metatarsophalangeal joints	0.210
12	Tarsal coalition and congenital vertical talus	0.210
	Total weighted average	**0.095**

5.3.2 THE VALUE OF THE BURDEN OF DISEASE CALCULATED

The burden of disease is calculated as the disability weight multiplied by the proportion of the year spent waiting for surgery (the DALYs), which is then converted into a dollar value by multiplying by the VSLY.

DALYs × VSLY = value of the burden of disease

Bearing in mind that the wage-risk studies underlying the calculation of the VSL take into account all known personal impacts – suffering and premature death, lost wages/income, out-of-pocket personal health costs and so on – this formula represents a 'gross' figure. As some of these costs borne by the individual are already captured elsewhere in the analysis, it is important to estimate a net value of the burden of disease. This is calculated as:

Gross cost of lost wellbeing;

minus health costs borne out-of-pocket:

(derived by multiplying direct hospital expenditure in Section 4.1.2 by the proportion of total health expenditure paid by individuals (AIHW, 2007);[18]

minus production losses net of tax.

The value of the burden of disease for people with foot and ankle conditions waiting for surgery also includes the burden of disease from any additional burden of disease for health complications developing during waiting times for surgery. These calculations are detailed in Section 6.1.3.

[18] In AIHW (2007) Table A3 'Total health expenditure, current prices, by area of expenditure and source of funds, 2005-06 ($ million)' shows that the proportion of health expenditure in Australia paid by individuals was 17.4%.

6. CEA AND CBA

This section draws together the findings from the previous sections and assesses the potential impact of utilising podiatric surgery in the Australian health system to assist reduction in elective surgery waiting lists. Cost effectiveness analysis (CEA) and cost benefit analysis (CBA) are used to make this assessment.

CEAs and CBAs are used to assess and compare the value of interventions in terms of their ability to provide health and other benefits, relative to the cost of the intervention. In this report, the **costs** include all elements of the surgical intervention and those associated with waiting for surgery and all are financial. The **benefits** comprise both financial and wellbeing benefits and accrue from lower surgeon fees, shorter hospital stays on average and reducing the wait time for other (orthopaedic) surgical interventions.

- The most common type of CEA in health is cost utility analysis, which compares the net financial cost of the intervention with the wellbeing benefit, measured in dollars spent per DALYs avoided (ie, $/DALY).
- A CBA is also used to evaluate the desirability of a given medical or surgical intervention. The aim is to gauge the efficiency of the intervention relative to the status quo. The CBA is similar to the CEA but converts the DALY to dollars using VSLY, and then compares the net costs with net benefits. The implicit benchmark of CBA is the break even point.

Each of the 95 types of surgeries performed by podiatric surgeons were analysed individually. The results of each CEA and CBA are presented in Appendix C. For presentational purposes, the results are presented as weighted averages for each of the 12 categories as defined in Section 3.1.1.

6.1 MODEL INPUTS

While the CEA and CBA produce slightly different outputs, they share the same inputs to the modelling. The key model inputs to these analyses comprise the following.

6.1.1 DIRECT HEALTH SYSTEM COSTS

The direct health system costs for the base case (status quo) are those presented in the Section 4.1. These costs have been disaggregated by surgeon fees, direct costs, and overhead costs to accommodate economic analysis.

- **Surgeon fees**: in the base case, the unit cost per surgery for podiatric surgeons is kept the same as their comparator, these are detailed in Section 4.1.1. The scenario analysis in Section 6.5 looks at the cost effectiveness and cost benefit of podiatric surgeon fees that are 12% lower than the status quo based information from Harris et al (1997).
- **Fixed costs**: these are detailed in Section 4.1.2 and represent costs that are typically fixed per procedure regardless of the length of stay in hospital (eg, pathology, imaging, prostheses – if you need one you need one, but it is unrelated to length of stay).
- **Variable costs**: these are also detailed in Section 4.1.2 and are proportional to the length of stay in care. These costs have been calculated on a daily rate based on the average length of stay (ALOS) in hospital. Research from Western Australia shows that

the ALOS for procedures performed by podiatric surgeons was on average 45.2% of the ALOS for the same procedures performed by all surgeons (WA, 2008).[19]

- **Average length of stay in hospital**: In comparing costs between podiatrists and orthopaedic surgeons in Western Australia, Stevenson (1988) identified that the greatest savings were achieved by reducing the stay in hospital.
- Shorter hospital stays principally reflect surgical practice and post-operative care (Tollafield, 1993). For example, in Kilmartin (2002), 93% of patients surveyed responded that they would have a preference for day surgery under local anaesthetic, after their experience of surgery by podiatrists.

6.1.2 INDIRECT OTHER FINANCIAL COSTS

The indirect other financial costs represent the productivity losses (Section 4.2.2) and deadweight losses (Section 4.2.4) from people with foot and ankle conditions waiting for surgery. These estimated losses are converted to daily rates in the model. This allows the modelling to compare any reduction in these losses due to shorter waiting times for surgery.

Waiting times: A major implicit benefit of podiatric surgery would be a decrease in the waiting times for foot surgery, for both (1) access for initial consultation, and (2) time to treat (surgery).[20] The orthopaedic surgeon waiting times for elective surgery presented in Section 2.3.1 are used as the benchmark waiting period for each of the foot and ankle surgical procedures. For modelling purposes, the wait time for the initial consultation has been set at the same time for the median waiting period for elective surgery by orthopaedics, that is, 50 days (AIHW, 2008).

A comparable national data set on podiatric surgeon waiting times is not available and a proxy waiting period has been estimated. Butterworth et al (2008) estimate that nine podiatric surgeons across Australia performed 2,387 in a 12-month period. This equates to around 265 procedures per surgeon per year. Given that a podiatric surgeon is capable of 1,250 procedures per year (NHS Trust UK, 2008)[21], the wait time for surgery by a podiatric surgeon is assumed to be 7 days, which is 21.2% (265 procedures per annum / 1,250 possible) * 32 days, which is median wait time for all surgical specialties combined in Australia (AIHW, 2008). The wait time for the initial consultation has been set at the same time for the median waiting period for elective surgery by podiatric surgeons.

The scenario analysis in Section 6.5 looks at the cost effectiveness and cost benefit of podiatric surgeon increasing waiting times to 16 days for surgery and 16 days for consultation.

[19] The ALOS ratio for podiatric surgeons is based on Western Australian separations data for 2002-2007. It was calculated as the total number of bed days (2,678) divided by the total number of separations for foot and ankle procedures performed by podiatric surgeons (1,977), divided by the total number of bed days (91,067) divided by the total number of separations for foot and ankle procedures performed by all surgeons in the private sector (20,291). Private sector data were chosen as podiatric surgeons are currently only able to operate in the private sector.

[20] AIHW (2008a) notes while reported waiting times for elective surgery represent the number of days between being added to the hospital's waiting list and being removed from the waiting list when admitted for surgery, this may not reflect the total time waited as perceived by patients. It does not include waits between referrals, appointments or the time between the appointment with the surgeon and being placed on the waiting list for surgery.

