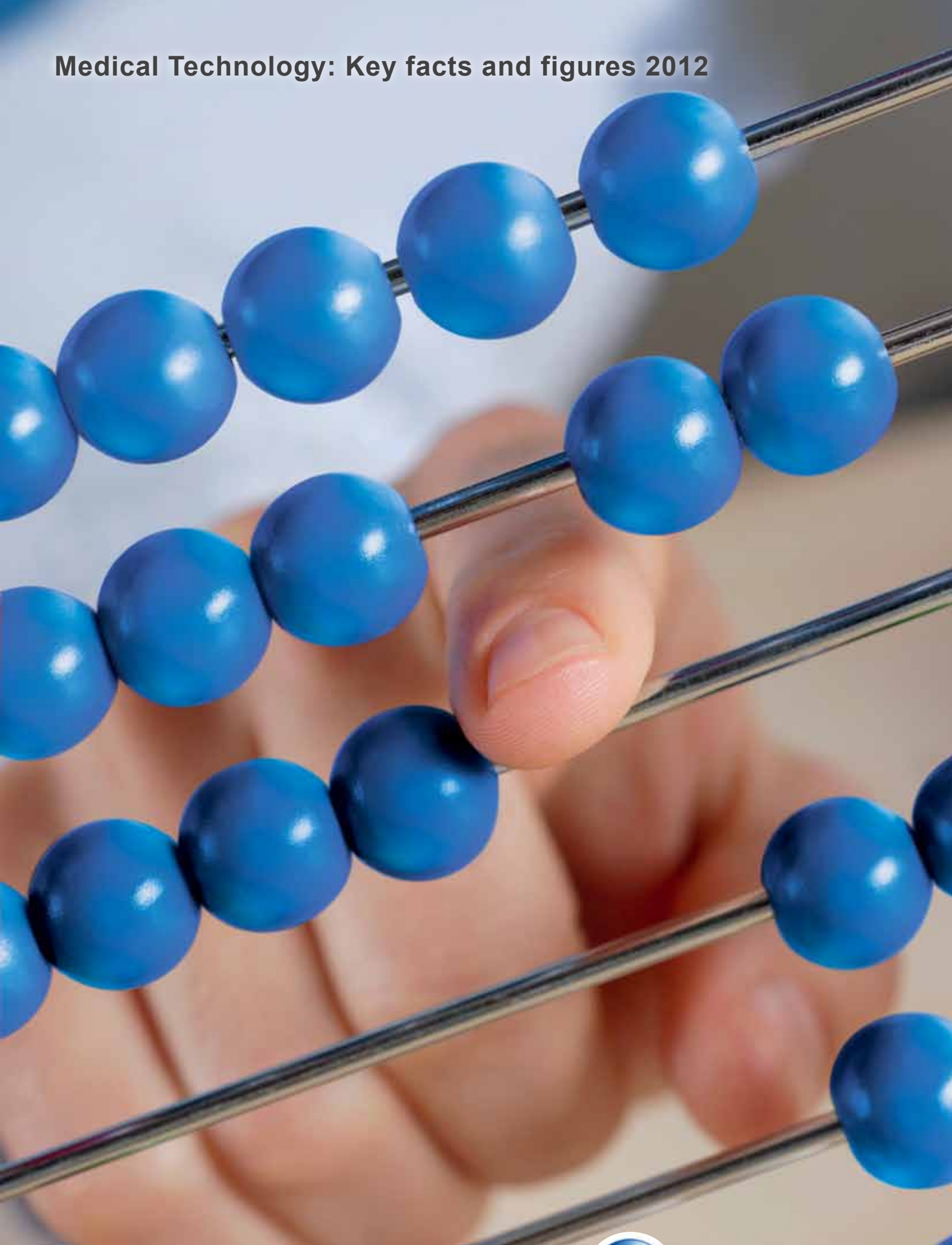
Medical Technology: Key facts and figures 2012



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Medical Technology
ASSOCIATION OF AUSTRALIA

Acknowledgements

MTAA acknowledges its members for contribution of data to this booklet. The information within this booklet has been obtained from a variety of sources. These include MTAA members, the Australian Bureau of Statistics (ABS), Australian Institute of Health and Welfare (AIHW), Therapeutic Goods Administration (TGA), Australian New Zealand Clinical Trials Registry (ANZCTR), Medicare Benefits Schedule (MBS), The National Joint Replacement Registry (NJRR), Access Economics and state and territory government websites. In some cases where direct data are not available extrapolations have been made (and noted where this is the case).

Suggested Citation

Medical technology in Australia: Key facts and figures 2012, Occasional Paper Series: Sydney. Medical Technology Association of Australia Limited (2012).

International Standard Serial Number (ISSN)

ISSN 2200-5668 (Print)

Contact Details

E: reception@mtaa.org.au

All correspondence: Medical Technology Association of Australia

PO Box 2016, North Sydney NSW 2059, Australia.

Disclaimer

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Contents

Introduction from the CEO

It is with great pleasure that I introduce the second edition of the Key facts and figures 2012 booklet. The "factbook" – as it is known in short – contains a snapshot of the medical technology industry in Australia and provides a definitive source of statistical data and facts about the industry.

The first edition in 2011 was very well received and much sought after. Over the last year we have seen the factbook quoted in a variety of publications and websites. It provided a baseline to better define the industry and to build on to identify trends over time and for industry sectors.

In 2011 we identified gaps in available data and commissioned research to close some of those knowledge gaps. That research has been incorporated into this factbook.

The Australian medical technology industry has revenue of over $10 billion (not counting IVD and dental products). This shows that the industry is experiencing growth, if somewhat slower when compared to a few years ago. The annual growth for 2010-11 has been estimated at 4%. This is comparable to global figures of 3% growth in employment, 5% growth in revenue and 4% growth in R&D, which is the best test of future growth of the industry.

The medical technology industry supplies products and innovative devices for a growing and ageing population while at the same time seeking growth in the face of global financial uncertainty and tighter health budgets.

Creating an environment which fosters a sustainable Australian industry has been one of our policy priorities. Building on the strength of the Australian hospital and university systems, using the proximity to Asian growth markets and leveraging access to a highly skilled labour force and research capabilities, the industry can contribute to retention of advanced manufacturing capabilities in Australia. The development of a strong Australian industry will act as a drawcard for international companies and improve access to funding.

The innovative devices of the Australian and global medical technology companies will continue to save and improve lives of Australian in the future.

I trust that you find this factbook an informative resource on the medical technology industry in Australia.

Anne Trimmer
Chief Executive Officer
Medical Technology Association of Australia

About MTAA

The Medical Technology Association of Australia (MTAA) is the national association representing companies in the medical technology industry. MTAA aims to ensure the benefits of modern, innovative and reliable medical technology are delivered effectively to provide better health outcomes to the Australian community.

MTAA represents manufacturers and suppliers of medical technology used in the diagnosis, prevention, treatment and management of disease and disability. The range of medical technology is diverse with products ranging from consumable items such as syringes and wound dressings, through to high-technology implanted devices such as cardiac pacemakers, defibrillators, hip and other orthopaedic devices. Products also include hospital equipment, surgical equipment and diagnostic imaging equipment such as ultrasounds and magnetic resonance imaging machines.

MTAA members distribute the majority of the non-pharmaceutical products used in the diagnosis and treatment of disease and disability in Australia. Our member companies also play a vital role in providing healthcare professionals with essential education and training to ensure safe and effective use of medical technology.

What is a medical device[1]

2.1 Definition

A 'medical device' is any instrument, apparatus, implement, machine, appliance, implant, in-vitro reagent or calibrator, software, material or other similar or related material:

A. intended by the manufacturer to be used, alone or in combination, for human beings for one or more of the specific purpose(s) of:

- diagnosis, prevention, monitoring, treatment or alleviation of disease,
- diagnosis, monitoring, treatment, alleviation of or compensation for an injury,
- investigation, replacement, modification, or support, of the anatomy or of a physiological process,
- support or sustaining life,
- control of conception,
- disinfection of medical devices,
- providing information for medical or diagnostic purposes by means of in-vitro examination of specimens derived from the human body;

and

B. which does not achieve its primary intended action in or on the human body by pharmaceutical, immunological or metabolic means, but which may be assisted in its intended function by such means.

2.2 Attributes of medical devices

There are 10,000 major categories of medical devices and diagnostics worldwide[2]. The following list, endorsed by the Global Medical Technology Alliance (GMTA), highlights the key attributes of medical devices[3]:

- **Diversity**
  Medical devices vary in size, complexity, packaging, and use.
- **Innovation**
  Innovation of medical devices results primarily from clinicians' insights, rather than laboratory exploration. Medical devices undergo incremental improvements, with a relatively short commercial life-cycle of about 18 months on average.
- **Durability**
  Medical devices have a wide range of durability with extremes ranging from a few minutes for disposable devices, to several decades for some implantable devices and medical equipment.
- **Mode of action**
  Medical devices, as such, do not achieve their principal intended action in or on the human body by pharmacological, immunological, or metabolic means, although some (e.g. syringes) may be used to deliver medicines. Medical devices produce mainly local and physical effects on the body rather than systemic and pharmacological effects.
- **Regulation**
  The extent of regulatory scrutiny of medical devices is based on the risk class attached to their use. Assessment of safety and efficacy for low-risk classes of medical devices can be performed by the manufacturer. For high-risk classes of medical devices, bibliographic evidence may be submitted to the competent authorities to prove safety and efficacy. Efficacy or effectiveness of medical devices is proven before they are put on the market. However, clinical effectiveness (i.e. when a device produces the effect intended by the manufacturer relative to the medical conditions) is more difficult to prove.
- **Supply**
  About 80% of the medical device industry is made up of small and medium enterprises. Distribution of heavy medical equipment is usually costly. There is no well-defined supply chain or profession (such as pharmacists for pharmaceuticals) involved in the supply of medical devices.
- **Usage**
  The performance of a device depends not only on the device itself but also on how it is used. The user interface of a medical device is usually not direct (device–patient) except for assistive devices, but in many cases involves an intermediary (device–operator–patient). There is often a learning curve associated with the use of medical devices, particularly for complex high-tech devices, with a need for technical training and support. Medical devices may require service and maintenance. Many medical devices are used for diagnostic purposes. Many medical devices are used to alleviate functional disabilities (most commonly referred to as assistive products).

1 This definition is taken from the Global Harmonisation Taskforce website available at www.ghtf.org/
2 GMTA. *Comments on the report of the World Health Organization, "Medical devices managing the mismatch"*. www.globalmedicaltechnologyalliance.org/category/positionpapers
3 Adapted from WHO. Medical devices: managing the mismatch: an outcome of the priority medical devices project. 2010.

