

Evidence Check

Orthotics and prosthetics workforce planning

An **Evidence Check** rapid review brokered by the Sax Institute for NSW Health: Health Workforce Planning and Development.
July 2015.

This report was prepared by:

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Orthotics and prosthetics workforce planning: a rapid review

An **Evidence Check** rapid review brokered by the Sax Institute for NSW Health. July 2015.
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Abbreviations

AACODS	Authority, Accuracy, Coverage, Objectivity, Date, Significance
ACC	Accident Compensation Corporation
ACCC	Australian Competition and Consumer Commission
AHN	Area Health Network
AHPA	Allied Health Professions Australia
AIHW	Australian Institute of Health and Welfare
ALS	Artificial Limb Service
AOPA	Australian Orthotic Prosthetic Association Ltd
CAD	Computer-aided design
CASP	Critical Appraisal Skills Programme
CNC	Computer Numerical Controlled
CPD	Continuing Professional Development
DVA	Department of Veterans Affairs
HARP	Hospital Admission Risk Program
HECS	Higher Education Contribution Scheme
HRF	High risk foot
HRFS	High risk foot services
IELTS	International English Language Testing System
IT	Information technology
MBS	Medicare Benefits Schedule
MDT	Multidisciplinary team
MeSH	Medical Subject Headings
NDIS	National Disability Insurance Scheme
NOTARI	Narrative, Opinion and Text Assessment and Review Instrument

NSW	New South Wales
NT	Northern Territory
NZALS	NZ Artificial Limb Service
OECD	Organisation for Economic Co-operation and Development
OP	orthotist and/or prosthetist
PPO	Preferred Provider Organisation
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QLD	Queensland
QOL	Quality of Life
QUT	Queensland University of Technology
SA	South Australia
SOL	Skilled Occupations List
SpOL	Specialised occupation list
STROBE	Strengthening of Reporting in Observational studies in Epidemiology tool
SWEP	State-Wide Equipment Program
USC	University of the Sunshine Coast
VALP	Victorian Artificial Limb Program
VET	Vocational education and training
VIC	Victoria
WA	Western Australia

1 Executive summary

ASERNIP-S was commissioned by the Sax Institute on behalf of the NSW Health Workforce Planning and Development branch, to provide evidence on five research questions pertaining to workforce planning for orthotists and/or prosthetists (OPs). The scope of the questions was structured around understanding the role that OPs and technical support staff play in the health system and whether the current model of care for OP services is appropriate for current and future demands. The OP workforce has been identified as being a 'small but critical workforce' for the delivery of a high quality and comprehensive service for the provision of orthoses and prostheses to NSW residents.¹

Question 1: What is the evidence regarding the adequacy of the training pathway for OPs in NSW?

- The Bachelor of Applied Science and Master of Clinical Prosthetics and Orthotics at La Trobe University, Melbourne, Victoria, is currently the solitary training program for OPs in Australia. There is a focus on clinical scope of work, client assessment, clinical decision making, and evidence-based clinical practice throughout the course. In 2016, the University of the Sunshine Coast, Queensland, will offer a Bachelor of Health Science (Prosthetics and Orthotics). This course is yet to be accredited by the Australian Orthotic Prosthetic Association Ltd (AOPA).
- Technical skills can be learnt via a technician course offered by the Queensland Government. No accredited training courses are available in NSW and a lack of training for the technical workforce in the future is anticipated.
- There are currently no minimum standards to practice as an OP in Australia.
- Recent work has considered implementing minimum Competency Standards for OPs at the point of accreditation with AOPA. Gaps in current competency were found to be a lack of emphasis on evidence-based and ethical practice with a client/patient focus; identification of scope of practice and the need for continuing professional development and/or mentoring to remain professionally current.
- Evidence suggests distance education, a clearly defined program and protected time for participation could be used for improving access to continuing professional development.

Question 2: What is the evidence regarding the factors that may determine the retention of the OP workforce in NSW?

- No literature was identified to inform on retention strategies specific to OPs.
- Based on evidence of recruitment and retention of allied health workers in Australia, key factors that may influence OP retention include: incorporation of mentorships and formal supervision arrangements; more communication between healthcare workers on the role of OPs in the healthcare system; strengthening career advancement and CPD opportunities; targeted training and recruitment to fill skills shortages.
- No peer-reviewed literature was available describing workforce data and retention in NSW OPs. The AOPA has prepared a manuscript on the Australian OP workforce which is due to be published in late 2015.

Question 3: What is the evidence regarding how new technologies and a changing population composition are shaping the future role and scope of practice of OPs in NSW?

- New technologies will cause a shift in how fabrication enters OP practice from measure, manufacture and fit to the use of pre-fabricated devices. Traditional skills and devices may remain best clinical practice for certain patient groups resulting in OPs having to retain a diverse skill set.
- Diabetic foot (a High Risk Foot disorder) is a leading cause of non-traumatic lower extremity amputation. The evidence indicates prevalence of diabetes in Australia is rising, which will lead to a commensurate increase in demand for services provided by High Risk Foot (HRF) clinics.
- The National Disability Insurance Scheme (NDIS), being rolled out across NSW in 2018, will provide more access to orthotic and prosthetic services.

Question 4: What is the evidence regarding which OP models of care are currently in use and what drivers may affect these models in the future? What is the evidence regarding how the process of fabrication currently enters the OP workflow and what drivers may affect it in the future?

- Government funded prosthetics are available via EnableNSW for NSW residents who are Australian citizens. Prosthetists work as part of multidisciplinary teams in amputee clinics accredited by EnableNSW to provide an interim limb as well as advice and patient training in use of the limb. Fabrication and customisation of prostheses forms a major component of the prosthetists workflow. The finishing of the interim limb to become the definitive limb may be performed by the prosthetist contracted to the amputee clinic or by another prosthetist of the patient's choice.
- Future changes to the model of care may arise from an increase in obesity requiring more advanced componentry, a possible diminishing in the role of fabrication as experienced prosthetists retire and increased use of pre-fabricated prostheses client care becomes a bigger part of the workflow; the NDIS may increase demand and change funding arrangements for amputee care.