[21] This volume is based on surgical audit data of a full-time podiatric surgeon operating within an orthopaedic department in an NHS Trust Hospital in the UK.

- It is noted that the modelling for indirect other financial costs is dependent on the number of days absent due to the foot and ankle condition prior to surgery (see Section 4.2.1). However, the costs associated are limited only to those days absent within the waiting period for each foot and ankle condition requiring surgery.
  - That is, the total number of days absent underlying any of the calculations will not exceed the number of days waiting for surgery – either the days absent or the maximum wait time will apply, whichever is the shorter of the two.

6.1.3 BURDEN OF DISEASE

The burden of disease for people with foot and ankle conditions waiting for surgery are those presented in Section 5.3, factored down to allow for the estimated waiting time as a share of a full year. Again, this allows the modelling to compare any change in the burden of disease from changes in waiting times for surgery. Added to this is any additional burden of disease for health complications developing during waiting times for surgery, also based on estimated probabilities of complication multiplied by average duration.

6.1.3.1 HEALTH COMPLICATIONS

Although waiting lists may be considered a health care rationing mechanism, waiting in queues for surgery increases the burden of the condition. Long waiting periods for surgery increase the time that individuals have to spend incurring pain, suffering and reduced quality of life.

Studies have demonstrated that waiting for surgery may lead to further worsening of a patient's condition, including their overall physical and psychosocial wellbeing, which in turn can impact on surgical outcomes (Access Economics, 2007, Mills et al, 1991, Faulkner et al, 1998, Fitzpatrick et al, 1998, and Fortin et al, 1999). Key health complications examined in this report include the development of foot problems in diabetics as a consequence of delayed treatment and risks associated with falls.

6.1.3.1.1 Diabetic foot

The foot in diabetes is associated with high morbidity and mortality. People with diabetes mellitus have a 15 times increased risk of undergoing a lower extremity amputation when compared to those without diabetes (Most and Sincock, 1983). It is accepted that foot ulceration precedes almost all lower extremity amputations (Australian Centre for Diabetes Strategies, 2001 and Pecoraro et al, 1990). A particular problem is foot deformity and the necessity of reducing pressures to prevent ulceration, which may lead to amputation (Strategies, 2001). Over 30% of diabetic amputees have a foot deformity (Mayfield et al, 2000).

The implications of reduction in incidence and recurrence of ulceration are significant and by preventing this initiating factor – deformity – with minor surgery, may significantly reduce amputation levels, hence improve quality of life and reduce the burden on our health system.

This annual probability of complications from the delayed treatment of diabetic foot is estimated at 1.7% and has been calculated as the prevalence of diabetes in Australia (5.4%)[22] * the annual probability of amputation caused by delays (37.5%) from Mills et al (1991). This annual probability of complication (0.04%) is applied in the model to each of the 95 MBS procedures identified and weighted by the waiting times for each procedure.

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[22] The total prevalence rate for diabetes is based the 1999 age and gender specific prevalence rates from AusDiab (2001) applied to updated Australian population data.

The direct health system costs, indirect other financial costs and the burden of disease for such amputations are based on the weighted average data presented in the category 'amputations' in the sections above.

6.1.3.1.2 Falls

Falls in older people are common and constitute a major public health concern. Every year, approximately one third of community-dwelling people older than 65 years experience a fall (Menz and Lord SR, 1999). In many cases, the injuries sustained from these falls have a significant detrimental effect on physical functioning and increase the likelihood of admission to a nursing home (Menz and Lord, 1999).

A number of lower-extremity risk factors for falling have been identified, including knee osteoarthritis, peripheral sensory loss, lower-limb muscle weakness and foot problems (Menz and Lord, 1999). The act of walking requires the complex interaction of joint motions at specific times if smooth transferral of body weight is to be achieved. It is reasonable to expect that foot dysfunction may interfere with normal progression of the body during walking and may therefore be a contributing factor to functional disability and falling in older people.

Findings from Menz and Lord (2001) provide further evidence that foot problems are a risk factor for falls and that this increased risk is mediated, in part, via impaired balance and reduced ability to perform functional tasks integral to daily living.

It was found that foot and ankle problems increase the risk of falls in older people - for patients (aged over 75 years) 13.0% that had foot problems also had suffered repeated falls over a 12 month period, and 27% had fallen at least once. Their analysis revealed that decreased toe plantarflexor strength and disabling foot pain were significantly and independently associated with falls after accounting for physiological falls risk factors and age (see also Menz et al, 2006).

This annual probability of complications from falls is estimated at 0.2% and has been calculated as the incidence of foot and ankle surgery for people aged 75 years and over in Australia (0.8%) * the annual probability of a fall for people with foot and ankle conditions (27.0%) from Menz and Lord, (2001). This annual probability is applied in the model to each of the 95 items identified and weighted by the waiting times for each procedure.

The scenario analysis in Section 6.5 looks at the cost effectiveness and cost benefit of podiatric surgery when these health complications from waiting for surgery are not included.

6.1.3.1.3 Post-surgery complications

In assessing the cost effectiveness and cost benefit of podiatry surgery, impacts on the quality and safety of service provision were also considered. It was found that a number of domestic and international clinical audits[23] had demonstrated that surgery performed by podiatric surgeons has the same quality of life and health outcomes (or better) as those performed by other surgeons. Some examples follow.

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[23] Clinical audit is not research but is a process that examines an aspect of care and compares it to best practice.20 Specifically, clinical audit is an important part of the process used to measure performance, reduce clinical risk and improve quality of care. Watters DK, Green AJ, Van Rij A. Guidelines for surgical audit in Australia and New Zealand. ANZ Journal of Surgery. 2006; 76: 78–83

- Bennett et al (2001) reported on a six-month prospective study that investigated the outcomes of foot surgery performed by Fellows of the ACPS, and found no significant adverse outcomes or unplanned re-admissions to the hospital.
- Kilmartin (2002) found podiatric surgery to be safe and effective and that the existence of podiatric surgery in a UK National Health Service Trust enhanced quality and range of care delivered by clinicians specifically trained in the conservative and surgical management of foot disorders.
- Butterworth et al (2008) concluded that podiatric surgery carried no greater risk of infection to the patient than other surgical disciplines, and results for Australia showed infection rates to be well within accepted industry standards as stated in recent literature.
- Gilheany and Robinson (2008) reported on comparative skill sets, finding that podiatric surgeons possess a skill set comparable to orthopaedic surgeons in the examined area of great toe joint surgery.

As surgery performed by podiatric surgeons was found in the literature to deliver the same quality of life and health outcomes (or better) as those performed by other surgeons, the cost of post-surgery complications was not modelled in this analysis.

6.2 INCREMENTAL COST EFFECTIVENESS AND BENCHMARKS

The CEA uses incremental cost effectiveness ratios (ICERs) to determine the cost effectiveness of podiatric surgery for each of the main categories relative to their comparator in terms of net dollars per DALY averted.

- If financial benefits outweigh financial costs, an intervention is described as **cost-saving**.
- If the intervention saves costs and averts more DALYs relative to its comparator, it is described as **dominating** (and its comparator is **dominated**).
- If an intervention is more expensive than its comparator but averts more DALYs, cost effectiveness benchmarks or other tools are needed to decide whether or not to pursue the intervention.
- If an intervention is less expensive but averts fewer DALYs, benchmarks or tools are also required, but change is often sticky in this direction.