2.3 Comparing medical devices and pharmaceuticals

Medical Devices	Drugs
Industry Composition	
Over 80% small and medium-sized companies	Very large multinationals dominate
Active Components	
Generally based on mechanical, electrical, and materials engineering	Based on pharmacology and chemistry; now encompassing biotechnology, genetic engineering, etc Pharmacologic properties and action of active ingredients are known, based on pre-clinical and clinical studies Standardized batch sizes, manufacturing processes and starting materials Products stable Generally stored at room temperature Generally long shelf lives
Product Development	
Wide variety of products and applications – from thermometers and bandages to pacemakers to x-rays	Products are usually in the form of pills, solutions, aerosols, or ointments
Designed to perform specific functions and approved on the basis of safety and performance	Product development by discovery, trial, and approved on basis of safety and efficacy
Many products developed by doctors or nurses	Products developed in laboratories by chemists and pharmacologists
How Products Work	
Most act through physical interaction with the body or body part	Products are administered by mouth, skin, eyes, inhalation, or injection and are biologically active; effective when absorbed into the human body. Often act systemically on the entire body
Intellectual Property Concerns	
Continuous innovation and iterative improvements based on new science, new technology, and new materials	Extensive research and development of a specific compound or molecule; takes several years for a new drug to enter the product pipeline
Short product life cycle and investment recovery period (typically 18 months on market).	Intensive patent protection, including data exclusivity and patent linkage, needed due to extensive product life cycle and long investment recovery period
Little patent linkage possible. Data exclusivity is important.	Usually large step innovation
Majority of new products bring added functions and clinical value based on incremental improvements	
Support Provided	
Large investment in manufacturing, distribution, and training/education; plus need to provide service and maintenance (for many high tech devices)	Low manufacturing and distribution cost, and, in most cases, no training, service or maintenance costs

3. Funding for Medical Technology in Australia

3.1 Consumable medical technology

Medical technology can be divided into consumables and implanted devices (see section 5.5). Medical consumables are provided to patients in the community through a variety of stand alone Commonwealth, state and territory schemes. A plurality of schemes tends to result in ad-hoc and inequitable allocation to consumers and act as a barrier to economies of scale for suppliers. Federal and state/territory schemes are listed below.

Federal schemes	
Repatriation Pharmaceutical Benefits Scheme (RPBS)	Administered by the Department of Veterans' Affairs (DVA). Provides access to certain medications and dressings for treatment of entitled veterans and war widows. The range of items is more comprehensive than is available through the PBS and includes assistive devices
Rehabilitation Appliances Program (RAP)	Administered by the DVA. Provides aids and appliances to eligible members of the veteran community to help them maintain their independence. A range of appliances are provided through six product groups (continence, mobility function and support, oxygen, diabetes, personal response systems, Continuous Positive Airway Pressure (CPAP))
National Diabetes Services Scheme (NDSS)	Administered by Diabetes Australia and delivers diabetes-related products at subsidised prices, information and support services to over a million people with diabetes each year
Stoma Appliance Scheme (SAS)	Provides stoma related products (medicines and appliances) to individuals who have undergone either a temporary or permanent surgically created body opening (stoma). Approximately 38,500 people receive products under the scheme
Continence Aids Payments Scheme (CAPS)	Assists individuals with permanent and severe incontinence to meet some of the costs of continence products
Epidermolysis Bullosa Dressing Scheme	The only Federal scheme for modern wound care devices assists patients with Epidermolysis Bullosa. In 2011-12, 166 people received subsidised dressings
Australian Hearing	Australian Hearing is one of the largest hearing service providers in the world providing hearing device products and services and research by the National Acoustic Laboratories

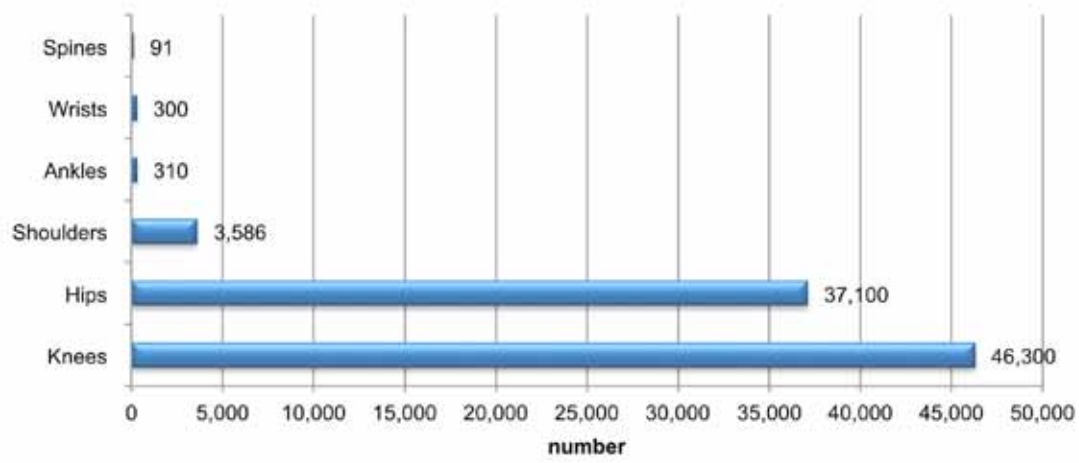
State/Territory schemes	
ACT	ACT Equipment Scheme
	Domiciliary Oxygen Scheme
	Continuous Positive Airway/Variable Positive Airway Pressure (CPAP/VPAP) Scheme
	ACT Spectacles Subsidy Scheme
	Breast Prosthesis Scheme
NSW	EnableNSW
	Aids for People in DAHDC Accommodation Services
NT	Territory Independence Mobility Equipment Scheme (TIME)
QLD	Medical Aids Subsidy Scheme (MASS)
SA	Independent Living Equipment Programme (ILEP)
	Disability SA Equipment Program
TAS	State wide Community Equipment Scheme
	State wide Continence Aids Scheme
	Spectacles and Intra-Ocular Assistance Scheme
	Home Oxygen Scheme
	Spinal Account
VIC	Victorian Aids and Equipment Scheme (A&EP)
WA	Community Aids and Equipment Program (CAEP)

3.2. Implantable devices

The Australian Population: As the field of medicine becomes increasingly technologised the frequency of device implantation is increasing. Between 2000-10 more than 10% of the population had a device implanted and the rate of implantation for almost all medical devices is increasing[4]. It is likely that the actual number of people in the Australian population with an implantable device is much higher as the 10% figure does not include implantation of pins, screws and plates due to fractures and Australian statistics do not take into account medical tourism or the growing numbers of procedures taking place in private clinics outside the hospital system.

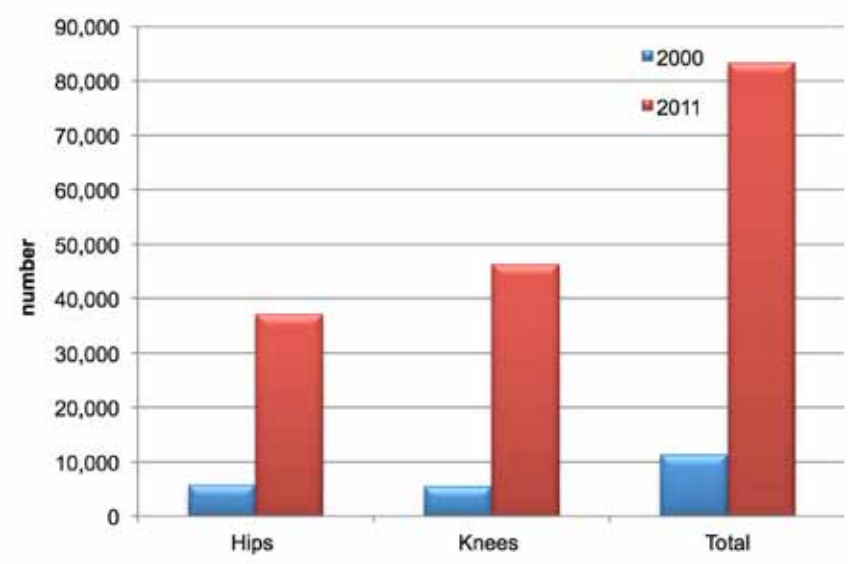
Joint replacement procedures: The National Joint Replacement Registry[5] (NJRR) records joint replacement procedures and revision rates in all public and private hospitals. The NJRR reported 87,687 joint replacements in 2011 (Figure 1). The majority were for knees (52.8%) and hips (42.3%). Since 2000, the number of knee and hip replacements has increased by 740% and 540% respectively (Figure 2).

Figure 1: Number of joint replacement procedures reported on the NJRR 2011[6]



Source: NJRR[7] 2012

Figure 2: Comparison of replacement surgeries reported on the NJRR 2000 and 2011



Source: NJRR 2012[8]

4 MTAA. *The number of people in the Australian population with an implantable device*. 2012.
This report draws from a variety of sources including the NJJR, the AIHW, Hospitals Data Cubes, industry reports and published research results.
5 National Joint Replacement Registry. Available at www.dmac.adelaide.edu.au/aoanjrr
6 National Joint Replacement Registry. Available at www.dmac.adelaide.edu.au/aoanjrr
7 Graphs based on data sourced from National Joint Replacement Registry. Available at www.dmac.adelaide.edu.au/aoanjrr
8 Graphs based on data sourced from National Joint Replacement Registry. Available at www.dmac.adelaide.edu.au/aoanjrr

4. General health trends in Australia

The average life expectancy in Australia is 79 years for males and 84 years for females. Around one in seven persons is aged 65 years or over[9]. Life expectancy is more than ten years lower for Aboriginal and Torres Strait Islander people compared to non-Indigenous Australians[10].

Coronary heart disease was the leading causes of death for both males and females in 2009, followed by lung cancer for males and stroke for females[11].

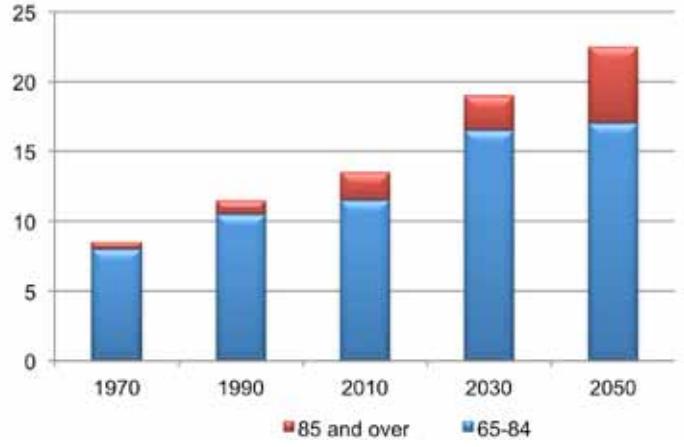
Australia has 1340 hospitals, 56% public and 44% private[12]. In 2010–11 there were 8.9 million separations (of episodes of care) for admitted patients—5.3 million in public hospitals and 3.6 million in private hospitals. This was an increase of 3.2% on average each year between 2006–07 and 2010–11 for public hospitals, and 5.0% for private hospitals. In 2010–11 there were 2.2 million admissions that involved a surgical procedure. Of these, about 280,000 were emergency admissions. About two-thirds of elective admissions involving surgery occurred in private hospitals. In contrast, about 87% of emergency admissions involving surgery were in public hospitals. Indigenous Australians had about twice the rate of emergency admissions involving surgery compared with other Australians. As at 31 March 2012 over half of all Australians (53%) were covered by general treatment private health insurance[13].