- Orthotic devices are available to patients in NSW who are referred to a hospital for treatment or who elect to see an orthotist privately (some of the cost may be reimbursed by private health insurance). Fabrication of orthotics is a major component of the OPs workflow.
- Future changes to the model of care may arise if the revised Medicare Benefits Schedule (MBS) includes a new item number for reimbursement under Chronic Disease Management arrangements and if greater private health insurance reimbursements for orthotic services are introduced. An increase in high risk foot clinics and partial foot amputations may also impact on the mode of care. Reports from the UK suggest that improved access to orthotics can reduce overall healthcare costs.

2 Introduction

ASERNIP-S^a was commissioned by the Sax Institute on behalf of the NSW Health Workforce Planning and Development Branch, to review questions related to orthotist and/or prosthetist (OP) workforce planning. The scope of the questions was structured around understanding the role that OPs and technical support staff play in the health system. OPs are involved in client care as well as device manufacture and customisation. Technical staff provide support for OPs through device fabrication. The OP workforce has been identified as being a “small but critical workforce” for the delivery of high quality comprehensive healthcare to the population of NSW.¹ Such workforces are defined as those that supply critical and essential healthcare services and they are experiencing threats to meeting both current and future needs.

In response to this threat, the NSW Health Professionals Workforce Plan Taskforce identified that “more of the same is no longer the answer”¹ to workforce planning. The Taskforce went on to highlight the need to have the “the right people, with the right skills in the right place”. However, to achieve this for OP there is a need to ensure:

- The workforce is maintained
- The profession is attractive and provides fulfilling careers to those already in the workforce as well as those entering the workforce
- OPs are appropriately trained and maintain their currency of required skills
- The number of OPs is appropriate to meet the system’s needs.

Failure in any one of these elements could have negative effects on delivery of OP services in NSW.

Key areas of interest were identified in terms of OP workforce planning in NSW. These included: training; decisions regarding the allocation of educational resources such as scholarships, placements and mentors; as well as understanding the role that OPs play in the health system and whether the current model of care for OP services is appropriate for current and future demands.

Based on these key areas, the following research questions were investigated for this Evidence Check:

1. What is the evidence regarding the adequacy of the training pathway for OPs in NSW?
2. What is the evidence regarding the factors that may determine the retention of the OP workforce in NSW?
3. What is the evidence regarding how new technologies and a changing population composition are shaping the future role and scope of practice of OPs in NSW?
4. What is the evidence regarding which OP models of care are currently in use and what drivers may affect these models in the future?
 - a. What is the evidence regarding how the process of fabrication currently enters the OP workflow and what drivers may affect it in the future.

The scope of each question is detailed in [Appendix 1](#).

^a Australian Safety and Efficacy Register of New Interventional Procedures – Surgical, Royal Australasian College of Surgeons.

3 Review methodology

This review was conducted in accordance with the Sax Institute’s methodology for Evidence Checks.

Two search strategies were developed, one to search databases for peer reviewed literature, the other to identify relevant grey literature. Search terms and strategy were translated from both the research questions and scope provided by NSW Health ([Table 1, Appendix 2](#)). Search terms included items for orthotists and prosthetists, workforce and training. These terms were used to search the listed range of relevant databases for peer-reviewed literature ([Table 2, Appendix 2](#)). Grey literature searches for relevant reports, submissions, training course details and reviews were conducted using the Google Advanced search utility to target relevant websites ([Table 3, Appendix 2](#)).

Detailed descriptions of methods including search terms, search strategy, databases and relevant websites are listed in [Appendix 2](#).

Evidence selection and appraisal

Evidence selection was conducted by a single reviewer. Selections were double-checked by a second reviewer. Any disagreement was discussed and if a consensus could not be achieved the selection was referred to a third reviewer. Quality appraisal of evidence was subject to the same review process.

Evidence prioritisation and synthesis

For research questions 1, 3 and 4, the evidence was prioritised by jurisdiction, with studies specific to NSW having the highest priority for inclusion. If the research question could not be answered comprehensively using data from NSW (or in the absence of data), inclusion was broadened to include evidence from Australia and New Zealand. If there was still insufficient evidence then the inclusion was broadened to include relevant literature from international sources, prioritising literature from Organisation for Economic Co-operation and Development (OECD) countries with a similar socioeconomic profile to Australia.

For research question 2, if no relevant literature was found from Australia and New Zealand specific to retention of OPs, literature relevant to other allied health professions was included. A jurisdiction-specific prioritisation was also employed.

Results from the included articles are tabulated in [Appendices 5-9](#) of this report.

4 Results

1. Adequacy of the training pathway:

What is the evidence regarding the adequacy of the training pathway for OPs in NSW?

A further description of the included studies and relevant data used to inform the answer to this research question is detailed in [Table 9](#) and [Table 10](#) of Appendix 5.

Evidence

Graduate training

The graduate training information is supported by grey literature including reports, websites and personal communication. Two peer-reviewed articles determine factors that have increased OP training adequacy in foreign countries.

At present, the Master of Clinical Prosthetics and Orthotics at La Trobe University, Melbourne, Victoria, is the solitary training program for OPs in Australia which is accredited locally by the Australian Orthotic Prosthetic Association (AOPA) and internationally by the International Society for Prosthetics and Orthotics (ISPO).¹ A Bachelor of Health Science (Prosthetics and Orthotics) is commencing in 2016 at the University of the Sunshine Coast, Queensland. It is anticipated that 10 students will enrol in the course annually (personal communication, University of Sunshine Coast, and AOPA).² This course is yet to be accredited by AOPA.

The course outline of the Bachelor of Applied Science and Master of Clinical Prosthetics and Orthotics at La Trobe University reveals a focus on clinical scope of work, client assessment, clinical decision making, and evidence-based clinical practice throughout the course ([Table 11, Appendix 5](#)). The course includes using external staff members from across the industry to expose students to new technologies that enhance the core foundation of clinical skills. The Course Coordinator confirmed the course structure was designed to provide graduates with the framework to understand and adopt future advancements in the field.³

Every year approximately 40 students graduate from the La Trobe course. It is not known, however, how many of those go on to work in NSW. The AOPA acknowledges that there is a group of unemployed graduates from this degree.⁴ Whether this speaks to the adequacy of training or a lack of employment opportunities is not known.