CBA has an internal benchmark – the ‘breakeven point’ (ie, anything above this benchmark is a net benefit). CEA may use a variety of benchmarks to determine public financing thresholds (Access Economics, 2008) such as:

- gross domestic product (GDP) per capita ie, $52,347 in 2008 (ABS 2008c) – in line with the WHO guidelines that interventions with ICERs between one and three times GDP per DALY averted are cost effective and those less than GDP per capita per DALY averted are very cost effective;[24]
- $60,000 – in line with DoHA (2003); or
- the value of a statistical life year (VSLY) at its lower bound from Access Economics (2008) of $164,553 – in line with the literature.

[24] http://www.who.int/choice/costs/CER_levels/en/index.html Average GDP per capita for the Western Pacific region is shown as US$27,534 with three times that shown as US$82,602 in the year 2000.

The CEAs and CBAs are evaluated using Markov modelling to determine the differences in ICERs and breakeven points. In this case, the Markov models are simple decision trees based on two-arm analysis. That is, they compare the costs and benefits of podiatric surgery against those of orthopaedic surgery. Table 6-1 represents the total cost of surgery for both types of surgeons and includes all direct health costs and all indirect productivity costs associated with each arm. The incremental cost is calculated as total costs for podiatric surgery minus the total costs of orthopaedic surgery.

TABLE 6-1: INCREMENTAL COSTS CALCULATED, AUSTRALIA

Category		Total incremental costs		
No	Description	Orthopaedic	Podiatric	Incremental cost
1	Toenail	6,333	4,918	-1,415
2	Foot and ankle trauma	13,094	8,163	-4,932
3	Lesser toes	7,880	5,237	-2,643
4	Ankle	7,328	5,162	-2,166
5	First metatarsophalangeal joint	7,032	5,136	-1,896
6	Neuroma	7,524	6,096	-1,427
7	Amputations	45,515	34,080	-11,434
8	Clubfoot	7,387	6,126	-1,261
9	Heel	6,706	5,512	-1,194
10	Rear foot	12,121	5,198	-6,923
11	Lesser metatarsophalangeal joints	11,161	4,313	-6,848
12	Tarsal coalition and congenital vertical talus	12,690	5,715	-6,974
	Total weighted average	**17,717**	**14,082**	**-3,635**

Note: A negative incremental cost denotes a financial cost saving.

The results of the incremental cost calculations show that podiatric surgery is less costly than orthopaedic surgery across all categories – on average by $3,635 per procedure. The principal reasons for this include: shorter hospital stays thereby lower variable costs, and shorter waiting times for surgery, resulting in lower productivity and deadweight losses.

Table 6-2 represents the DALYs averted from using podiatric surgeons rather than the waits associated with exclusive use of orthopaedic surgeons. It highlights that podiatric surgery has less DALYs prior to surgery, principally because of shorter waiting times to surgery. The difference between the podiatric surgery and orthopaedic surgery are the DALYs averted by people with foot and ankle conditions waiting for surgery.

TABLE 6-2: DALYS AVERTED CALCULATED, AUSTRALIA

Category		Total DALYs		
No	Description	Orthopaedic	Podiatric	DALYs averted
1	Toenail	0.0190	0.0026	0.0165
2	Foot and ankle trauma	0.0406	0.0055	0.0351
3	Lesser toes	0.0285	0.0039	0.0246
4	Ankle	0.0251	0.0034	0.0217
5	First metatarsophalangeal joint	0.0232	0.0032	0.0201
6	Neuroma	0.0191	0.0026	0.0165
7	Amputations	0.0624	0.0085	0.0539
8	Clubfoot	0.0179	0.0024	0.0155
9	Heel	0.0179	0.0024	0.0155
10	Rear foot	0.0591	0.0080	0.0511
11	Lesser metatarsophalangeal joints	0.0591	0.0080	0.0511
12	Tarsal coalition and congenital vertical talus	0.0591	0.0080	0.0511
	Total weighted average	**0.0276**	**0.0038**	**0.0239**

Table 6-3 uses the results from Table 6-2 and converts these to dollar values using the methodology discussed in Section 5.2 (ie, the DALYs in Table 6-2 are multiplied by the VSLY of 266,843). The incremental gross value of disease burden averted is the difference between the two. The incremental individual costs (the difference between health and productivity costs for orthopaedic and podiatric surgery) are then subtracted to derive the net value of the disease burden.

TABLE 6-3: INCREMENTAL VALUE OF DISEASE BURDEN CALCULATED, AUSTRALIA

Category		Total value of BoD		
No	Description	Gross value of BoD	Incremental Individual costs	Net value of BoD
1	Toenail	4,390	485	3,905
2	Foot and ankle trauma	9,361	2,299	7,062
3	Lesser toes	6,567	1,225	5,342
4	Ankle	5,793	955	4,838
5	First metatarsophalangeal joint	5,352	801	4,551
6	Neuroma	4,415	493	3,922
7	Amputations	14,383	4,644	9,739
8	Clubfoot	4,137	397	3,740
9	Heel	4,137	385	3,752
10	Rear foot	13,624	3,677	9,947
11	Lesser metatarsophalangeal joints	13,624	3,664	9,960
12	Tarsal coalition and congenital vertical talus	13,624	3,686	9,938
	Total weighted average	**6,364**	**1,348**	**5,016**

The results shows that, in addition to the $3,635 per procedure saved in financial costs from podiatric surgery relative to orthopaedic surgery, there is also a relative gain in wellbeing worth $5,016 per procedure.

6.3 CEA

The calculations from Table 6-1 and Table 6-2 are combined to assess the ICER of podiatric surgery compared to orthopaedic surgery – ie, the CEA. Table 6-4 presents the results of the CEA as defined by the incremental costs and the DALYs averted. As negative incremental costs denotes a financial cost saving and as the DALYs averted are positive, the results of the CEA indicated that podiatric surgery dominates its comparator in terms of cost effectiveness.