5. Healthcare expenditure in Australia

Australia ranks as the 12th largest healthcare market in the world[14] and sits toward the lower middle of the World Health Organization (WHO) statistics on health expenditure (see figure 4)[15]. Health expenditure in Australia in 2009-10 was $121 billion[16]. As a percentage of GDP this represents 9.4%, an increase of 0.4% compared to 2008-09[17]. The trend toward higher relative healthcare costs continued in 2010-11[18].

Population ageing will continue to drive up the healthcare spend. By 2050 the number of people aged 65–84 will double, the number aged 85 years and over will quadruple[19] and spending on aged care will increase two fold[20]. In 2010-11 Australia's public hospitals employed about 263,000 full-time equivalent workers and private hospitals employed over 59,000[21], in total about 1.5% of the population. As the demography ratio changes there will be less people of working age to provide elder care and hospital services.

Figure 3: Proportion of the population aged 65 and over



Source: Treasury 2010[22]

9 AIHW. *Australia's welfare 2011*. Australia's welfare no. 10. Cat. no. AUS 142. Canberra: AIHW. 2011
10 AIHW. *Life expectancy and mortality of Aboriginal and Torres Strait Islander people*. Media Release. Canberra, AIHW. 2011, May. *AIHW Australia's health 2012: in brief. Cat. no. AUS 157. Canberra: AIHW. 2012.*
AIHW. Australia's health 2012: The thirteenth biennial health report of the Australian Institute of Health and Welfare.
11 AIHW. *Australia's health 2012. Australia's health series no.13.* Cat. no. AUS 156. Canberra: AIHW. 2012
12 AIHW. *Australia's hospitals 2010–11, at a glance*. Health services series no. 44. Cat. no. HSE 118. Canberra: AIHW. 2012
13 PHIAC. Membership and coverage. 2012.
14 ESPICOM. The medical device market: Australia: Opportunities and challenges. 2011.
15 WHO. World Health Statistics. 2012.
16 AIHW. *Health expenditure Australia 2009-10*. Health and welfare expenditure series no. 46. Cat. no. HWE 55. Canberra: AIHW. 2011, October. DoHA. *Australian health and aging system*. Concise Expenditure Factbook. March 2012.
17 Ibid.
18 Health Workforce Australia. *National Health Workforce Innovation and Reform Strategic Framework for Action 2011–2015.* 2011.
19 National Health and Hospitals Reform Commission. *A healthier future for all Australians – final report.* Canberra, DoHA. 2009.
20 Australian Government. Australia to 2050: Future challenges. *The 2nd Intergenerational Report.* 2010.
21 ABS. *Private hospitals Australia 2009–10*. ABS cat. no. 4390.0.Canberra: ABS. 2011.
22 See ministers.treasury.gov.au/DisplayDocs.aspx?doc=speeches/2010/001.htm&pageID=005&min=wms&Year=&DocType

6. The future of the healthcare system

At the same time as demographic change is pushing up the cost of healthcare the current convergence of health and technology enables the opportunity for savings across the health sector. Genomics, big data diagnostics, personalised medicine and individual monitoring systems mean that health consumers have access to more information about their health than ever before. Healthcare is moving away from a sickness model and face-to-face interaction toward a wellness model, remote monitoring, and disease prevention. In the United Kingdom (UK) a two year, £31 million, randomised control study of the effects of telehealth involving COPD[23], heart failure, and diabetes reported major improvements to health outcomes. Results showed a 15% reduction in Accident and Emergency (A&E) attendance, a 20% decrease in emergency admissions, a 14% reduction in elective admissions and bed days, and a 45% reduction in mortality[24]. These results demonstrate that technology can be used to decrease the number of potentially preventable hospitalisations[25].

As populations age in developed countries and developing nations become increasingly affluent world expenditure on health care is increasing. This is likely to lead to major changes in the way health care is delivered. In the US the *Patient Protection & Affordable Care Act* 2010 and in the UK the *Health and Social Care Act* 2012 will result in extensive structural change. Futurist David Houle predicts that by 2020 one third of hospitals in the US will be closed[26].

7. Increasing healthcare demand

In the future the Australian healthcare system will come under pressure from the increasing healthcare needs of an aging population. Functional health decreases gradually over the lifespan. One of the biggest conditions associated with advanced economies is obesity, which limits life expectancy and increases the risk of chronic diseases that can dramatically increase both mortality and morbidity in remaining years.

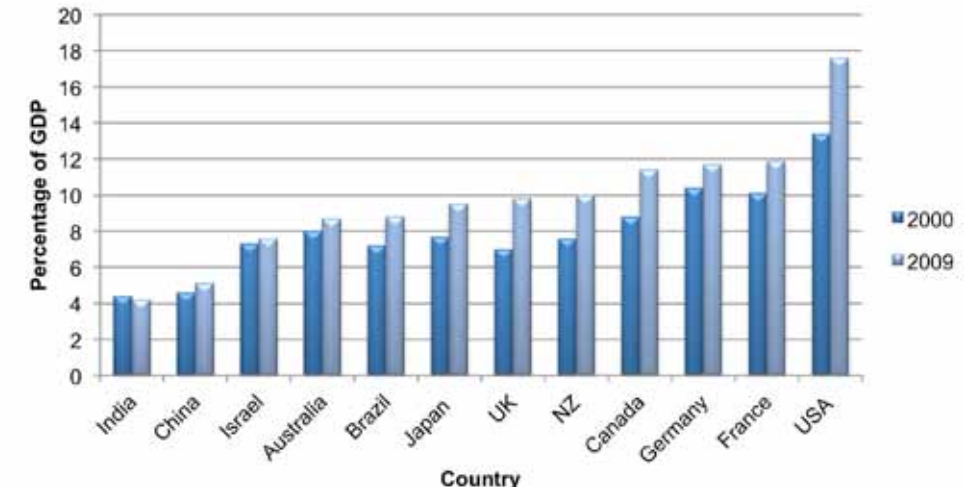
- The number of people aged 65-84 years will double and the number of people aged over 85 will quadruple by 2050[27]
- Type 2 diabetes is expected to become the leading cause of disease burden and it is estimated that by 2030 approximately 75% of Australians will be overweight or obese[28]
- Rapid growth in chronic diseases is expected in the areas of diabetes, mental illness, cardiovascular disease, cancer and joint disorders[29]
- Population ageing will double the cost of healthcare by 2050[30]
- The number of aged care places will need to double by 2030 in order to meet demand[31]
- The available pool of workers will decrease[32]
- The annual loss of workforce participation from chronic disease in Australia is around 537,000 person years of participation in employment and approximately 47,000 person years of part-time employment[33]
- For 2010–11, potentially avoidable GP-type presentations accounted for about 39% of all presentations to emergency departments[34]
- Over 30% of Australia's total burden of death, disability and disease can be accounted for by risk factors (e.g. smoking, obesity).[35]

23 The main conditions associated with chronic obstructive pulmonary diseases are emphysema and chronic bronchitis.
24 Tunstall Health. *A view from inside: Whole systems demonstrator and beyond* (Dave Tyas). 2012.
25 The number of hospitalisations that could have been avoided if adequate non-hospital care had been provided.
26 Houle, D. & J. Fleece. *The new health age: The future of healthcare in America. New Health Age Publishing.* 2011.
27 National Health and Hospitals Reform Commission. *A healthier future for all Australians – final report.* Canberra, DoHA. 2009.
28 National Preventative Health Taskforce. *Australia: the healthiest country by 2020 – National preventative health strategy – the roadmap for action*. 2009.
29 AIHW. Risk factors contributing to chronic disease. Canberra: AIHW. 2012.
WHO. *Preventing chronic diseases : a vital investment : WHO global report.* Geneva. WHO. 2005.
30 Australian Government. Australia to 2050: future challenges. *The Intergenerational Report*. 2010.
31 National Health and Hospitals Reform Commission. 2009.
32 ABS. *Private hospitals Australia 2009–10.* ABS cat. no. 4390.0.Canberra: ABS. 2011.
33 AIHW. C*hronic disease and participation in work.* Cat. no. PHE 109. Canberra: AIHW.
34 AIHW. *Australian hospital statistics 2010–11: Emergency department care and elective surgery waiting times.* Health Services series no. 41. Cat. no. HSE 115. Canberra: AIHW. 2011, November 30.
35 AIHW. *Australia's health 2010. Australia's health series no. 12.* Cat. no. AUS 122. Canberra. 2010.

8. International health expenditure[36]

Healthcare for 12 major economies as a percentage of GDP is shown below. According to WHO statistics the Australian health spend is just under half of that of the USA. Spending on healthcare as a percentage of GDP has increased across all nations except India[37].

Figure 4: Total health expenditure as a parentage of gross domestic product (GDP) for 12 industrialised economies



Source: WHO 2012[38]

9. Value of global medical technology industry

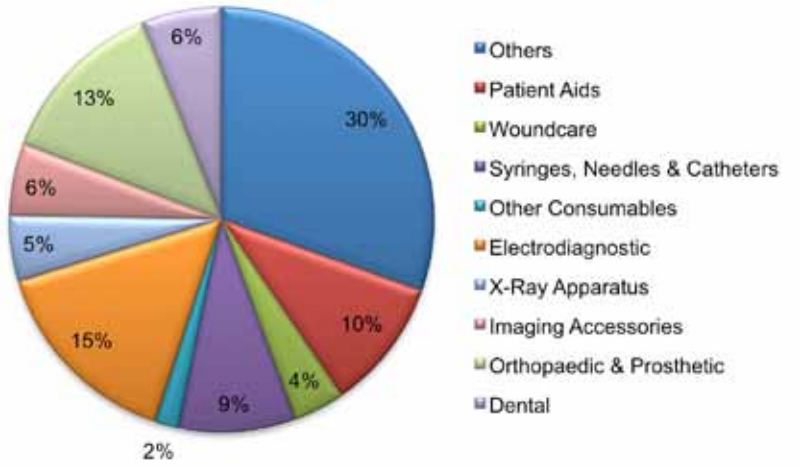
Medical technology is a competitive and highly innovative market[39]. In 2011, medical device makers innovated within existing product lines, launched new devices and invested in R&D. At the same time they also experienced funding cutbacks and new taxes and regulations in major world healthcare systems. Funding is more difficult to attract, and hospitals and healthcare programs are facing budget cuts, pushing medtech companies into tighter margins[40]. Despite this the market managed to expand 5% in 2011[41]. In a world of fast paced technological change, decision making by industry, regulatory bodies, and individuals is increasingly complex and the outcomes uncertain. Innovation in an environment of risk has become the norm[42].