Published research on undergraduate OP students at the University of Jordan showed that a research-based clinical practice module helped students provide a higher standard of patient care in terms of diagnosing, prescribing and manufacturing prostheses. Students also expressed increased interest in using evidence in clinical decision making.⁵

A review in the USA reported on OP curriculums' lack of uniform vision for the future, no contemporary curricular design and lack of texts designed for comprehensive overview to teach about evolving, fragmented and complex subject matter.⁶ It is critical that OP courses are improved as technology and healthcare evolves.⁷ Wong et al. (2007) reported training in developing critical thinking skills allows OPs to improve their practice.⁸

Wong et al. (2004) explored whether OP learning can be assisted by eLearning resources and found this model was able to produce equivalent or significantly higher results on career relevance and problem solving, despite the fact that OP training involves substantial practical content.⁹

Funk (2007) found the use of learning portfolios provided a global structure from which OP students could meet established objectives and that portfolios assisted students in directing their education, staying accountable to their objectives, evaluating self and others, and developing higher-level thinking skills.¹⁰

As far as training sufficient OPs to meet the workforce needs, the literature on financial support include a suggestion of HECS (Higher Education Contribution Scheme) forgiveness for some allied health courses in Australia.¹¹ An example of another form of financial support that may be applied to OP training is the scholarships for medical students who agree to work in rural areas after graduation.¹²

Other suggestions include giving more direction to secondary students who are considering OP as a career. Research shows there is poor knowledge of health careers among secondary school students and career advisers should target students early in their studies before senior subjects are decided.¹³ As has been demonstrated in the rural workforce, health practitioners are more likely to work in the area they originate from or in which they have had study placements.¹⁴

Technical skills

The technical skills information is supported by grey literature including reports, websites and personal communication. Three peer-reviewed articles determine factors that have increased OP technical skills training adequacy in foreign countries.

When OP curricula from 10 programs in Northern Europe, the Middle East, Southern Asia, Oceania and North America were compared, an important finding was that programs should aim to improve fabrication and communication skills and student cooperation.¹⁵

Mentoring has been used as a positive strategy for skill development in health professionals.¹⁶ This has been raised as a gap in the Competency Standards for OPs by Ash and colleagues.¹⁷ Mentoring may ensure skills, especially fabrication skills, remain in the workforce.

The Certificate III in Prosthetic-Orthotic Technology course for training OP technicians will be removed from the Australian Skills Quality Authority Health Training Package (HLT07) at the end of 2015. Advice from the Community Services and Health Industry Skills Council has informed that this is likely due to low demand and the fact that no Recognised Training Provider was listed as offering the course. No accredited training courses are available in NSW.¹⁸ The only other technician course on offer in Australia is run by the Queensland Government. A new course in biofabrication at the Queensland University of Technology offers an introduction to 3D printing, however this will not fill the current need for fabricators.¹⁹

Accreditation

The accreditation information is supported by grey literature.

AOPA has published minimum Competency Standards for an OP to be eligible for entry to the Australian workforce (either at the point of graduation from a recognised tertiary training program in Australia or, for international health practitioners, at the point of assessment for AOPA membership).²⁰ These standards are not binding and OPs are not required to be members of the association to practise in Australia. It is anecdotally reported that approximately half (57%) of practising Australian OPs are members of AOPA, so these standards do not apply to a large proportion of the OP workforce.

Gaps in current competency were found to be a lack of emphasis on evidence-based and ethical practice with a client/patient focus; the need for continuing professional development and mentoring to remain professionally current.¹⁷

AOPA has planned an Assessment of Competence process for all practitioners who were trained in non-accredited programs which will be assessed against the Competency Standards.²⁰

Continuing Professional Development

There is no peer-reviewed or grey literature regarding continuing professional development (CPD) for Australian OPs. A peer-reviewed article reports barriers to CPD opportunities for Australian nurses include financial constraints, computer and internet access at the workplace, lack of technical support at the workplace, personal barriers such as access to childcare, energy and motivation (self-efficacy), transport and lack of appropriate and accessible CPD opportunities.²¹ Two Australian articles provide suggestions for improving CPD for health professionals.

Continuing professional development for allied health practitioners can be structured to involve flexible requirements for hours spent at conferences, reading journals, mentoring and giving presentations, with hours spent on each component capped to ensure individuals undertake a mixture of activities. Such requirements are described in relation to chiropractors.²²

Tele-learning technologies have been proven effective in delivering education and training materials/programs for health professionals.²³

Summary of evidence base

- Peer reviewed literature, all from overseas sources, could be sourced on adequacy of allied health training and methods that may improve OP training. Its relevance to the Australian context cannot be assured.
- Narrative reviews were appraised using the NOTARI appraisal tool shown in [Table 7, Appendix 4](#). All of these studies met the a priori determined minimum quality standard to be graded as 'good quality studies' (overall score ≥ 6 out of a possible score of 10).
- Qualitative studies were appraised using the CASP appraisal tool shown in [Table 6, Appendix 4](#). All studies met the a priori determined minimum quality standard to be graded as 'good quality studies' (overall score ≥ 6 out of a possible score of 10).

- The grey literature and personal communication with experts in the field returned the majority of good quality information on this topic. Comments regarding continuing professional development are particularly reliant on personal communication.
- Grey literature sources were appraised using the tool shown in [Table 8, Appendix 4](#) and all met the a priori determined minimum quality standard to be graded as 'good quality studies' (overall score of ≥ 4 out of a possible score of 7).

Gaps in the literature

- There is no peer-reviewed literature on the adequacy of the training pathway for OPs in NSW.
- Australia-wide, there is a review which used the Delphi process and a methods paper.^{15, 17}
- Regarding allied health degrees in Australia, there is one relevant review.²⁴
- Six peer-reviewed articles provided information on OP training pathways from an international context.⁵⁻¹⁰ No information on continuing professional development in the Australian OP workforce was found in the peer-reviewed or grey literature.