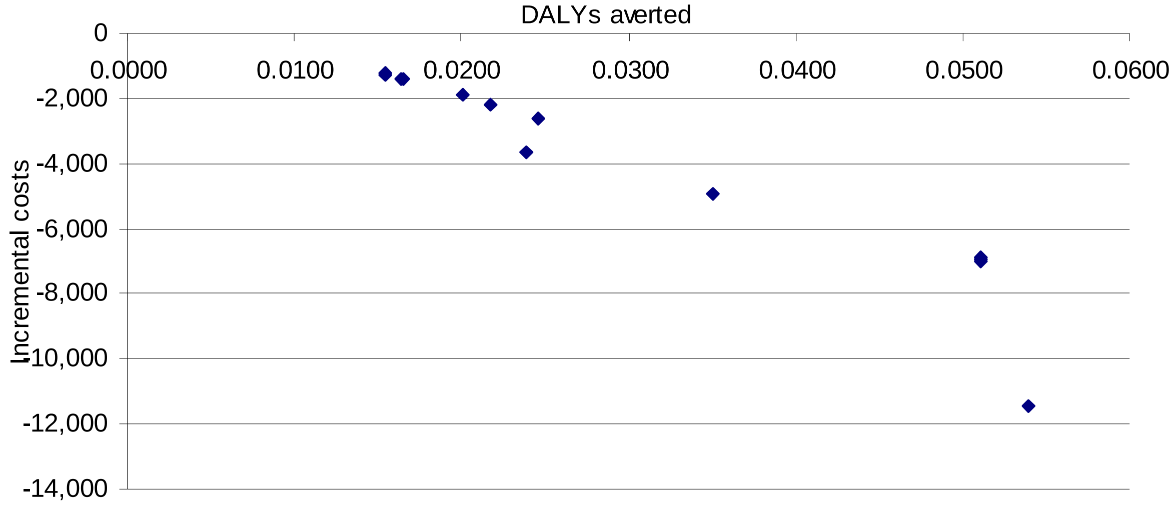
TABLE 6-4: CEA RESULTS: INCREMENTAL COST EFFECTIVENESS RATIOS

Category		Cost effectiveness		
No	Description	Incremental cost	DALYs averted	ICER
1	Toenail	-1,415	0.0165	dominates
2	Foot and ankle trauma	-4,932	0.0351	dominates
3	Lesser toes	-2,643	0.0246	dominates
4	Ankle	-2,166	0.0217	dominates
5	First metatarsophalangeal joint	-1,896	0.0201	dominates
6	Neuroma	-1,427	0.0165	dominates
7	Amputations	-11,434	0.0539	dominates
8	Clubfoot	-1,261	0.0155	dominates
9	Heel	-1,194	0.0155	dominates
10	Rear foot	-6,923	0.0511	dominates
11	Lesser metatarsophalangeal joints	-6,848	0.0511	dominates
12	Tarsal coalition and congenital vertical talus	-6,974	0.0511	dominates
	Total weighted average	**-3,635**	**0.0239**	**dominates**

Figure 6-1 presents the results from the CEA analysis based on the inputs described above. The scatterplot displays the incremental cost and effectiveness (DALYs averted) of using podiatric surgeons versus using orthopaedic surgeons for the 12 main categories of foot and ankle surgery.

- Orthopaedic surgery is the baseline in the calculations and so is represented by the origin – where the X and Y axes of the scatterplot intersect.
- The benchmark ICER is at the WTP or ICER threshold of $60,000/QALY. This benchmark is sometimes used as an (informal) indication that an intervention is cost effective.[25]
- All podiatric surgical procedures were found to save costs and avert more DALYs relative to the comparator and, as such, **dominate** orthopaedic surgery).

FIGURE 6-1: CEA RESULTS: INCREMENTAL COST EFFECTIVENESS



6.4 CBA

The calculations from Table 6-1 and Table 6-3 are used to calculate the costs and benefits of podiatric surgery compared to orthopaedic surgery. Table 6-5 presents the results of the CBA as defined by the benefits minus the costs. Essentially this is the results of Table 6-3 minus the results of Table 6-1, valuing the DALYs in dollar terms.

TABLE 6-5: CBA RESULTS, AUSTRALIA

Category		CBA		
No	Description	Incremental cost	Net value of BoD	Net benefit
1	Toenail	-1,415	3,905	5,320
2	Foot and ankle trauma	-4,932	7,062	11,993
3	Lesser toes	-2,643	5,342	7,985
4	Ankle	-2,166	4,838	7,004
5	First metatarsophalangeal joint	-1,896	4,551	6,447
6	Neuroma	-1,427	3,922	5,349
7	Amputations	-11,434	9,739	21,173
8	Clubfoot	-1,261	3,740	5,001
9	Heel	-1,194	3,752	4,946
10	Rear foot	-6,923	9,947	16,870
11	Lesser metatarsophalangeal joints	-6,848	9,960	16,808
12	Tarsal coalition and congenital vertical talus	-6,974	9,938	16,912
	Total weighted average	**-3,635**	**5,016**	**8,651**

[25] For example, drugs may be more likely to be listed on the Pharmaceutical Benefits Scheme if cost effectiveness studies indicate the drug can purchase a QALY at a price of $60,000 or less (DoHA 2003:11,12).

As all of the net benefits from Table 6-5 are positive, podiatric surgery is estimated to be superior to orthopaedic surgery – that is, it is benefits outweigh costs relative to those of orthopaedic surgeons.

6.5 SENSITIVITY ANALYSES

Three separate sensitivity analyses were undertaken to test the robustness of the findings in Sections 6.3 and 6.4. These sensitivity analyses included:

- lower podiatric surgeon fees:
  - The cost of service provided by podiatric surgeons has been reduced by 12% compared to the Medicare item fee and AMA listed fee. This parameter is based on analysis of US health insurance data of 94,457 individual transactions, which showed that podiatric surgeons charged 12% less per individual service than orthopaedic surgeons (Harris et al, 1997).
- longer waiting period for the initial consult and for surgery by a podiatric surgeon:
  - The findings by Butterworth et al (2008) indicate that podiatric surgeons are underutilised in Australia (see Section 6.1.2) – operating at around 21.2% of their capacity. This scenario analysis measures the impact of lengthening podiatric surgeon waiting times (both for the initial consultation and surgery) to 50% of the median waiting time for all surgery combined, that is, increasing the waiting time from 7 days to 16 days (32 days * 50%).
- excluding health complications from the calculations:
  - Two health complications are estimated in the modeling based on the risk of diabetic foot and falls. Both attach significant costs if they occur while a person with a foot and ankle condition is waiting for surgery. This scenario excludes these complications to compare just the costs and benefits of each foot and ankle condition on their own.

Table 6-6 and Table 6-7 present the results of the sensitivity analyses for the CEA and CBA.

TABLE 6-6: SENSITIVITY ANALYSES: CEA, AUSTRALIA, 2008

Category		CEA ($/DALY)							
		Base case		Scenario 1		Scenario 2		Scenario 3	
No	Description	Incr'l cost	ICER	Incr'l cost	ICER	Incr'l cost	ICER	Incr'l cost	ICER
1	Toenail	-1,415	dominates	-1,462	dominates	-779	dominates	-1,190	dominates
2	Foot and ankle trauma	-4,932	dominates	-5,048	dominates	-2,374	dominates	-4,706	dominates
3	Lesser toes	-2,643	dominates	-2,749	dominates	-685	dominates	-2,417	dominates
4	Ankle	-2,166	dominates	-2,331	dominates	-678	dominates	-1,940	dominates
5	First metatarsophalangeal joint	-1,896	dominates	-2,076	dominates	-675	dominates	-1,670	dominates
6	Neuroma	-1,427	dominates	-1,513	dominates	-776	dominates	-1,201	dominates
7	Amputations	-11,434	dominates	-11,486	dominates	-8,877	dominates	-11,209	dominates
8	Clubfoot	-1,261	dominates	-1,561	dominates	-778	dominates	-1,035	dominates
9	Heel	-1,194	dominates	-1,297	dominates	-711	dominates	-968	dominates
10	Rear foot	-6,923	dominates	-7,088	dominates	-4,366	dominates	-6,697	dominates
11	Lesser metatarsophalangeal joints	-6,848	dominates	-6,942	dominates	-4,291	dominates	-6,622	dominates
12	Tarsal coalition and congenital vertical ta	-6,974	dominates	-7,143	dominates	-4,417	dominates	-6,749	dominates
	Total weighted average	**-3,635**	**dominates**	**-3,753**	**dominates**	**-1,800**	**dominates**	**-3,409**	**dominates**