Globally, the medical technology market is valued at over US$300 billion per annum[43] [44] . By 2016, the global medical device market will approach US$350 billion[45]. The United States (US) is the traditional epicenter of medical technology innovation. However, the US's position at the forefront of the industry is not as secure as it once was[46]. As the medical technology industry matures and low cost competitors enter the market [47]there is an increasing emphasis on value for money[48]. Emerging economies are capturing an increasing share of the industry. The BRIC countries (Brazil, Russia, India, and China) are able to deliver cheaper devices fast, decreasing the overall cost of healthcare[49]. Increasing GDP, healthcare expenditures and Purchasing Power Parities (PPP) in these countries make them attractive markets for device manufactures[50]. The Chinese market for example is expected to increase at a compound annual growth rate (CGAR) of 14% from its 2010 value of US$7.8 billon to US$20 billion in 2016[51]. While India, with its emphasis on low cost production, a US$3 billion dollar market, growth exceeding 15% in 2011 and CGAR of 20% or more expected over the next five years[52], is another attractive market for device manufacturers.

36 WHO. *World health statistics.* 2012.
37 In India state funding as a percentage of GDP as well as healthcare spend in absolute terms is low compared to other developing nations.
38 Available at www.who.int/gho/publications/world_health_statistics/2012/en/index.html. Also see OECD Health Data 2011.
39 Zacks. *MedTech Industry Stock Outlook - 2012, June.*
40 Oxbridge Biotech Roundtable. *Medtech Motions with Ernst and Young 2012, June.*
41 Kolorama. *The global market for medical devices, 3rd Edition. Essential Insights on Medical Markets.* 2012.
42 Ernst&Young *Pulse of the industry: Medical technology report 2011.*
43 Hack, Griffith. *Mind the gap: medical technology innovation in Australia.* 2010, June.
44 Clinica. *Review and analysis of the medical technology industry.* 2010.
45 Research and Markets. *The outlook for medical devices worldwide.* Espicom Business Intelligence Ltd 2011.
46 PricewaterhouseCoopers (PWC). *Medical technology innovation scorecard: The Race for Global Leadership.* 2011.
47 Kamp, J. *Low-Cost orthopedic device firms aim to shake-up market.* The Wall Street Journal. 2011, 5 July.
48 Eucomed. European medical technology industry launches 5-year strategy and commits to value-based innovation: Industry to change business model and mind-set, contributing to more productive and efficient European healthcare systems. *Eucomed Newsletter(21).* 2011.
49 PWC (2012). Smaller, faster, cheaper: The future of medical technology. www.pwc.com/us/en/10minutes/assets/medical-innovation.pdf
50 Singal, *V. In-vitro diagnostics, opportunities and challenges.* Medical Technology Industry Practice. Accenture, 2011, 15 August.
51 PWC Taking advantage of the Medtech market potential in India: Success will hinge on operating model innovation. 2012.
52 Calculation based on data obtained from PWC. *Taking advantage of the Medtech market potential in India: Success will hinge on operating model innovation.* 2012.

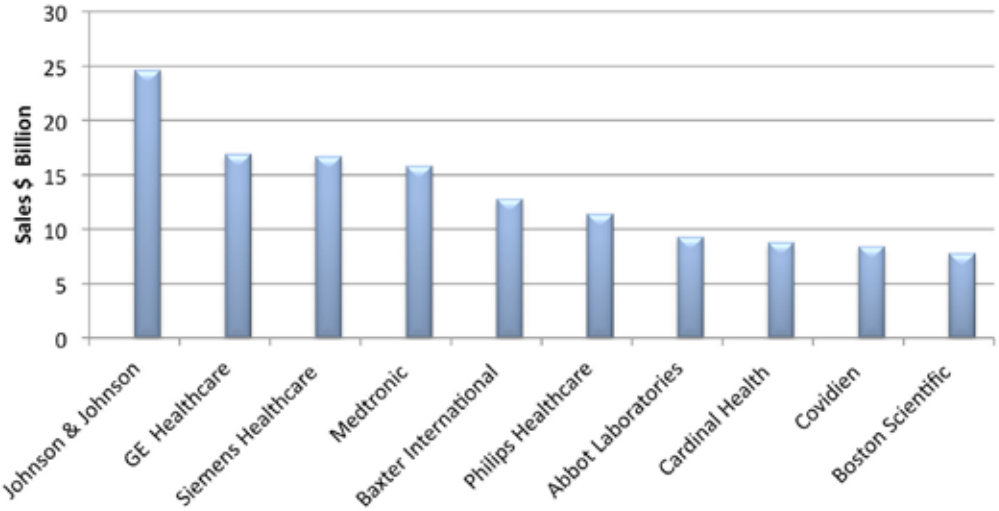
At the same time as emerging economies such as India and China begin to boom, growth in the more mature markets remains stable. The Australian market continues to develop with modest growth evident in the industry. There were 90 Australian patent applications made by Australian medical devices firms in 2009[53]. In keeping with this figure results from the MTAA industry wide survey indicate that 53 patents were filed in the 2010-11 period[54]. This survey captured the majority market share of the Australian medical technology industry.

Figure 5: Global medical equipment market by category 2011



Source: Espicom Business Intelligence 2011[55]

Figure 6: Top 10 Device Manufacturing Companies 2010



Source: MPO[56] 2011

53 DIISRTE. World Intellectual Property Organization. Report on global patent activity by Australian medical devices firms.

54 UltraFeedback, MTAA industry wide survey 2012.

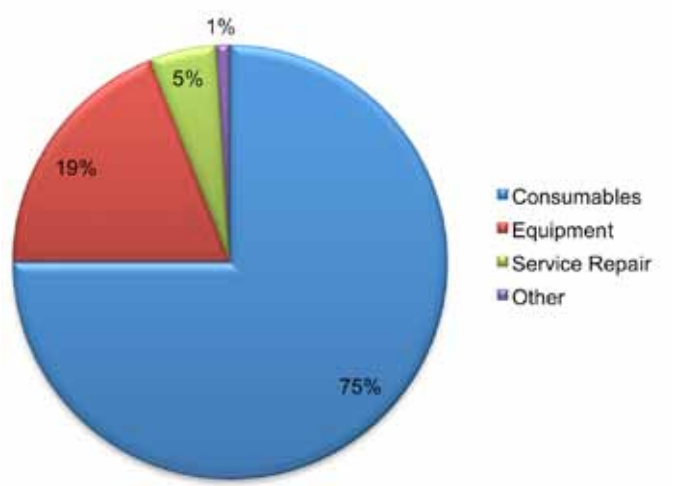
55 Espicom Business Intelligence *Medistat Worldwide Medical Market Forecasts To 2016*. 2011, June. www.espicom.com/web3.nsf/structure/Samplepdf/$File/wmmf-samp.pdf
Epsicon divide the global equipment market into the following categories: 'consumables' (including other consumables, syringes, needles catheters & wound care), 'diagnostic imaging' (including Imaging parts & accessories , x-ray apparatus), 'electodiagnositc', 'dental products'(including drills, chars & x-ray, 'orthopedic & prosthetic' (including splints & other fracture appliances, artificial joints, other artificial body parts), 'patient aids' (including portable aids and theraputic appliances) and 'others'.

56 Medical-Products Outsourcing. Top Medical Device Companies 2011 (July/August).
Editors' note: Note that while the device and diagnostic companies are ranked according to sales reported for FY 2010 some may include non-device sales within a division, such as combination products, drug delivery, software or device-related services. Not all companies explicitly break out the device portion of total revenues. MPO consulted numerous public documents and contacted company officials as needed to arrive at the best estimates. Also note that foreign currency conversions were done based on the exchange rate at the end of the fiscal reporting period being discussed.

10. Value of the medical technology industry in Australia

There are no official data collected on sales of medical technology in Australia. MTAA calculates the size of the industry based on extrapolation of data from the MTAA database and from statistics collected by its contracted service provider UltraFeedback via an industry wide survey and a quarterly Market Barometer Online Survey (MBOS). This information is augmented by data obtained from the Manta Media website[57]. Total revenue for the Australian medical technology industry for 2010-11 was $10.02 billion. If sales of *in vitro* diagnostics (IVDs) are also included[58] the revenue is $10.9 billion, and with the further addition of dental products, around $11.7 billion[59]. The annual growth rate of the industry has decreased from 9.5% in 2009 to 4% in 2012[60].

Figure 7: Company sales breakdown 2010-11[61]



The Other category includes consultancy and licensing fees. Consumables include all single use items, including prostheses. Equipment includes capital equipment and reusable items. Service Repair includes maintenance, repair, auditing, training and miscellaneous services.

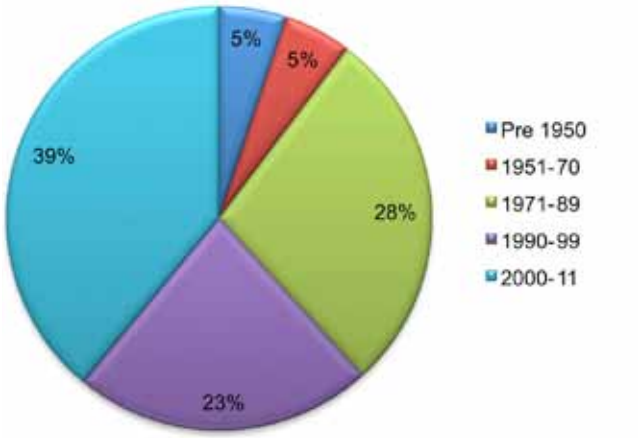
57 *www.manta.com/world/Oceania/Australia/*
58 *www.ivd.org.au/files/9913/1770/3601/IVD_annual_2011_WEB.pdf*
59 *Australian Dental Industry Association. 2012.*
60 Market barometer online survey (MBOS). No. 37 (Quarter 1). 2012.
61 MTAA industry wide survey 2012.

11. Industry profile in Australia[62]

Year of establishment:

The medical technology industry has grown substantially since 1990 with the majority of companies (62%) established during the 1990-12 period. Only 10% of medical technology companies operating in Australia were established prior to 1970. Through the 1950s and 60s the industry experienced sustained growth but it was not until post 1970 that more rapid expansion occurred. Almost 40% of companies were established post 2000.

Figure 8: Year of establishment

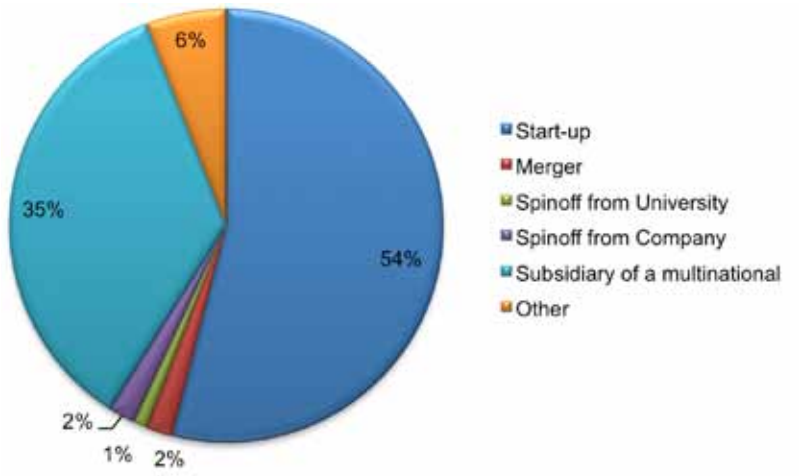


Source: MTAA industry wide survey 2012.