2. Retention in the workforce:

What is the evidence regarding the factors that may determine the retention of the OP workforce in NSW?

A description of the included studies and relevant data used to inform the answer to this research question is detailed in [Table 12](#) and [Table 13](#) of Appendix 6.

Background and description of the NSW workforce

There were 48 practising OPs registered with the AOPA in NSW in 2012. Most of this workforce is practising in a metro setting (90%) with only four per cent practising in a rural or remote setting.²⁵ The number of registered OPs has remained steady at 48 practitioners since 2007, while since that time the population of NSW has experienced an increase in population from 6,927,000 to 7,348,000.^{26, 27} This has resulted in a net reduction of approximately 10% in registered practitioners per head of population (from 0.70 per 100,000 in 2007 to 0.66 per 100,000 in 2012). Compared to the national average of 1.09 per 100,000, NSW has one of the lowest ratios of OPs to residents in Australia. On the other hand, there are a disproportionate number of practitioners in and around Melbourne (possibly due to the proximity of training at La Trobe University).²⁸ The AOPA suggests that three OPs per 100,000 of population is recommended. This figure is based on the recommended rate for orthotists in Scotland, however, no Australian state has reached this rate.²⁵ It appears the greatest shortage is in experienced practitioners and there is an unemployed cohort of OP graduates.⁴

Retention in the OP workforce

No peer reviewed publications or grey literature documents were identified that looked specifically at the retention of OPs in NSW or wider Australia.

Peer-reviewed literature on retention of allied health workers

Seven qualitative studies were identified that identified and discussed issues relating to workforce retention in Australia's allied health sector.

The key factors for workforce retention were:

- Type of work, work-life balance, career advancement, supportive supervisory structures, flexible work hours, positive organisational cultures, job recognition and income were factors that attracted workers to their current roles.^{29, 30}
- Factors cited as reasons for looking for new employment included better career prospects, higher income, mid-life career change, lack of recognition, lack of professional development and work-life balance.^{29, 30}
- A significant correlation has been found between lower job satisfaction and intention to leave a workplace.^{31, 32}
- There appears to be lower job satisfaction in mid-career practitioners.³⁰
- Strengthening job satisfaction and career advancement opportunities such as advanced practitioner, teaching or research positions may help workforce retention.³⁰
- Professional support contributes to high quality clinical practice, enhanced workplace satisfaction and better client outcomes. Implementation requires organisational time and resources. Professional support activities may include inservice supervision, peer review, mentoring, journal clubs or work shadowing. At least 50% of professional support should be obtained from an appropriate supervisor within the same profession.³³
- Responsibility for addressing shortages should be jointly shared between the health sector, education and training organisations, industry groups and government.³⁴

Summary of literature base

- No peer-reviewed literature discussing the makeup of the NSW OP workforce was found. Good quality grey-literature was available to describe the NSW OP workforce. This literature was used to provide context and background to the research question.
- No peer-reviewed or grey literature was identified that described retention factors for the OP workforce.
- Good quality peer-reviewed literature was available on workforce retention in allied health. Seven qualitative studies were identified on allied health retention. The articles were appraised using the CASP checklist shown in [Table 6, Appendix 4](#).³⁵ All studies met minimum quality standard (overall score ≥ 6 out of a possible score of 10). The key messages were consistent between studies.
- No peer-reviewed or grey literature was identified on how applicable allied health studies are to the NSW OP workforce.

Gaps in literature

- Peer-reviewed studies describing workforce data on NSW OPs. The AOPA has prepared a manuscript on the OP workforce in Australia which is due to be published in late 2015. It is not known whether this manuscript will include all practising OPs or the 53% of OPs who are registered with AOPA.
- There is no peer-reviewed or grey literature describing OP workforce retention.
- There is no peer-reviewed or grey literature describing how applicable general Australian allied health workforce studies are to the NSW OP workforce.

3. Future role and scope of practice:

What is the evidence regarding how new technologies and a changing population composition are shaping the future role and scope of practice of OPs in NSW?

A description of the included studies and relevant data used to inform the answer to this research question is detailed in Table 14 to 18 and Figure 4 to 6 of [Appendix 7](#).

Evidence on how new technologies are shaping the future role of practice of OPs in NSW

The available literature is limited. There are three non-Australian peer-reviewed articles and four pieces of non-Australian grey literature on new technologies and the OP workforce. The majority of articles describe technical aspects of emerging technologies which are not yet in use. Peer-reviewed literature was appraised by the NOTARI tool shown in [Table 7, Appendix 4](#). All studies met the minimum quality standard. The grey literature was appraised using the tool shown in [Table 8, Appendix 4](#). All of the appraised grey literature met the minimum quality standard. An indicative list of new technologies and skills that will be required for OP practise in the near or far future is provided in [Appendix 7](#).

Points reported in peer-reviewed literature

- A degree of difficulty is predicted in transitioning into the new role for OPs as some current skills will become obsolete, Changes in the OP skill set should be seen as a realignment rather than a loss.³⁶
- Old skills and devices may remain the best clinical practice for certain patient groups. This will result in OPs having to retain a diverse skill set. This can be difficult and costly if the patient load is low.³⁶
- It is anticipated that the technologies necessitating change in OP practice will be the introduction of a computer-aided design (CAD) 3D modelling and scanning techniques to replace casting. This skill is already used in some cases to create the Computer Numerical Controlled (CNC) milled cast and thus can be used with existing knowledge.³⁶
- CAD skills are transferable to other jobs which may lead to a retention issue.³⁶
- Historically, new OP technologies are used sparingly at first, for example for athletes or those with private funding. As experience is gained, the same principles are applied to moderate cost devices intended for less active individuals, and the device performance gradually improves.³⁷