TABLE 6-7: SENSITIVITY ANALYSES: CBA, AUSTRALIA, 2008

Category		CBA (Net-Benefit)			
			Scenario 1	Scenario 2	Scenario 3
No	Description	Base case	Lower surgeon fees	Shorter wait time	No complications
1	Toenail	5,320	5,359	4,097	4,745
2	Foot and ankle trauma	11,993	12,089	8,888	11,427
3	Lesser toes	7,985	8,073	5,732	7,414
4	Ankle	7,004	7,140	5,117	6,431
5	First metatarsophalangeal joint	6,447	6,595	4,768	5,873
6	Neuroma	5,349	5,420	4,114	4,774
7	Amputations	21,173	21,216	16,996	20,615
8	Clubfoot	5,001	5,249	3,897	4,425
9	Heel	4,946	5,030	3,842	4,370
10	Rear foot	16,870	17,006	12,855	16,310
11	Lesser metatarsophalangeal joints	16,808	16,885	12,793	16,248
12	Tarsal coalition and congenital vertical talus	16,912	17,051	12,897	16,353
	Total weighted average	**8,651**	**8,749**	**6,494**	**8,079**

It is evident from the sensitivity analyses that the conclusions presented in Sections 6.3 and 6.4 remain robust. The sensitivity analyses do, however, highlight that shortening waiting times for surgery significantly improves the cost effectiveness and cost benefit of foot and ankle surgery.

6.6 ASSESSING INDIVIDUAL PROCEDURES

The modeling presented in this report provides a framework that can be used to design and assess the effectiveness of an intervention approach or of individual procedures.

- The sensitivity analyses above provide insight into which inputs can generate the greatest benefits.
  - For example, the framework has the capability to assess the impact on the health system of incremental changes in key parameters, such as a 10% change: in waiting times; in the average length of stay; or in surgeon fees.
- Additionally, each of the 95 different types of foot and ankle surgery can be analysed individually.
  - Three commonly performed procedures (MBS items 49833, 49866, and 44359) are presented in Table 6-8 as examples of the capability of assessing the cost effectiveness and net benefit of individual procedures.

TABLE 6-8: CEA AND CBA: SELECTED INDIVIDUAL EXAMPLES

Surgical procedure			Incremental	Net value	Net
Eg	MBS Item no.	Brief description	costs	of BoD	benefit
1	49833	Correction of hallux valgus by osteotomy of first metatarsal	-2,117	3,224	5,341
2	49866	Neurectomy for plantar or digital neuritis	-2,416	3,356	5,772
3	44359	Amputation of one or more toes of one foot	-15,271	7,713	22,983
	Total weighted average		**-3,635**	**5,016**	**8,651**

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APPENDIX A: FOOT AND ANKLE SURGICAL PROCEDURES (ITEMS 1-45)

Count	Category	MBS Item	MBS Desricption
1	1. Toenail	44136	INGROWN TOE NAIL, operation for, under general anaesthesia
2		47904	DIGITAL NAIL OF TOE, removal of, not being a service to which item 47906 applies
3		47906	DIGITAL NAIL OF TOE, removal of, in the operating theatre of a hospital
4		47912	PULP SPACE INFECTION, PARONYCHIA of FOOT, incision for, not being a service to which another item in this Group applies (excluding aftercare)
5		47915	INGROWING NAIL OF TOE, wedge resection for, including removal of segment of nail, ungual fold and portion of the nail bed
6		47916	INGROWING NAIL OF TOE, partial resection of nail, including phenolisation but not including excision of nail bed
7		47918	INGROWING TOENAIL, radical excision of nailbed
8	2. Foot and ankle trauma	47063	ANKLE or TARSUS, treatment of dislocation of, by closed reduction
9		47066	ANKLE or TARSUS, treatment of dislocation of, by open reduction
10		47069	TOE, treatment of dislocation of, by closed reduction
11		47072	TOE, treatment of dislocation of, by open reduction
12		47594	ANKLE JOINT, treatment of fracture of, not being a service to which item 47597 applies
13		47597	ANKLE JOINT, treatment of fracture of, by closed reduction
14		47600	ANKLE JOINT, treatment of fracture of, by internal fixation of 1 of malleolus, fibula or diastasis
15		47603	ANKLE JOINT, treatment of fracture of, by internal fixation of more than 1 of malleolus, fibula or diastasis
16		47606	CALCANEUM OR TALUS, treatment of fracture of, not being a service to which item 47609, 47612, 47615 or 47618 applies, with or without dislocation
17		47609	CALCANEUM OR TALUS, treatment of fracture of, by closed reduction, with or without dislocation
18		47612	CALCANEUM OR TALUS, treatment of intra-articular fracture of, by closed reduction, with or without dislocation
19		47615	CALCANEUM OR TALUS, treatment of fracture of, by open reduction, with or without dislocation
20		47618	CALCANEUM OR TALUS, treatment of intra-articular fracture of, by open reduction, with or without dislocation
21		47621	TARSO-METATARSAL, treatment of intra-articular fracture of, by closed reduction, with or without dislocation
22		47624	TARSO-METATARSAL, treatment of fracture of, by open reduction, with or without dislocation
23		47627	TARSUS (excluding calcaneum or talus), treatment of fracture of
24		47630	TARSUS (excluding calcaneum or talus), treatment of fracture of, by open reduction, with or without dislocation
25		47633	METATARSAL, 1 of, treatment of fracture of
26		47636	METATARSAL, 1 of, treatment of fracture of, by closed reduction
27		47639	METATARSAL, 1 of, treatment of fracture of, by open reduction
28		47642	METATARSALS, 2 of, treatment of fracture of
29		47645	METATARSALS, 2 of, treatment of fracture of, by closed reduction
30		47648	METATARSALS, 2 of, treatment of fracture of, by open reduction
31		47651	METATARSALS, 3 or more of, treatment of fracture of
32		47654	METATARSALS, 3 or more of, treatment of fracture of, by closed reduction
33		47657	METATARSALS, 3 or more of, treatment of fracture of, by open reduction
34		47663	PHALANX OF GREAT TOE, treatment of fracture of, by closed reduction
35		47666	PHALANX OF GREAT TOE, treatment of fracture of, by open reduction
36		47672	PHALANX OF TOE (other than great toe), 1 of, treatment of fracture of, by open reduction
37		47678	PHALANX OF TOE (other than great toe), more than 1 of, treatment of fracture of, by open reduction
38	3. Lesser toes	49800	FOOT, flexor or extensor tendon, primary repair of
39		49803	FOOT, flexor or extensor tendon, secondary repair of
40		49806	FOOT, subcutaneous tenotomy of, 1 or more tendons
41		49809	FOOT, open tenotomy of, with or without tenoplasty
42		49812	FOOT, tendon or ligament transplantation of, not being a service to which another item in this Group applies
43		49848	FOOT, correction of claw or hammer toe
44		49851	FOOT, correction of claw or hammer toe with internal fixation
45		50345	HYPEREXTENSION DEFORMITY OF TOE, release incorporating V-Y plasty of skin, lengthening of extensor tendons and release of capsule contracture