Company structure:

Company structures have evolved in a number of ways in Australia with the majority of companies (54%) growing from start up companies. Thirty five percent (35%) were established as a subsidiary of a multinational company. Other companies were formed as spin off companies (2%), spin off companies from Universities (1%) and mergers (2%)[63].

Figure 9: Company structure



Source: MTAA industry wide survey 2012.

Sales and Revenue[64]:

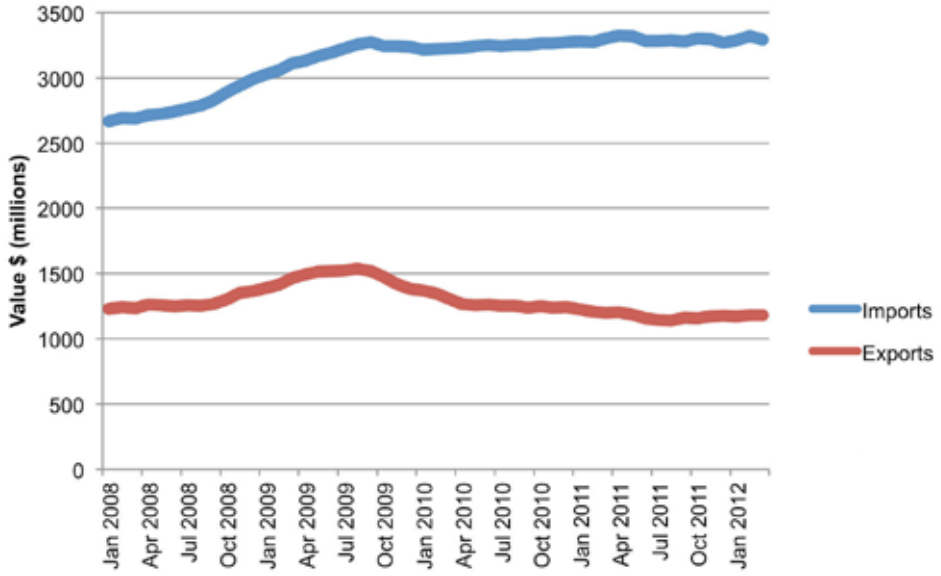
The majority of companies generate under $20 million turnover a year (although some companies do generate over $450 million). In 2010-11, 76% of revenue was generated by sales of consumables followed by equipment (19%). Hospitals are the greatest user of medical technology products accounting for 85% of revenue.

62 MTAA industry wide survey 2012.
63 Ibid. another 5% of companies listed 'Other' as the origin of the company.
64 MTAA industry wide survey 2012.

12. Imports and exports of medical technology in Australia

Nearly all medical technology products manufactured in Australia are exported, while the majority of medical technology products used in Australia are imported. In 2011, the value of medical technology imports was $3.3 billion and the value of medical technology exports was $1.2 billion[65]. Historically exports and imports grew at comparable rates. However, from mid 2009 imports remained fairly static while exports declined. In the first half of 2012 the decline in exports appears to have stabilised.

Figure 10: Australian medical technology imports and exports 2008-11

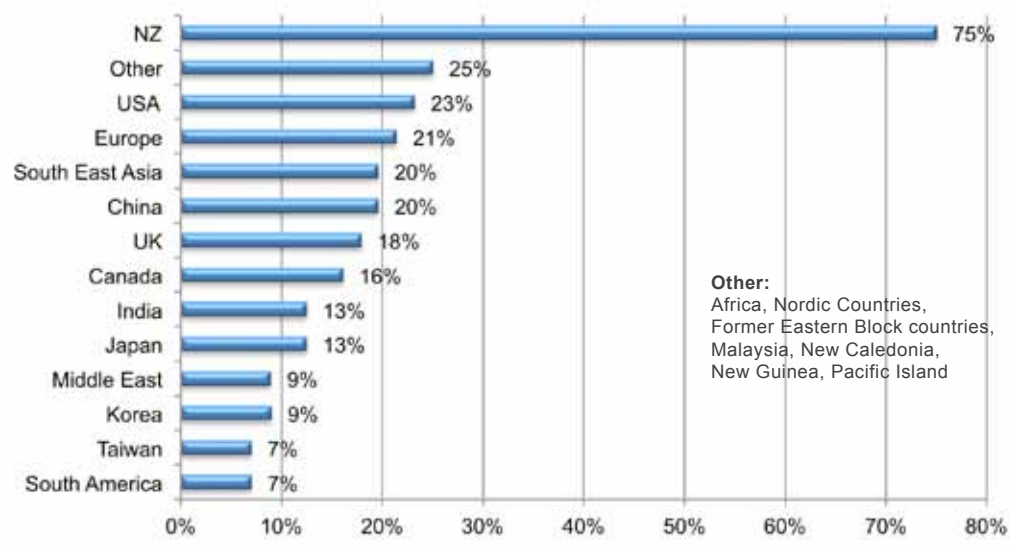


Source: ABS 2012[66]

Exports of Australian Products:

New Zealand is Australia's most popular export destination with 75% of companies exporting to our closest neighbour. Europe (including the UK) is the highest value market providing 39% of export revenues, followed by New Zealand (27%), the USA (23%) and Canada (16%)[67].

Figure 11: Export destination markets



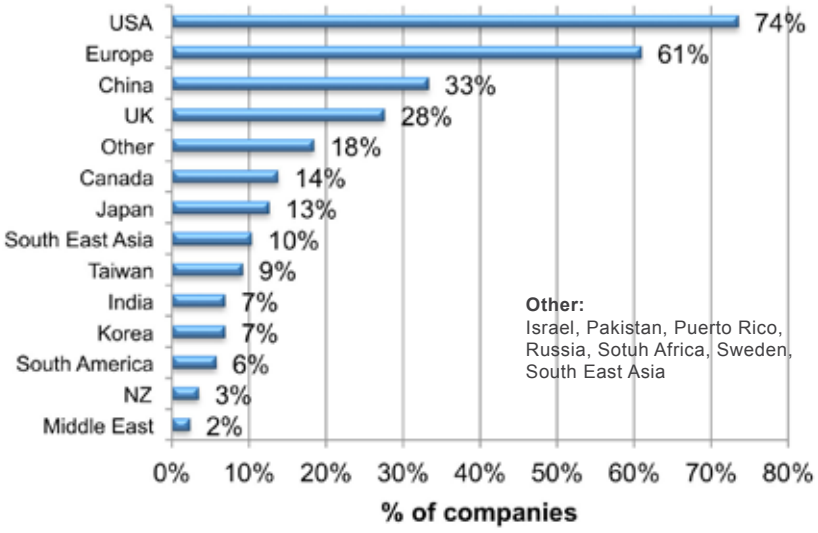
Source: MTAA industry wide survey 2012.

65 ABS - 5368.0 *International trade in goods and services, Australia*. 2012. January.
66 Ibid.
67 MTAA industry wide survey 2012.

Imports of medical technology into Australia:

The majority of medical technology companies are importers (77%) (see figure 13 below)[68]. The main countries from which companies import are USA (74%), Europe (61%), China (33%) and the UK (28%).

Figure 12: Australian medical technology import markets

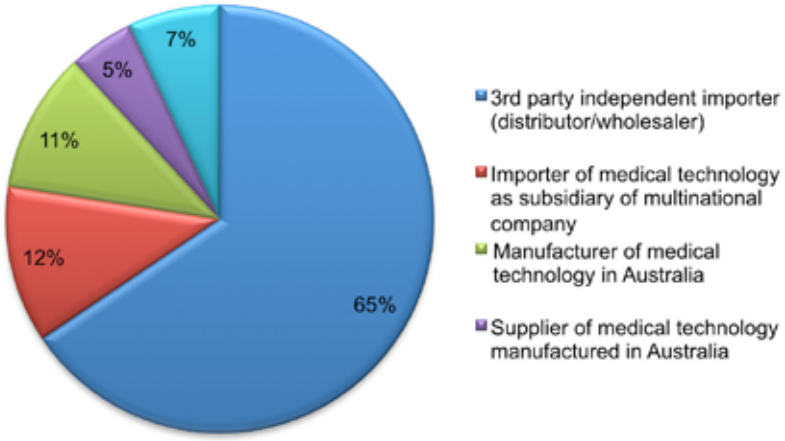


Source: MTAA industry wide survey 2012.

13. The medical technology landscape in Australia

There are over 500 medical technology companies in Australia with products included on the Australian Register of Therapeutic Goods (ARTG). This number does not include IVD companies that supply medical devices (of which there are approximately 60) or dental companies (of which there are over 50).

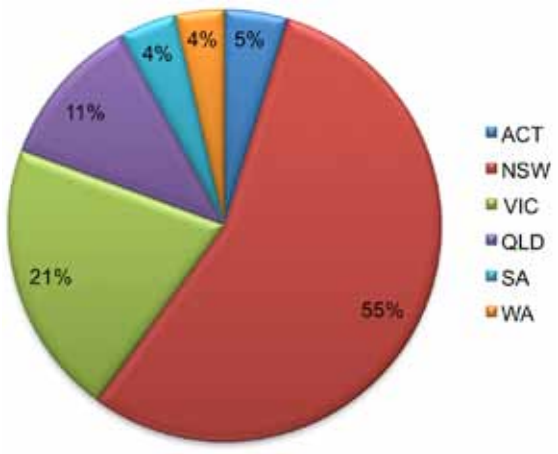
Figure 13: Classification of medical technology companies in Australia
Data obtained from 244 companies in the MTAA database. Note: companies were able to select more than one category.



Source: MTAA 2012

68 MTAA database

Figure 14: Location of medical technology companies in Australia (%)



Source: MTAA 2012

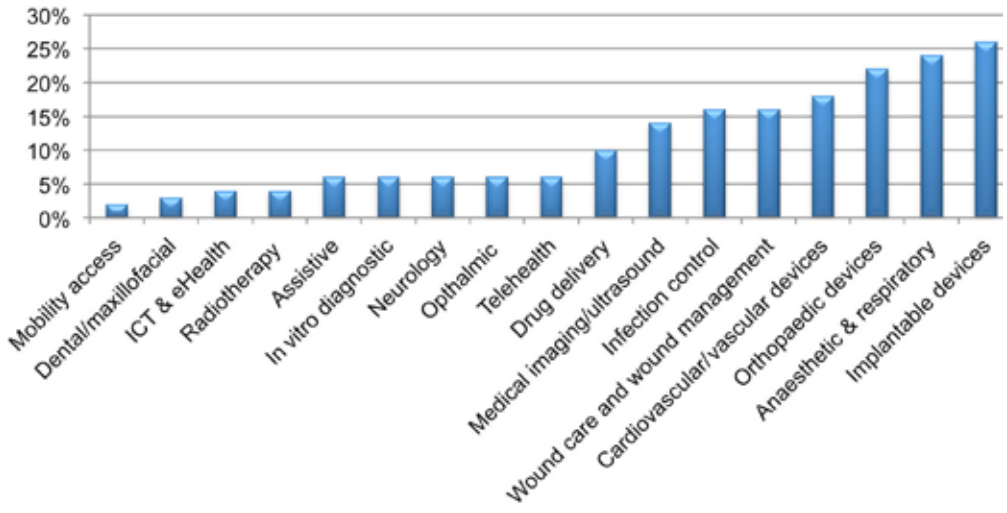
The majority of medical technology companies (head offices) are located in NSW (55%) followed by Victoria (21%) and Queensland (11%).