Points reported in grey literature

- New technologies will cause a shift in OP practice, from measure, manufacture and fit to the use of pre-fabricated devices. This will mean a paradigm shift with higher demand leading to more time being required of the OP as they take on the role of patient educator and trainer, assisting people to use the new devices.³⁸
- The time saved scanning versus casting is approximately 50%, with an average three-hour procedure reduced to one-and-a-half hours.³⁸
- Advances in socket design,³⁹ fabrication and 3D imaging⁴⁰ may place an increased demand on orthotists and prosthetists. However, these technological advancements should improve practitioner efficiencies creating a certain amount of counter-balance surrounding the overall technology influence on supply and demand.³⁸
- In the United States, a key issue which will affect the number of certified OPs required in the future is health insurance policies for particular categories of providers.⁴¹

Evidence on how a changing population composition is shaping the future scope of practice of OPs in NSW

Literature available on how the scope of practice of OPs will be shaped by a changing population is limited. One Australian peer-reviewed article, two non-Australian peer-reviewed articles and two grey literature reports, from Australia and the USA, discuss this topic.^{6, 36, 41-43} The magnitude of population changes in Australia was able to be estimated with Medicare Benefits Schedule (MBS) and Australian Institute of Health and Welfare (AIHW) data in [Appendix 7](#).

Points reported in peer-reviewed literature

- The proportion of amputations above and below the ankle changed in Australia in 2000–2010 with an increase in partial foot amputations. The implications are that the provision of prosthetic services may decline temporarily while demand for high-risk foot clinics increase. As a result, the work of clinicians is shifting with a growing need for specialised education and training.⁴²
- The rapidly expanding elderly population in need of orthotics and prosthetics care, encroachment by other health care providers delivering orthotics and prosthetics services and changes in managed health care are all issues for the OP workforce.⁶
- The needs of the world's amputees are unfulfilled, both in developed countries due to problems of an aging population battling obesity, and in developing countries affected by poverty and injuries from land mines.⁶

Points reported in grey literature

- Rising rates of chronic disease have been linked to an increased demand for OP services. Of these, diabetes and the associated high-risk foot (HRF) and subsequent lower limb amputations will increase the need for OPs.^{43,44}
- Diabetic foot disorders (a HRF disorder) are the leading cause of non-traumatic lower extremity amputation. Patients with diabetes have 10–40 fold higher prevalence of amputation than people without.⁴³ In 2000 it was estimated that there were more than 2600 diabetes-related lower limb amputations annually in Australia, equating to 14 per 100,000 total population.⁴⁴
- Internationally, it is projected that between 2000 and 2030, the prevalence of diabetes in adults will double.⁴⁵ Australian data (Table 17, Appendix 7) indicates a 100% increase in type 2 diabetes between 1999–2000 and 2012–13. It can only be inferred that this will affect the OP workforce.⁴⁶ Orthotists, for example, work to prevent amputation in this population.
- The main driver for diabetic foot disorders is type 2 diabetes, therefore lifestyle programs could have an impact on OP services. With appropriate early intervention the need for prostheses could be avoided in some patients.⁴⁷
- AIHW data (Figure 1, below) illustrates the marked increase in OP interventions over a 10-year period between the 2002–03 and 2012–13 financial years. Any shift in services between orthotics and prosthetics, together with the type of service provided, is not able to be determined.

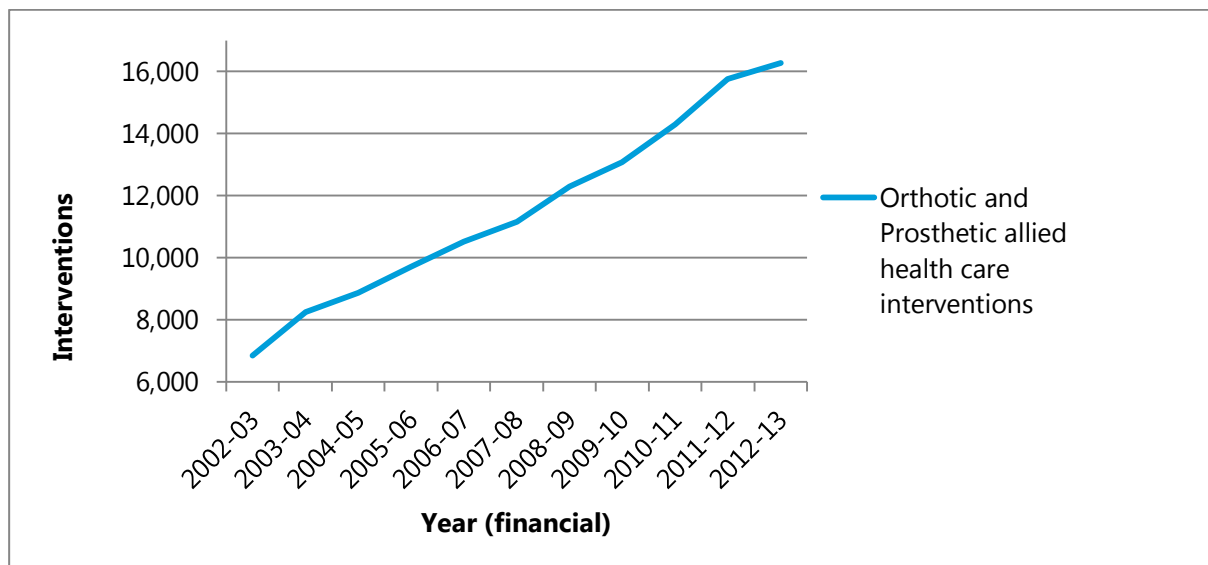


Figure 1: Orthotic and Prosthetic allied healthcare interventions ACHI 7th edition – AIHW

Figures and Tables in Appendix 7 depict: amputations per state from 2008–09 to 2014–15; amputations per capita, per state from 2010–11 to 2014–15; amputations by item in NSW from mid-2010 to mid-2015; type 2 diabetes incidence in Australia from 1999–00 to 2012–13; most common OP diagnoses from 2008–09 to 2012–13; and incidence of OP interventions from 2002–03 to 2012–13.

National Disability Insurance Scheme

Information on the National Disability Insurance Scheme (NDIS) was informed by government documents and grey literature.