APPENDIX A (CONT.): FOOT AND ANKLE SURGICAL PROCEDURES (ITEMS 46-95)

Count	Category	MBS Item	MBS Desricption
46	4. Ankle	49700	ANKLE, diagnostic arthroscopy of, including biopsy
47		49703	ANKLE, arthroscopic surgery of
48		49706	ANKLE, arthrotomy of, involving 1 or more of: lavage, removal of loose body or division of contracture
49		49709	ANKLE, ligamentous stabilisation of
50		49712	ANKLE, arthrodesis of
51		49715	ANKLE, total joint replacement of
52		49718	ANKLE, Achilles' tendon or other major tendon, repair of
53		49721	ANKLE, Achilles' tendon rupture managed by non-operative treatment
54		49724	ANKLE, Achilles' tendon, secondary repair or reconstruction of
55		49727	ANKLE, Achilles' tendon, operation for lengthening
56		50312	ANKLE, synovectomy of
57	5. First metatarsophalangeal joint	49821	FOOT, correction of hallux valgus or hallux rigidus by excision arthroplasty (Keller's or similar procedure) - unilateral
58		49824	FOOT, correction of hallux valgus or hallux rigidus by excision arthroplasty (Keller's or similar procedure) - bilateral
59		49827	FOOT, correction of hallux valgus by transfer of adductor hallucis tendon - unilateral
60		49830	FOOT, correction of hallux valgus by transfer of adductor hallucis tendon - bilateral
61		49833	FOOT, correction of hallux valgus by osteotomy of first metatarsal including internal fixation where performed - unilateral
62		49836	FOOT, correction of hallux valgus by osteotomy of first metatarsal including internal fixation where performed - bilateral
63		49837	FOOT, correction of hallux valgus by osteotomy of first metatarsal and transfer of adductor hallicus tendon, including internal fixation where performed - unilateral
64		49838	FOOT, correction of hallux valgus by osteotomy of first metatarsal and transfer of adductor hallicus tendon, including internal fixation where performed - bilateral
65		49839	FOOT, correction of hallux rigidus or hallux valgus by prosthetic arthroplasty - unilateral
66		49842	FOOT, correction of hallux rigidus or hallux valgus by prosthetic arthroplasty - bilateral
67		49845	FOOT, arthrodesis of, first metatarso-phalangeal joint
68		49857	FOOT, metatarso-phalangeal joint replacement
69		49860	FOOT, synovectomy of metatarso-phalangeal joint, single joint
70		49863	FOOT, synovectomy of metatarso-phalangeal joint, 2 or more joints
71	6. Neuroma	49866	FOOT, neurectomy for plantar or digital neuritis (Morton's or Bett's syndrome)
72	7. Amputations	44338	1 DIGIT of foot, amputation of
73		44342	2 DIGITS of 1 foot, amputation of
74		44346	3 DIGITS of 1 foot, amputation of
75		44350	4 DIGITS of 1 foot, amputation of
76		44354	5 DIGITS of 1 foot, amputation of
77		44358	TOE, including metatarsal or part of metatarsal each toe , amputation of
78		44359	ONE OR MORE TOES OF ONE FOOT, amputation of, including if performed, excision of 1 or more metatarsal bones of the foot, performed for diabetic or other mic
79		44361	FOOT AT ANKLE (Syme, Pirogoff types), amputation of
80		44364	FOOT, MIDTARSAL OR TRANSMETATARSAL, amputation of
81	8. Clubfoot	50315	TALIPES EQUINOVARUS, posterior release of
82		50318	TALIPES EQUINOVARUS, medial release of
83		50321	TALIPES EQUINOVARUS, combined postero-medial release of
84		50324	TALIPES EQUINOVARUS, combined postero-medial release of, revision procedure
85		50327	TALIPES EQUINOVARUS, bilateral procedures
86		50339	FOOT AND ANKLE, tibialis anterior tendon (split or whole) transfer to lateral column
87		50342	FOOT AND ANKLE, tibialis or tibialis posterior tendon transfer, through the interosseous membrane to anterior or posterior aspect of foot
88	9. Heel	49818	FOOT, excision of calcaneal spur
89		49854	FOOT, radical plantar fasciotomy or fasciectomy of
90	10. Rear foot	49815	FOOT, triple arthrodesis of
91		50118	SUBTALAR JOINT, arthrodesis of
92	11. Lesser metatarsophalangeal joints	49860	FOOT, synovectomy of metatarso-phalangeal joint, single joint
93		49863	FOOT, synovectomy of metatarso-phalangeal joint, 2 or more joints
94	12. Tarsal coalition and congenital vertical talus	50333	TARSAL COALITION, excision of, with interposition of muscle, fat graft or similar graft
95		50336	TALUS, VERTICAL, CONGENITAL, combined anterior and posterior reconstruction

APPENDIX B: CONCORDANCE MAPPING (ITEMS 1-45)

Count	Category	MBS Item	ICD-10-AM		AR-DRG
1	1. Toenail	44136			J67A
2		47904			J67B
3		47906	4790600	4790601	J67A
4		47912			J11Z
5		47915	4791500		J67A
6		47916	4791600		J67B
7		47918	4791800		J67A
8	2. Foot and ankle trauma	47063	4706300		I74B
9		47066	4706601		I74A
10		47069	4706900		I74C
11		47072			I74C
12		47594	4759400		I74C
13		47597	4759700		I74B
14		47600	4760000	4760001	I74A
15		47603	4760300	4760301	I74A
16		47606			I20Z
17		47609			I20Z
18		47612			I20Z
19		47615	4761501	4761503	I20Z
20		47618			I20Z
21		47621			I74C
22		47624	4762401		I74A
23		47627			I74C
24		47630	4763001		I74A
25		47633	4763300		I20Z
26		47636	4763600	4763601	I20Z
27		47639	4763901		I20Z
28		47642			I20Z
29		47645			I20Z
30		47648			I20Z
31		47651			I20Z
32		47654			I20Z
33		47657			I20Z
34		47663	4766301		I20Z
35		47666	4766601		I20Z
36		47672	4767200	4767203	I20Z
37		47678			I20Z
38	3. Lesser toes	49800	4980000		I20Z
39		49803			I20Z
40		49806	4980600		I20Z
41		49809	4980900	4980901	I20Z
42		49812	4981200		I20Z
43		49848	4984800	4984801	I20Z
44		49851	4985100	4985101	I20Z
45		50345	5034500		I20Z

APPENDIX B (CONT.): CONCORDANCE MAPPING (ITEMS 46-95)