14. Products supplied by Australian medical technology companies[69]

The data was obtained through the MTAA industry wide survey[70]. Companies were able to select more than one category.

Medical technology companies develop, manufacture and supply a wide variety of devices. Principal products supplied or manufactured in Australia are anaesthetic and respiratory (24%), orthopeadic devices (22%), cardiovascular/vascular devices (18%), wound care and management devices (16%) , infection control products (16%) and medical imaging/ ultrasound devices (14%). 38% of companies supply re-usable products, 34% single use items and 26% implantable devices. Services supplied by companies include education and training (9%) and professional services or consultancy (6%).

Figure 15: Principal products supplied in Australia

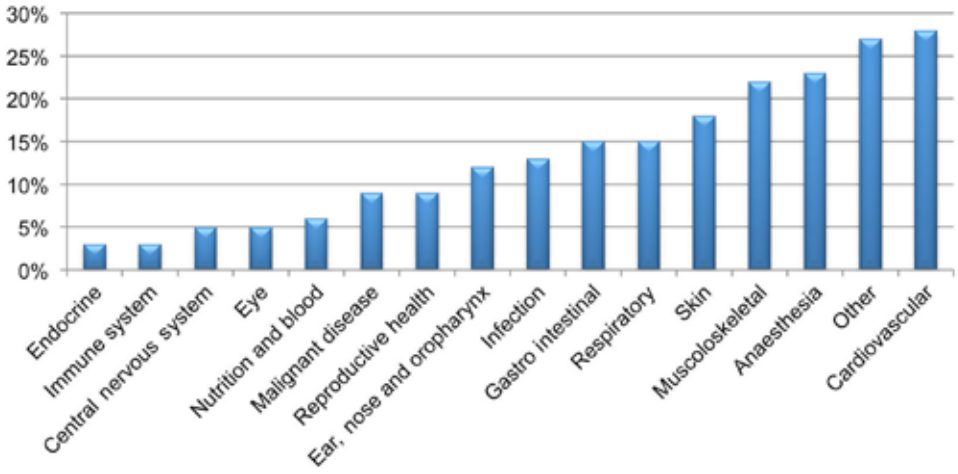


Source: MTAA industry wide survey 2012.

69 MTAA Industry wide survey 2012.
70 Ibid.

Figure16: Main therapeutic focus of business

The main therapeutic focus of the industry is cardiovascular, anaesthetic and musculoskeletal devices.



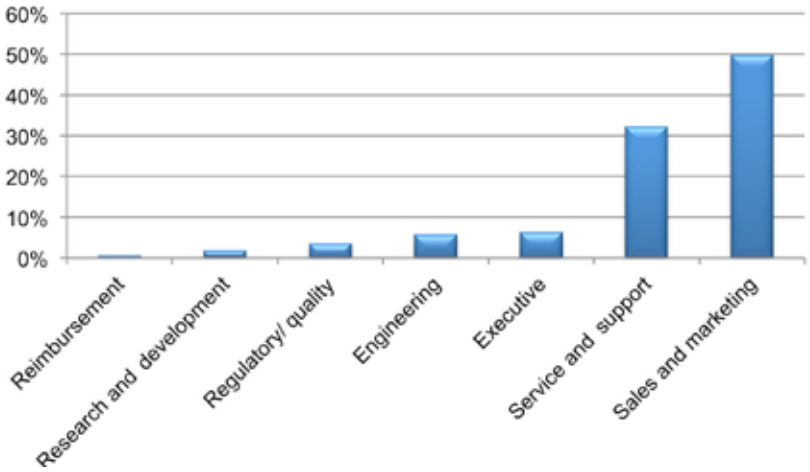
Source: MTAA industry wide survey 2012.

15. Employment in the medical technology sector in Australia[71]

The medical technology industry in Australia employs more than 19,000 people. Staff in medical technology companies are highly qualified with 50% of staff having a tertiary qualification and 21% having a postgraduate qualification[72]. Amalgamations of major companies with staff of over 100 occurred in the 2011-12 year. In the same time period the number of member companies who employ between 20-100 staff has increased from 77% to 79% of the industry.

Disciplines relevant to the medical technology industry include biomedical engineering, biological sciences, health economics, information technology, law, manufacturing, nursing, physical sciences, regulatory and quality, sales and marketing.

Figure 17: Composition of Australian medical technology employment market

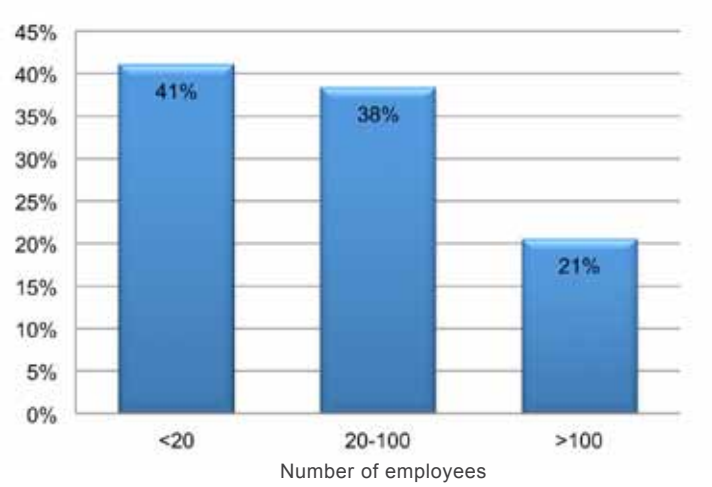


Source: MTAA industry wide survey 2012.

71 Ibid.
72 MTAA industry wide survey 2012.

The majority of employees work in sales and marketing or service and support with these employment categories looking set to expand in the near future. The principal areas of workforce expansion are sales and marketing with 49% of companies surveyed indicating that they would expand sales and service functions in the next 24 months. This was followed by service and support with 37% of companies intending to expand in this area.

Figure 18: Number of staff in MTAA member companies (%)



Source: MTAA 2012

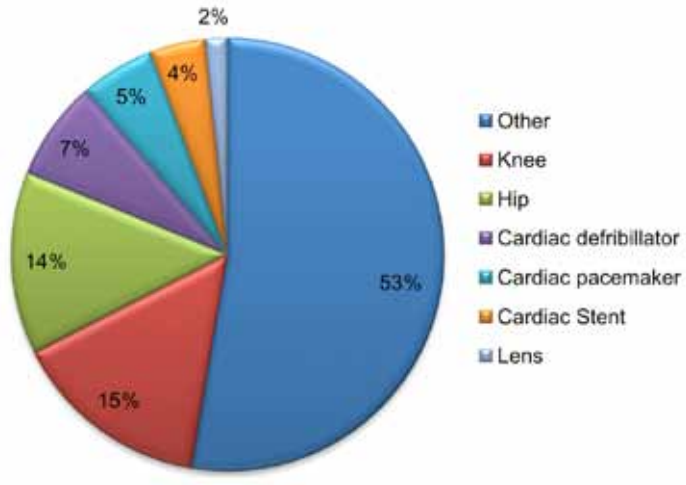
16. Medical technology listed on the Prostheses List[73]

There are 9748 devices listed on the February 2012 Department of Health and Ageing (DoHA) Prostheses List which are reimbursed by private health insurance. In 2011, benefits of $1.4 billion were paid by registered health insurers. The February List included 1274 new Billing Codes, 411 of which are for new products. There are approximately 4,000 products with the same Billing Code on both the 2005 and the February 2012 Prostheses List. While there has been substantial growth in benefits paid for listed prostheses since 2005, an analysis of these items shows that the average minimum benefits have decreased by 5% since 2005, whereas had CPI been applied, the per cent change would have resulted in an increase of 19.8%. The majority of devices on the Prostheses List are supplied by MTAA members.

Prosthesis category	Sum of benefits paid for prostheses ($ Millions) 2010-11	Percentage of payments in each category
Other	727	53%
Knee	205	15%
Hip	188	14%
Cardiac defibrillator	103	7%
Cardiac pacemaker	77	6%
Cardiac Stent	57	4%
Lens	23	2%
Total	1380	

73 Figures do not include human tissue.

Figure 19: Percentage of benefits paid for prostheses 2011 in each category

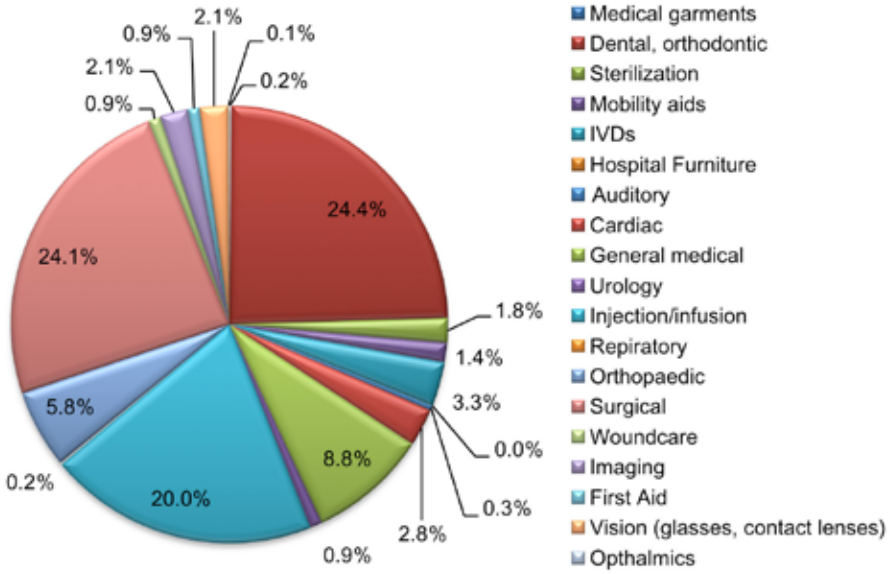


Source: PHIAC 2012[74]

17. Medical device inclusions in the ARTG

All medical technology products sold domestically or exported from Australia are regulated by the Therapeutic Goods Administration (TGA) and have to be entered in the ARTG before they can be supplied. New medical technologies are added to the ARTG daily. There are over 36,000 entries for medical devices in the ARTG (2012) (including IVDs and dental products) with an estimated 500,000 to one million different devices linked to them.