The NDIS, to be rolled out across NSW in 2018, will increase the burden on orthotic and prosthetic services. It aims to fund reasonable and necessary orthoses and prostheses appropriate to a patient's needs due to disability and established goals.^{48, 49}

A person can become a participant of the NDIS if they are aged under 65 years, are a resident of an area where the scheme is rolled out, have a permanent impairment which results in substantial reduced functional capacity to undertake relevant tasks, or require an early intervention.⁴⁸ Therefore people requiring assistive technologies can access the plan. The NDIS will provide the following supports:

- Aids and equipment, including orthoses and permanent prostheses for increased independent functioning in the home and community
- Care by clinically trained staff, where care is essential for living in the community, for example, skin integrity checks by OPs⁴⁹
- Necessary and reasonable ongoing (definitive) prostheses, adjustments and repairs
- Ancillary costs related to prosthetic limbs such as stump socks and sheaths (six per year)
- Any limbs external to osseo implants.⁴⁸

Gaps in the literature

- There is no Australian peer-reviewed or grey literature on new technologies and the OP workforce.
- There is limited Australian peer-reviewed evidence on how the scope of OPs will be shaped by a changing population. However, this is illustrated with trends from existing MBS and AIHW data.

4. Current model of care:

What is the evidence regarding which OP models of care are currently in use and what drivers may affect these models in the future?

a. What is the evidence regarding how the process of fabrication currently enters the OP workflow and what drivers may affect it in the future?

A description of the included studies and relevant data used to inform the answer to this research question is detailed in Table 19 to Table 25 of [Appendix 8](#).

What is the current model of care for prosthetic provision in NSW?

No peer-reviewed literature was identified that described the model of care for prosthetic provision in NSW. Grey literature including government documents from EnableNSW were used to inform the current model of care for prosthetic provision in NSW.⁵⁰⁻⁵³

Government funding, via the public health system, is available to all Australian citizens who require a prosthetic device. In NSW, this government funding is managed and administered by a central body, EnableNSW, which covers the entire state. The current model of care for prosthetic provision in NSW under EnableNSW is described in [Figure 2](#).

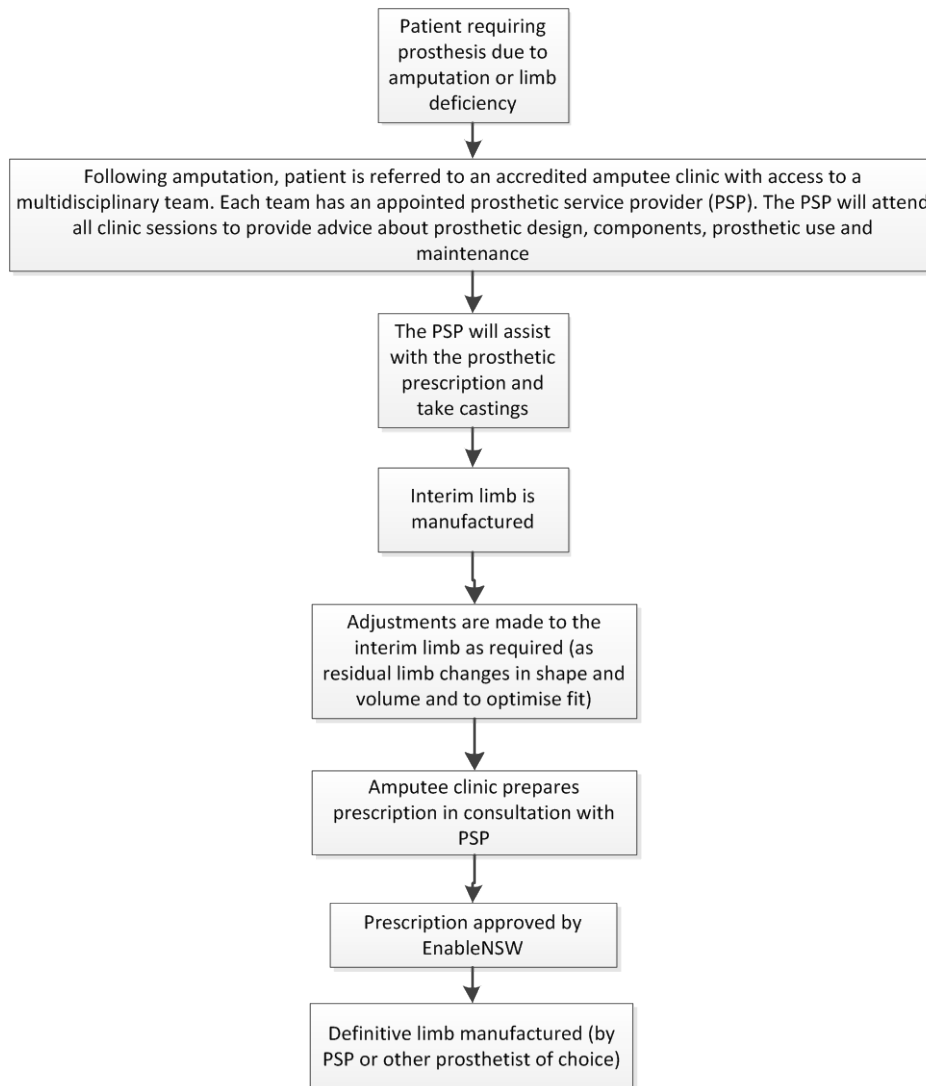


Figure 2: Model of care for prosthetic provision in NSW. This care pathway was informed using resources from EnableNSW⁵⁰⁻⁵³

Role of prosthetist

No peer-reviewed literature was identified that described the role of the prosthetist in the model of care in NSW. Grey literature from NSW Government sources and from amputee support organisation Limbs 4 Life was used to inform the answer for this section of the report.