Count	Category	MBS Item	ICD-10-AM				AR-DRG
46	4. Ankle	49700	4970000				I20Z
47		49703	4970301	4970302	4970304	4970305	I20Z
48		49706	4970600				I75C
49		49709	4970900				I75B
50		49712	4971200	4970602			I20Z
51		49715	4971500				I20Z
52		49718	4971800	4971801			I20Z
53		49721					I20Z
54		49724	4972400	4972401			I20Z
55		49727	4972700				I20Z
56		50312	5031200				I20Z
57	5. First metatarsophalangeal joint	49821	4982100				I20Z
58		49824	4982400				I20Z
59		49827	4982700				I20Z
60		49830					I20Z
61		49833	4983300				I20Z
62		49836	4983600				I20Z
63		49837	4983700				I20Z
64		49838	4983800				I20Z
65		49839	4983900				I20Z
66		49842	0				I20Z
67		49845	4984500				I20Z
68		49857	4985700				I20Z
69		49860	4986000				I20Z
70		49863					I20Z
71	6. Neuroma	49866	4986600				B66B
72	7. Amputations	44338	4433800				F11A
73		44342					F11A
74		44346	4436400	4436401			F11A
75		44350					F11A
76		44354					F11A
77		44358	4435800				F11A
78		44359					F11A
79		44361					F11A
80		44364	4436400	4436401			F11A
81	8. Clubfoot	50315					I20Z
82		50318					I20Z
83		50321	5032100				I20Z
84		50324					I20Z
85		50327	5032700				I20Z
86		50339	5033900				I20Z
87		50342	5034200				I20Z
88	9. Heel	49818	4981800				I20Z
89		49854	4985400	4985401			I20Z
90	10. Rear foot	49815					I20Z
91		50118	5011800				I20Z
92	11. Lesser metatarsophalangeal joints	49860	4986000				I20Z
93		49863					I20Z
94	12. Tarsal coalition and congenital vertical talus	50333	5033300				I20Z
95		50336					I20Z

APPENDIX C: INDIVIDUAL CEA AND CBA (ITEMS 1-45)

Count	Category	MBS Item	MBS Desricption	Incremental costs	Net value of BoD	Net benefit
1	1. Toenail	44136	INGROWN TOE NAIL, operation for, under general anaesthesia	-2,360	3,349	5,708
2		47904	DIGITAL NAIL OF TOE, removal of, not being a service to which item 47906 applies	-2,474	3,329	5,803
3		47906	DIGITAL NAIL OF TOE, removal of, in the operating theatre of a hospital	-2,304	3,359	5,662
4		47912	PULP SPACE INFECTION, PARONYCHIA of FOOT, incision for, not being a service to which another item in this Group applies (excluding afte	**-2,301**	**3,359**	**5,660**
5		47915	INGROWING NAIL OF TOE, wedge resection for, including removal of segment of nail, ungual fold and portion of the nail bed	-2,351	3,350	5,701
6		47916	INGROWING NAIL OF TOE, partial resection of nail, including phenolisation but not including excision of nail bed	-2,470	3,330	5,800
7		47918	INGROWING TOENAIL, radical excision of nailbed	-2,345	3,351	5,696
8	2. Foot and ankle trauma	47063	ANKLE or TARSUS, treatment of dislocation of, by closed reduction	-2,667	3,714	6,381
9		47066	ANKLE or TARSUS, treatment of dislocation of, by open reduction	-5,365	5,085	10,449
10		47069	TOE, treatment of dislocation of, by closed reduction	-4,358	3,420	7,778
11		47072	TOE, treatment of dislocation of, by open reduction	-6,791	4,837	11,628
12		47594	ANKLE JOINT, treatment of fracture of, not being a service to which item 47597 applies	-10,966	7,373	18,339
13		47597	ANKLE JOINT, treatment of fracture of, by closed reduction	-9,224	7,676	16,899
14		47600	ANKLE JOINT, treatment of fracture of, by internal fixation of 1 of malleolus, fibula or diastasis	-9,688	7,595	17,283
15		47603	ANKLE JOINT, treatment of fracture of, by internal fixation of more than 1 of malleolus, fibula or diastasis	-9,634	7,604	17,239
16		47606	CALCANEUM OR TALUS, treatment of fracture of, not being a service to which item 47609, 47612, 47615 or 47618 applies, with or without disl	-2,924	3,794	6,718
17		47609	CALCANEUM OR TALUS, treatment of fracture of, by closed reduction, with or without dislocation	-2,924	3,794	6,718
18		47612	CALCANEUM OR TALUS, treatment of intra-articular fracture of, by closed reduction, with or without dislocation	-2,924	3,794	6,718
19		47615	CALCANEUM OR TALUS, treatment of fracture of, by open reduction, with or without dislocation	-3,133	3,758	6,891
20		47618	CALCANEUM OR TALUS, treatment of intra-articular fracture of, by open reduction, with or without dislocation	-2,924	3,794	6,718
21		47621	TARSO-METATARSAL, treatment of intra-articular fracture of, by closed reduction, with or without dislocation	-4,587	3,506	8,092
22		47624	TARSO-METATARSAL, treatment of fracture of, by open reduction, with or without dislocation	-3,077	3,768	6,845
23		47627	TARSUS (excluding calcaneum or talus), treatment of fracture of	-4,587	3,506	8,092
24		47630	TARSUS (excluding calcaneum or talus), treatment of fracture of, by open reduction, with or without dislocation	-3,184	3,749	6,933
25		47633	METATARSAL, 1 of, treatment of fracture of	-2,927	3,794	6,721
26		47636	METATARSAL, 1 of, treatment of fracture of, by closed reduction	-3,013	3,779	6,792
27		47639	METATARSAL, 1 of, treatment of fracture of, by open reduction	-3,096	3,765	6,860
28		47642	METATARSALS, 2 of, treatment of fracture of	-2,924	3,794	6,718
29		47645	METATARSALS, 2 of, treatment of fracture of, by closed reduction	-2,924	3,794	6,718
30		47648	METATARSALS, 2 of, treatment of fracture of, by open reduction	-2,924	3,794	6,718
31		47651	METATARSALS, 3 or more of, treatment of fracture of	-2,924	3,794	6,718
32		47654	METATARSALS, 3 or more of, treatment of fracture of, by closed reduction	-2,924	3,794	6,718
33		47657	METATARSALS, 3 or more of, treatment of fracture of, by open reduction	-2,924	3,794	6,718
34		47663	PHALANX OF GREAT TOE, treatment of fracture of, by closed reduction	-2,943	3,791	6,734
35		47666	PHALANX OF GREAT TOE, treatment of fracture of, by open reduction	-3,064	3,770	6,834
36		47672	PHALANX OF TOE (other than great toe), 1 of, treatment of fracture of, by open reduction	-3,054	3,772	6,826
37		47678	PHALANX OF TOE (other than great toe), more than 1 of, treatment of fracture of, by open reduction	-2,924	3,794	6,718
38	3. Lesser toes	49800	FOOT, flexor or extensor tendon, primary repair of	-5,313	5,094	10,407
39		49803	FOOT, flexor or extensor tendon, secondary repair of	-5,128	5,126	10,254
40		49806	FOOT, subcutaneous tenotomy of, 1 or more tendons	-5,213	5,111	10,324
41		49809	FOOT, open tenotomy of, with or without tenoplasty	-5,185	5,116	10,301
42		49812	FOOT, tendon or ligament transplantation of, not being a service to which another item in this Group applies	-5,162	5,120	10,282
43		49848	FOOT, correction of claw or hammer toe	-2,867	3,679	6,546
44		49851	FOOT, correction of claw or hammer toe with internal fixation	-2,840	3,684	6,523
45		50345	HYPEREXTENSION DEFORMITY OF TOE, release incorporating V-Y plasty of skin, lengthening of extensor tendons and release of capsule cc	-2,935	3,667	6,602