Figure 20: Categorisation of medical devices on the ARTG



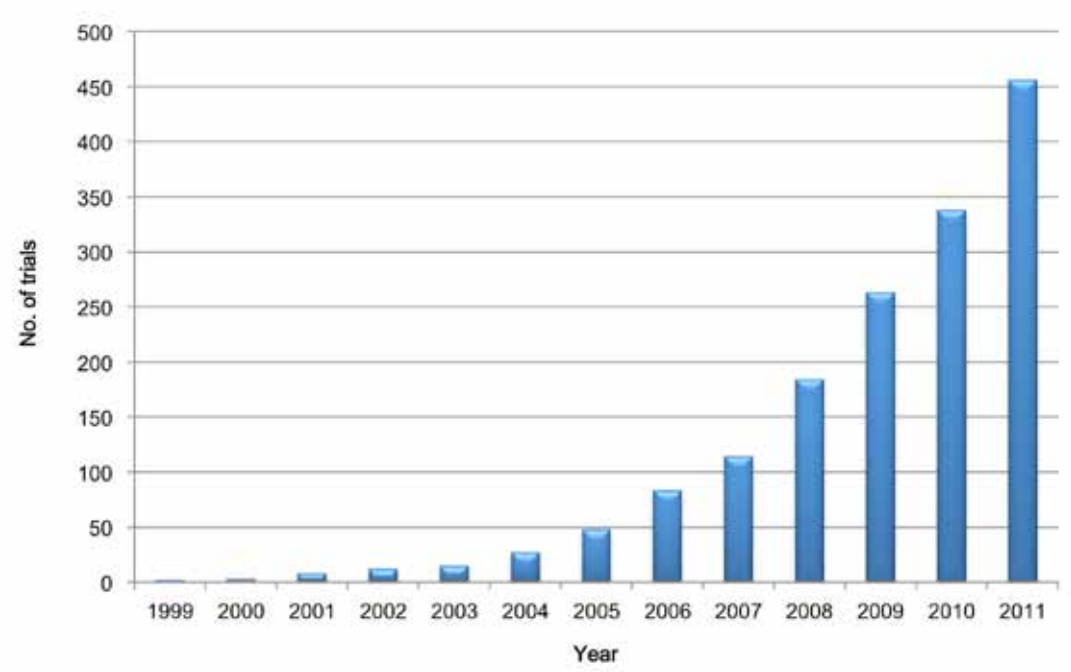
Source: ARTG 2012

74 Available at www.phiac.gov.au/for-industry/industry-statistics/operations-of-the-private-health-insurers-annual-report/

18. Medical technology and clinical investigations

Australia is a good location for clinical investigations due to its sound healthcare infrastructure. Clinical investigations are worth around $1 billion to the Australian economy each year[75]. Australia attracts investigations internationally and the $1 billion figure includes approximately $450 million of foreign investment. The number of clinical investigations increased steadily over the 1999-2011 period and in the period from January to September 2012 108 new medical technology trials were registered.

Figure 21: Cumulative number of ANZCTR registered medical technology investigations in Australia



Source: ANZCTR [76]

Australia's popularity as a location for clinical investigations is not linked to cost. The 2012 KPMG Competitive Alternatives report shows that of the 14 countries under review, only Japan is a more expensive country in which to invest in clinical trials[77]. Despite this Australia attracts a high number of clinical trials. It is likely that the 45 % refundable tax offset provided under the 2011 Research & Development (R&D) Tax Incentive scheme accounts for some of the continuing popularity. Tax incentives include a 45% refundable tax offset for companies with a turnover of less than $20 million per annum and a non refundable 40% tax offset for all other eligible entities.

The tax incentive is a relatively new strategy and it is unlikely that it accounts for all of Australia's continuing popularity as a destination for clinical investigations. Aside from the tax incentive Australia's proximity to Asian markets and the heterogeneity of its population also count in its favour as does its relative experience in the device manufacturing market. The majority of medical technology companies in Australia were established prior to 2000[78] whereas in many Asian countries the industry is much younger. China's current US$308 billion five-year plan for developing its biotechnology industry for example, presents Australia with a window of opportunity to capitalise on its experience in clinical investigations and device development[79].

75 Australian Government. Clinically competitive: Boosting the business of clinical trials in Australia. Clinical Trials Action Group Report. 2011.
76 Information regarding clinical investigations in Australia is available from the Australian New Zealand Clinical Investigations Registry (ANZCTR). The ANZCTR includes investigations covering pharmaceuticals, medical devices, and treatment and rehabilitation therapies. Sponsors are responsible for registering investigations and details of all investigations in Australia are made available online. The registry includes objectives, treatment(s) under investigation, outcomes, sample size and recruitment status, design, principal investigator and contact person. Certain details are mandatory and items must comply with the International Committee of Medical Journal Editors (ICMJE) and the WHO.
Available at www.anzctr.org.au/trialSearch.aspx
77 KPMG. Competitive Alternatives. 2012. Available at www.competitivealternatives.com
78 MTAA Industry wide survey 2012.
79 Peter Beattie. Billions in play in a bio world. The Australian, July 14.

19. Research and Development (R&D)

The medical technology industry faces significant changes in the R&D area with the combination of increasing health care costs in developed nations and increasing R&D activity in developing nations driving change. The US is the traditional epicentre of medical technology innovation with 32 of the 36 companies globally that have an annual turnover greater then US$1b. However, the US's position at the forefront of the industry is not as secure as it once was with emerging economies capturing an increasing share of the industry[80]. The diminishing dominance of the US looks set to continue due to a less flexible pricing environment and the proposed excise tax (part of the Patient Protection & Affordable Care Act)[81]. Technological innovation in medicine and increased consumer power and information via the internet and social networking are also shifting the traditional balance of power in the industry[82]. This provides an opportunity for Australia, where there has been steady growth in the size of the Australian medical research and life sciences sectors over the past decade, to capitalize on its proximity to Asian markets and its reputation in the medical technology market.

The annual spend for R&D in 2009-10, medical biotechnology, nanotechnology and biomedical engineering was $309 million[83]. This is a drop from the previous year mainly due to a drop in R&D spending for biomedical engineering. R&D spending by companies surveyed in the MTAA industry wide survey accounted for between 0.1% of revenue to over 100% varying in amount spent from under $500 to over $10 million. The total amount spent by the 44 R&D active companies which took part in the survey was $184 million.

20. Value of Technology project

VOT Introduction

Medical technology can deliver significant savings to the health system over time. Unfortunately, the benefits of medical technology are often poorly understood, insufficiently articulated and developed and may be perceived as being a burden on the healthcare system.

MTAA developed the Value of Technology project to contribute to an improved understanding of the impact of advances in medical technology on healthcare expenditure in Australia, and the associated costs and benefits for the Australian healthcare system and community. The outcome of this research will improve evidence-based cost-benefit analysis of medical technologies.

20.1 Implantable infusion pumps

Chronic pain is a condition that affects nearly 3 in 10 Australians at any given time[84]. The prevalence of chronic pain is estimated to be around 3.3 million in 2010 and projected to reach 5 million by 2050[85].

Pain contributes to economic strain through lost productivity, disability, and increased healthcare utilisation. In 2007, the total cost of chronic pain was estimated at around $34.3 billion (or $10,847 per person with chronic pain)[86].

Implantable infusion pumps are generally the recommended treatment for patients with chronic pain who are ineligible for corrective surgery and require continuous pain relief. Implantable infusion pumps are preferred when systemic/conventional drug delivery systems such as pills or patches have failed to provide sufficient pain relief and/or cause intolerable adverse events.

An implantable infusion pump is a medical device that is surgically implanted into the patient to provide continuous long-term drug treatment. The infusion pump is implanted subcutaneously and delivers drugs from the pump device to the site of administration. The types of medication that can be infused include opioids, local analgesics, and calcium channel blockers. These drugs can be delivered intravenously, intra-arterially, subcutaneously, intraperitoneally, intrathecally or epidurally.

Clinical benefits: The clinical benefits of implantable infusion pumps have been well documented and include:

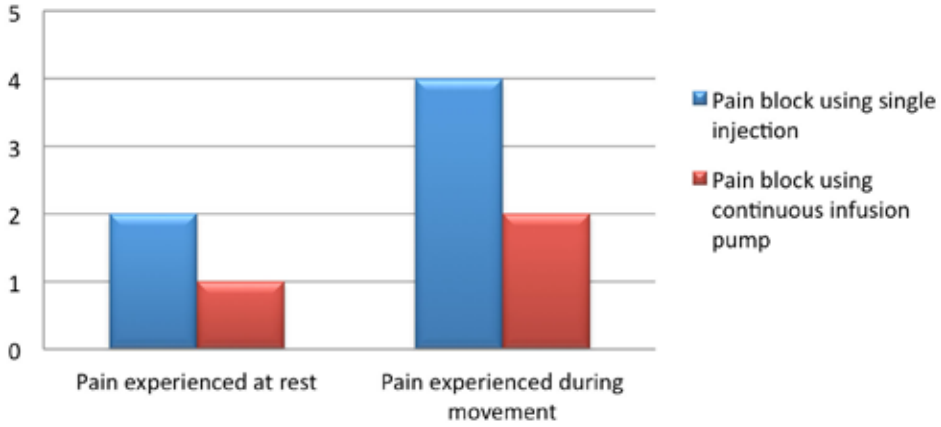
- Drug dispensing schedules and dosage can be programmed by the clinician
- Reduction in pain levels
- Reduction in opioid intake and opioid side-effects such as vomiting and nausea
- Reduction in the incidence of surgical site infections[87].

80 Ibid.
81 Zacks Equity Research. *MedTech Industry stock outlook - June.* 2012.
Zhong, H. & De Carlo, J. Weekly checkup: Job losses and reduced R&D for med-tech companies. *American Action Forum (028).* 2012, April.
82 Topol, E., *The creative destruction of medicine.* 2012.
83 ABS. *Research and experimental development, businesses Australia, 2009-10.* 81040DO007 and 81040DO008. Canberra: ABS. 2010-11.
84 Stollznow Research for Pfizer Australia. Chronic pain. 2010.
85 WHO. *Who's pain ladder.* 2007.
86 Access Economics. *The high price of pain: The economic impact of persistent pain in Australia. 2007*, November.
87 Singh, K. et al. (2005). A prospective, randomized, double-blind study evaluating the efficacy of postoperative continuous local anesthetic infusion at the ilac crest bone graft site after spinal athrodesis. Spine, 30: 2477-2483.

Cost benefits: Infusion pumps have been demonstrated to be cost-effective by:

- Reducing overall treatment costs such as reducing the need for narcotics[88]
- Reducing the risk of surgical site infections
- Significantly reducing the length of hospital stay (reduction of 1-3 days across a variety of surgical areas)[89].

Figure 22: Pain Scores



Source: Adapted from Fredrickson et al., 2010[90]

Significantly lower pain scores are evident in patients given continuous interscalence ropivacaine infusion compared with single-injection interscalene block.

20.2 Remote monitoring of chronic heart failure

There are approximately 300,000 Australians with chronic heart failure (CHF) and a further 214,000 people with asymptomatic CHF[91]. An estimated 30,000 Australians are diagnosed with CHF every year[92]. CHF is one of the leading causes of premature death in Australia. In 2006, CHF alone accounted for the loss of 2,352 lives and was an associated cause of death in a further 14,466 cases[93].

In 2006-07, around 43,681 Australians were hospitalised due to CHF[94]. A further 100,000 hospitalisations were CHF-associated incidents (totalling around 1.4 million days of hospital stay per year due to CHF and CHF-related incidents)[95]. CHF is also one of the most common reasons for elderly patients to consult a GP[96].