Following amputation, patients are referred to an accredited amputee clinic which will have a prosthetist on staff or have a contract with a private prosthetic clinic to provide interim care to the patient. The prosthetist will attend multidisciplinary clinics and provide advice on prosthetic requirements, design, use and maintenance. Once the residual limb has stabilised and any changes to the interim prosthetic limb have ceased, the definitive limb will be prescribed and manufactured. This finishing may be by the prosthetists who manufactured the interim limb or by another prosthetist of the patient's choice. The definitive limb provider can also undertake any repairs to the limb, with the exception of major repairs that require a change to the prosthetic design. These require a new prescription from the amputee clinic.⁵⁰⁻⁵³

The funding of the patient care and the prosthetic device currently depends on the cause of the amputation. The NSW government, through EnableNSW, will fund prosthetic provision for patients who required an amputation due to illness, a congenital condition or accident where no insurance covers the patients care.⁵⁰⁻⁵⁴ Some patients may have their care covered by a compensation insurance scheme, for example the Transport Accident Commission of WorkCover. Veterans who lost their limb as a result of their service will have their care funded by the Department of Veterans Affairs.⁵⁴

How does fabrication enter the prosthetists workflow?

One peer-reviewed publication was identified that described the breakdown of work performed by a prosthetist in the context of the NSW health system.⁵⁵ Gordon et al. (2010) reported that the role of the prosthetist is in both the manufacture of the limbs (including casting and fabrication) and client care (fitting the limb and providing advice to patients). Analysis of time-keeping records from one prosthetist employed in a public hospital showed that 31% of a prosthetist's time is spent on interim limb provision (manufacture and fitting). Potential limitations of this study are discussed below under '[Comparative models of care](#)' but do not impact on the conclusion that fabrication is a key component of the prosthetist role.

Results from the peer-reviewed literature were in concordance with grey literature identified on this topic. A submission from the AOPA states that many OPs have a high level of technical involvement in prosthetic manufacture.⁵⁶

In the United States, two methods of fabrication for prosthetics using CAD/CAM technology have been discussed in a peer-reviewed article; onsite fabrication and centralised fabrication.⁵⁷ In the first model, a large practice owns and operates a full in-house suite of CAD/CAM equipment and performs the entire fabrication process, from digitised hand-casts to prosthetic delivery to the client. In the second model, a solo practitioner takes casts which are digitised and sent to a central fabrication facility where the socket is fabricated. A test socket and subsequently a definitive socket are returned for client fitting.

No literature was identified that discussed whether either of these models is routinely used by Australian OPs.

Comparative models of care

No peer-reviewed literature was identified that described the model of care for prosthetics provision in any Australian or overseas setting.

Grey literature was used to describe the models of care in Victoria, NZ, UK and USA.

- In the Victorian public health system, each Area Health Network (AHN) is given funds to provide both interim and definitive prostheses. Each AHN runs a prosthetic clinic and decides how to manage it (whether to provide an in-house service or outsource to a private provider).⁵⁸
- In NZ, the NZ Artificial Limb Service (NZALS) is a crown entity that is the national provider of prostheses to amputees via multidisciplinary clinics. In this scheme prosthetists are employed directly by the NZALS, and the majority of funding is provided by the Ministry of Health, although some funding is made on an individual basis by the Accident Compensation Corporation (ACC) where the prosthesis is required following an accident.^{59, 60}

- In the UK, the National Health Service (NHS) funds all prosthetic provision. Rehabilitation and re-ablement of patients is provided by a multidisciplinary team. There is a focus on flexible arrangements for patients. For example, appointments are available out of working hours if required. Prosthetists are employed directly by the NHS.⁶¹
- In the USA, prosthetic services are provided by the third party reimbursement model (private insurers, Health Maintenance Organisations (HMOs), workers compensation schemes). Government funding is available through Medicare (for people aged over 65 years) or Medicaid (for certain persons in financial need). Coverage is reportedly poor and there are concerns access to treatment may be decreasing over time while demand increases.⁶²

A report by Three Rivers Consulting (commissioned by NSW Health and finalised in 2011) provides more detail on models of care in other jurisdictions.⁶³ This report was undertaken as part of a review into prosthetic funding in NSW and the model of care described therein has since been modified and is as described above.⁵²

No literature (grey or peer-reviewed) was identified that compared patient outcomes between the current NSW model of care and any of the different models of care described above.

In 2011, the AOPA proposed a model of care for prosthetics funding which was detailed in their submission to the Productivity Commission.⁶⁴

One peer-reviewed study compared a public versus private model of funding in the context of the NSW Health system.⁵⁵ The results of the study found the public model (where the prosthetists are employed by the hospital) was associated with lower overall costs for equivalent patient outcomes. Some concerns regarding aspects of the methodology used in this paper have been raised in "Letters to the Editor".⁶⁵ The authors have subsequently addressed these concerns in their response and have acknowledged the limited scope of the study and the need for further research in this area.⁶⁵

Future changes/challenges

No peer-reviewed literature was identified that described factors that may impact on the model of care for prosthetics in the future.

Grey literature sources were used to identify a number of factors that may impact on the prosthetic model of care in the future:

- Rates of obesity are increasing in Australia. This will increase the requirements for titanium componentry to be incorporated into limbs and increase the complexity of manufacture and fitting.⁶⁶
- In a submission to the Community Services & Health Industry Skills Council, AOPA suggested that the prosthetists role in manufacturing limbs will diminish as fabrication skills are lost from the workforce (through retirement and a lack of fabrication training and experience for younger prosthetists as a result of new custom manufacturing technologies).⁵⁶
- In the same submission, AOPA hypothesised that an increase in patient demand, coupled with workforce shortages (described in Question 2), may reduce the amount of time prosthetists have

available for limb manufacture. The submission noted that fabrication can be performed by skilled prosthetic technicians, while client care can only be performed by the prosthetist.⁵⁶

- The rollout of the NDIS may provide a national standard of prosthetic models of care and increase equity for patients. Prosthetists will need to be registered with the NDIS and will work with patients under individualised participant plans to achieve patient-specific goals.^{67, 68}

Summary of the literature

- Government documents for EnableNSW were used to describe the model of care for prostheses provision in NSW.
- No peer-reviewed literature discussing the role of the prosthetist in the model of care was identified. Good quality grey literature was available to describe their role. Grey literature was appraised using the tool shown in [Table 8, Appendix 4](#) and all met the minimum quality standard (overall score of ≥ 4 out of a possible score of 7).
- One peer-reviewed study was identified that compared costs and patient outcomes associated with a public and private model of care in the NSW Health system. This article was also used to inform how fabrication enters the OP workflow. The articles were appraised using the CASP checklist shown in [Table 6, Appendix 4](#).³⁵ This study met the minimum quality standard (overall score ≥ 6 out of a possible score of 10).
- Grey literature which met the minimum quality standard was used to describe the models of care in Victoria, NZ, UK and USA. All documents met the minimum quality standard (overall score of ≥ 4 out of a possible score of 7).
- Grey literature which met the minimum quality standard was used to describe possible future changes and challenges to the current model of care (overall score of ≥ 4 out of a possible score of 7).