APPENDIX C (CONT.): INDIVIDUAL CEA AND CBA (ITEMS 46-95)

Count	Category	MBS Item	MBS Desricption	Incremental costs	Net value of BoD	Net benefit
46	4. Ankle	49700	ANKLE, diagnostic arthroscopy of, including biopsy	-2,189	3,211	5,400
47		49703	ANKLE, arthroscopic surgery of	-2,043	3,237	5,280
48		49706	ANKLE, arthrotomy of, involving 1 or more of: lavage, removal of loose body or division of contracture	-1,836	3,273	5,109
49		49709	ANKLE, ligamentous stabilisation of	-2,106	3,226	5,332
50		49712	ANKLE, arthrodesis of	-10,201	8,091	18,292
51		49715	ANKLE, total joint replacement of	-12,468	16,862	29,330
52		49718	ANKLE, Achilles' tendon or other major tendon, repair of	-2,133	3,221	5,354
53		49721	ANKLE, Achilles' tendon rupture managed by non-operative treatment	-2,010	3,242	5,252
54		49724	ANKLE, Achilles' tendon, secondary repair or reconstruction of	-2,010	3,242	5,252
55		49727	ANKLE, Achilles' tendon, operation for lengthening	-2,126	3,222	5,348
56		50312	ANKLE, synovectomy of	-12,468	52,913	65,381
57	5. First metatarsophalangeal joint	49821	FOOT, correction of hallux valgus or hallux rigidus by excision arthroplasty (Keller's or similar procedure) - unilateral	-2,105	3,226	5,331
58		49824	FOOT, correction of hallux valgus or hallux rigidus by excision arthroplasty (Keller's or similar procedure) - bilateral	-2,010	3,242	5,252
59		49827	FOOT, correction of hallux valgus by transfer of adductor hallucis tendon - unilateral	-2,010	3,242	5,252
60		49830	FOOT, correction of hallux valgus by transfer of adductor hallucis tendon - bilateral	-2,010	3,242	5,252
61		49833	FOOT, correction of hallux valgus by osteotomy of first metatarsal including internal fixation where performed - unilateral	-2,117	3,224	5,341
62		49836	FOOT, correction of hallux valgus by osteotomy of first metatarsal including internal fixation where performed - bilateral	-2,106	3,226	5,331
63		49837	FOOT, correction of hallux valgus by osteotomy of first metatarsal and transfer of adductor hallicus tendon, including internal fixation where perf	-2,030	3,239	5,269
64		49838	FOOT, correction of hallux valgus by osteotomy of first metatarsal and transfer of adductor hallicus tendon, including internal fixation where perf	-2,010	3,242	5,252
65		49839	FOOT, correction of hallux rigidus or hallux valgus by prosthetic arthroplasty - unilateral	-2,010	3,242	5,252
66		49842	FOOT, correction of hallux rigidus or hallux valgus by prosthetic arthroplasty - bilateral	-2,010	3,242	5,252
67		49845	FOOT, arthrodesis of, first metatarso-phalangeal joint	-2,092	3,228	5,320
68		49857	FOOT, metatarso-phalangeal joint replacement	-2,144	3,219	5,363
69		49860	FOOT, synovectomy of metatarso-phalangeal joint, single joint	-12,468	16,862	29,330
70		49863	FOOT, synovectomy of metatarso-phalangeal joint, 2 or more joints	-12,468	16,862	29,330
71	6. Neuroma	49866	FOOT, neurectomy for plantar or digital neuritis (Morton's or Bett's syndrome)	-2,416	3,356	5,772
72	7. Amputations	44338	1 DIGIT of foot, amputation of	-14,823	7,790	22,613
73		44342	2 DIGITS of 1 foot, amputation of	-15,271	7,713	22,983
74		44346	3 DIGITS of 1 foot, amputation of	-14,745	7,804	22,549
75		44350	4 DIGITS of 1 foot, amputation of	-15,271	7,713	22,983
76		44354	5 DIGITS of 1 foot, amputation of	-15,271	7,713	22,983
77		44358	TOE, including metatarsal or part of metatarsal each toe , amputation of	-14,794	7,795	22,590
78		44359	ONE OR MORE TOES OF ONE FOOT, amputation of, including if performed, excision of 1 or more metatarsal bones of the foot, performed for	-15,271	7,713	22,983
79		44361	FOOT AT ANKLE (Syme, Pirogoff types), amputation of	-15,271	7,713	22,983
80		44364	FOOT, MIDTARSAL OR TRANSMETATARSAL, amputation of	-14,799	7,794	22,594
81	8. Clubfoot	50315	TALIPES EQUINOVARUS, posterior release of	-2,010	3,242	5,252
82		50318	TALIPES EQUINOVARUS, medial release of	-2,010	3,242	5,252
83		50321	TALIPES EQUINOVARUS, combined postero-medial release of	-2,206	3,208	5,414
84		50324	TALIPES EQUINOVARUS, combined postero-medial release of, revision procedure	-2,010	3,242	5,252
85		50327	TALIPES EQUINOVARUS, bilateral procedures	-2,199	3,209	5,409
86		50339	FOOT AND ANKLE, tibialis anterior tendon (split or whole) transfer to lateral column	-2,187	3,212	5,399
87		50342	FOOT AND ANKLE, tibialis or tibialis posterior tendon transfer, through the interosseous membrane to anterior or posterior aspect of foot	-2,182	3,212	5,394
88	9. Heel	49818	FOOT, excision of calcaneal spur	-2,145	3,219	5,364
89		49854	FOOT, radical plantar fasciotomy or fasciectomy of	-2,107	3,225	5,333
90	10. Rear foot	49815	FOOT, triple arthrodesis of	-10,073	8,113	18,187
91		50118	SUBTALAR JOINT, arthrodesis of	-10,178	8,095	18,273
92	11. Lesser metatarsophalangeal joints	49860	FOOT, synovectomy of metatarso-phalangeal joint, single joint	-10,073	8,113	18,187
93		49863	FOOT, synovectomy of metatarso-phalangeal joint, 2 or more joints	-10,073	8,113	18,187
94	12. Tarsal coalition and congenital vertical talus	50333	TARSAL COALITION, excision of, with interposition of muscle, fat graft or similar graft	-10,201	8,091	18,292
95		50336	TALUS, VERTICAL, CONGENITAL, combined anterior and posterior reconstruction	-10,073	8,113	18,187