In Australia, chronic cardiovascular disease accounts for around $5.94 billion per year in healthcare costs[97]. CHF alone is estimated to contribute more than $1 billion per year to healthcare costs with the major contributor to CHF-related costs being hospitalisation and recurrent hospital stays[98]. The cost burden of CHF in Australia is expected to rise due to the increasing incidence and prevalence.

CHF patients with an implanted cardiac device such as an implantable cardiac defibrillator or pacemaker require regular clinical monitoring. This is usually done in a clinical environment. A cost-effective and efficient alternative to in-clinic monitoring is currently available using remote monitoring technologies. These allow reliable transfer of data from the implanted cardiac device to the clinician's office while the patient remains in their own home. This allows the clinician to detect and assess device-related issues, as well as monitor changes in patient cardiac status, without the need for the patient to physically attend at the clinic.

88 White, P.F. et al. (2003). The use of continuous popliteal sciatic nerve block after surgery involving the foot and ankle: does it improve the quality of recovery? *Anesthesia & Analgesia*, 97: 1303-1309.
89 Yoost, T. et al. (2009). Continuous infusion of local anesthetic decreases narcotic use and length of hospitalization after laparoscopic renal surgery. *Journal of Endourology*, 23: 623-626.
90 Fredrickson, M. et al. (2010).Analgesic effectiveness of a continuous versus single-injection interscalene block for minor arthroscopic shoulder surgery. *Regional Anesthesia & Pain Medicine,* 35(1):28-33.
91 ABS. 4364.0 - *National Health Survey: Summary of Results, 2004-05*. Canberra. 2006.
92 AIHW. *Australia's health 2008*. Cat. No. AUS 99. Canberra: AIHW, 2008.
93 Ibid.
94 Ibid.
95 Abhayaratna, W.P. et al. (2006). Prevalence of heart failure and systolic ventricular dysfunction in older Australia: the Canberra Heart Study. *Medical Journal of Australia*, 184:151-154.
96 Krum, H. et al. (2001). Chronic heart failure in Australian general practice: the Cardiac Awareness Survey and Evaluation (CASE) study. *Medical Journal of Australia*, 174:439-444.
97 AIHW. *Healthcare expenditure on cardiovascular diseases 2004-05*. AIHW Cat no CVD 43. Canberra: AIHW, 2008a.
98 Clark, R.A. et al. (2004). Uncovering a hidden epidemic: a study of the current burden of heart failure in Australia. *Heart Lung Circulation*, 13:266-273.

Clinical benefits: There is growing evidence of the many benefits of remote monitoring for patients with implantable cardiac devices. The positive health outcomes shown to be associated with remote monitoring include[99] [100] [101]:

- Lower mortality rates
- Reduced number of hospitalisations
- Improved quality of life
- Decreased cardiac events such as strokes
- Shorter hospital stay
- Reduced anxiety associated with possible device failure.

Cost benefits: Research has shown that remote monitoring of patients with CHF is associated with a decrease in both direct and indirect health costs.

Direct cost savings can be achieved as a result of:

- Reducing the number of clinical visits (including GP and nurse specialist visits)
- Reducing the distance travelled by healthcare professionals
- Early detection of symptoms exacerbations and early intervention[102]
- Fewer or shorter hospital stays[103]
- Delaying the transition into residential care
- Decreased utilization of healthcare resources.

Indirect cost savings can be achieved as a result of:

- Reducing travel for patients and/or carers
- Increasing patient and carer productivity (including reduced leisure and work time for patients and their carers).

A recent meta-analysis reported cost savings associated with remote monitoring ranging from $355 to $1,185*[104]. The authors argue that combining these cost savings with a QALYs gain of 0.06 make remote monitoring superior to existing standard care[105].

Raatikainen et al. (2008) reported a 41% saving associated with replacing a portion of in-clinic visits with remote monitoring. The total annual saving with online monitoring was reported to be $620-886* per patient. An analysis that applied remote monitoring to all new patients with implantable cardiac devices within Western Europe estimated that cost savings of $19-27 million could be achieved annually[106].

20.3 Modern wound care devices

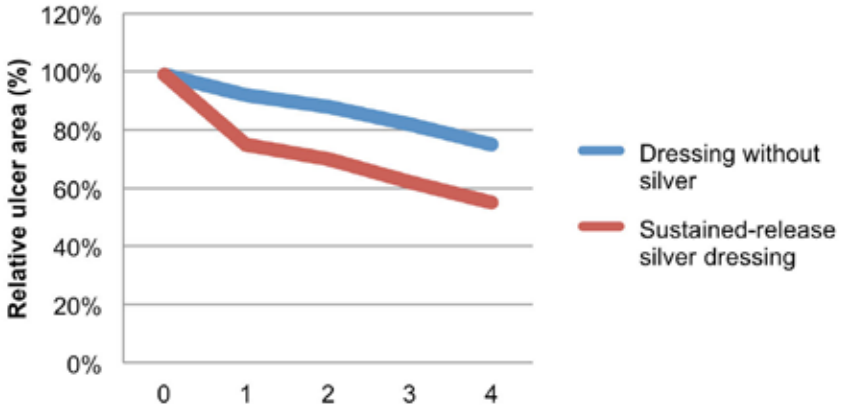
Wound care treatment and management have been practiced since prehistory. The area of medical technology has continued to advance the science of wound care treatment and management.

Today there are many types of modern wound care devices (MWCDs) that can be used to treat different kinds of wounds, depending on the cause and the type of wound. Different types of MWCDs include: wound closure devices, synthetic dressings, antimicrobial wound dressings and negative pressure wound therapy (NPWT).

MWCDs compared with the traditional 'wet or dry' gauze have been shown to be more effective for wound healing and protection against secondary infection[107] [108] .

99 Saxon, L.A. et al. (2010). Long-term outcome after ICD and CRT implantation and influence of remote device follow-up: The ALTITUDE survival study. *Circulation,* 122: 2559-2567.
100 Klersy, C. et al. (2011). Economic impact of remote patient monitoring: An integrated economic model derived from a meta-analysis of randomized controlled trials in heart failure. *European Journal of Heart Failure*, 13(4): 450-459.
101 Crossley, G.H. et al. and CONNECT investigators (2011). The CONNECT (Clinical Evaluation of Remote Notification to Reduce Time to Clinical Decision) Trial: The value of wireless remote monitoring with automatic clinician alerts. *Journal of the American College of Cardiology*, 57: 1181-1189.
102 Ibid.
103 Ibid.
104 Price converted from Euros.
105 Klersy, C. et al. (2011). Economic impact of remote monitoring: An integrated economic model derived from a meta-analysis of randomized controlled trials in heart failure. *European Journal of Heart Failure*, 13(4): 450-459.
106 Raatikainen, M.J.P. et al. (2008). Remote monitoring of implantable cardioverter defibrillator patients: A safe, time-saving, and cost effective means for follow-up. *Europace,* 10(10): 1145-1151.
107 Ovington LG. (2007). Advances in wound dressings. *Clinics in Dermatology*, 25(1):33-8.
108 Jorgensen, B. et al. (2005). The silver-releasing foam dressing, Contreet Foam, promotes faster healing of critically colonized venous leg ulcers: a randomised, controlled trial. *International Wound Journal*, 2(1): 64-73.

Figure 23. Sustained-release silver dressing vs dressing without silver



Source: Singh 2011[109]

Significant improvements in wound healing were observed with sustained-release silver dressing compared with foam dressing without silver with average ulcer area reduction of 45% vs 25%, relatively (p=0.003).

Clinical benefits

There are many clinical advantages of MWCDs over traditional dressings and these include:

- Ease of application
- Reduction in pain and anxiety at dressing change
- Lower infection rates
- Remain in place on the wound longer than traditional dressings
- Reduction in procedural medications[110 111].

Cost benefits

There are numerous evidence sources showing the use of MWCDs offers economic advantages over the traditional/ conventional treatment (e.g. 'wet or dry' gauze).

An Australian study has estimated (using a Markov model) the cost-effectiveness of MWCDs compared with traditional treatment when used for venous leg ulcers. The study reported the following findings:

- Patients have significant gains in quality of life on MWCDs compared with patients treated with standard gauze.
- Patients treated with standard gauze have larger costs accrue in the form of higher nursing hours (estimated 40% savings of nursing time using MWCD), slower healing times and reduced quality of life.

The study concluded that MWCDs are more cost-effective compared with traditional treatment when used for the treatment of venous leg ulcers.

Overall MWCDs compared with traditional gauze offer considerable economic benefits by:

- Reducing the number of dressing changes required
- Reducing the healing time of the wound
- Reducing clinician and nursing time for assessment and treatment
- Reducing cost and frequency of complicating infections[112 113 114 115].

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21.Timeline of Australian medical technology inventions

1926 The world's first electronic heart pacemaker is developed at Sydney's Crown Street Women's Hospital by Dr Mark Lidwell and Edgar Booth

1930s The humidicrib is developed in Tasmania in response to the polio epidemic and is a portable alternative to the 'iron lung' made from plywood. The technology is used to save premature babies

1961 Drs George Kossoff and David Robinson build the first ultrasound scanner and pioneer the field of fetal ultrasound obstetrics

1970s Professor Earl Owen and microscope manufacturers Zeiss pioneer microsurgery, which uses specialised microinstruments and equipment for precision surgery

1978 The first person is implanted with a cochlear implant (bionic ear) developed by Professor Graeme Clark at The University of Melbourne

1980s Dr Victor Chang pioneers modern heart transplantation in Australia. His work in conjunction with St Vincent's Hospital leads to the development of the artificial heart valve

1981 Professor Colin Sullivan and co-workers at Sydney University invent the continuous positive airways pressure (CPAP) machine which supplies pressure to keep the airways of sleep apnoea patients open during sleep

1990 Professor Fred Hollows is named Australian of the Year for his work in eye health, including the development of low cost manufacturing of intraocular lenses

1991 Drs Michael Ryan and Stephen Ruff from Sydney perfected plastic rod bone repair, using plastic rods rather than metal pins and tubes which interfere with scans (e.g. MRI)

1992 Optical research scientist Stephen Newman develops the world's first multi-focal contact lens in Queensland, giving clear vision at all distances to individuals with presbyopia

1998 The Solarscan™ device is developed which scans the skin and compares the image to a database to determine whether sunspots are melanomas

1999 Long-wearing night and day contact lenses that transmit an increased volume of oxygen and can remain in place for 30 days are developed by the Cooperative Research Centre for Eye Research and Technology in NSW

2005 Dr Fiona Wood is named Australian of the Year for her work in burns treatment, including the development of spray-on skin for burns victims

2011 Melbourne-based company Phosphagenics aims to offer patients with diabetes the world's first transdermally delivered insulin

2012 An Australian hospital performs world's first bionic eye implantation. AIMEDICS, an Australian company, develops HypoMon the world's first non-invasive night time low blood glucose management system.

www.mtaa.org.au

Street Address
Level 12, 54 Miller St, North Sydney
NSW 2060 Australia

Postal Address
PO Box 2016 North Sydney
NSW 2059 Australia

P (+612) 9900 0650
F (+612) 9900 0655
E reception@mtaa.org.au

Medical Technology
ASSOCIATION OF AUSTRALIA