Gaps in the literature

- No peer-reviewed literature was available describing the role of prosthetists in the model of care or comparing a NSW model of care to models used in other national and international locations.
- No peer-reviewed literature was identified that discussed future challenges associated with the NSW model of care.

What is the current model of care for orthotic provision in NSW?

No peer-reviewed literature was identified that described the model of care for orthotic provision in NSW. Grey literature was used to inform the current model of care for orthotic provision in NSW.⁵⁰⁻⁵³

In a submission on the 2015/16 Federal Budget, AOPA reported that orthotic devices are currently provided to patients in the public health system following GP referral to the public hospital. This may be associated with waiting periods.⁶⁹ Orthotists may be employed directly by the hospital or work in a private clinic which is contracted to provide orthotic services to the hospital. In either case, orthotists work as part of a multidisciplinary team (MDT). NSW Health has a policy that describes how prescription and supply of orthotic devices should be separated to avoid conflicts of interest (real or perceived).⁷⁰

AOPA reported in a submission to the ACCC that patients can see an orthotist privately at their own cost. Some private health insurance providers will reimburse orthotist visits and it is not uncommon for insurers to reimburse for the cost of prescribed devices (but not for any clinical service) following referral by another healthcare provider, for example a podiatrist.⁷¹

How does fabrication enter the orthotists workflow?

- No peer-reviewed literature described the role of fabrication in the orthotists workflow.
- Similarly, no grey literature was identified to address this question.
- Anecdotal evidence from a practising OP is that fabrication and customisation is a major component of the orthotists workflow.⁷²

Comparative models of care

No peer-reviewed literature was identified that described the model of care for orthotic provision in other relevant jurisdictions.

Grey literature was used to describe the models of care from Victoria, New Zealand and the UK:

- In Victoria, the State Government will fund orthoses for patients with a permanent or long-term disability who are not eligible for other funding options. The prescriber must be registered with the State-Wide Equipment Program (SWEP) and the quote must be approved by the SWEP before manufacture (similar to EnableNSW).⁷³
- The Hospital Admission Risk Program (HARP) is a Victorian Government initiative to reduce demand on the hospital admissions. Patients with diabetes who have foot problems (ulceration, infection) are eligible to enter high-risk foot clinics with access to publicly funded, hospital-based outpatient clinics and/or community clinics as required. Orthotists form a part of the HARP multidisciplinary teams.⁷⁴
- In New Zealand, private orthotic clinics have contracts with public hospitals for publicly-referred patients. Patients do not pay for treatment. Accident Compensation Corporation (ACC) will cover costs for orthotic devices and all associated costs for patients referred by a specialist where the orthotic is required following an accident. Alternatively, patients may self-refer or be referred by a

GP or other health professional. In these cases patients are responsible for the full cost of treatment.⁷⁵

- In the UK, orthotic services are funded by the NHS. Patients are referred by a GP or specialist to an NHS orthotics clinic in a hospital or a private clinic with a contract to the NHS. Patients may also see an orthotist privately. It has been suggested that orthotic services in the UK are underused and that an increase in awareness of services and ease of access will result in overall cost-savings to the NHS.⁷⁶

No evidence (grey or peer-reviewed) was identified that provided a comparison between the NSW model of care and those from elsewhere in Australia or overseas.

Future changes/challenges

No peer-reviewed literature was identified that discussed potential future changes or challenges to the orthotic model of care.

Grey literature sources were used to identify the following potential issues:

- In a submission to the Federal Budget (2015–16), the AOPA is lobbying for orthotists to have access to a new MBS item number under Chronic Disease Management arrangements. This would enable GPs to refer patients with chronic conditions and complex care needs to an orthotist (up to a maximum of five times per year). This would increase patients' access to orthotists and possibly enable patients to be seen at an earlier stage of disability when care may be less complex.⁶⁹
- Through submissions to the ACCC, the AOPA is also lobbying for increased scope of reimbursement for orthotists under private health insurance. This would enable orthotists to be reimbursed for both clinical care and supply aspects of orthotic provision which would increase the orthotists scope of practice.⁷¹
- The Agency for Clinical Innovation has reported that NSW is implementing guidelines for high-risk foot clinics for hospital outpatients. Orthotists would work as part of a multidisciplinary team to treat patients who are at risk of hospital admission. Similar to HARP; this may also enable patient to be seen earlier in the care pathway before significant deterioration occurs.⁷⁷

Summary of the literature

- Government documents for EnableNSW were used to describe the model of care for orthoses provision in NSW.
- No peer-reviewed or grey literature discussing how fabrication enters the orthotists workflow was identified.
- Grey literature was used to describe the models of care in Victoria, NZ and the UK. Grey literature was appraised using the tool shown in [Table 8, Appendix 4](#) and all met minimum quality standard (overall score of ≥ 4 out of a possible score of 7).

- No evidence from grey or peer-reviewed sources was identified that compared the NSW model of care to that used in other locations.
- Grey literature which met the minimum quality standard was used to describe possible future changes and challenges to the current model of care. All documents met minimum quality standard (overall score of ≥ 4 out of a possible score of 7).

Gaps in the literature

- No peer-reviewed literature was available describing the role of orthotists in the model of care.
- No literature (peer-reviewed or grey) was identified that discussed the role of fabrication in the orthotists workflow.
- No peer-reviewed or grey literature was identified that compared a NSW model of care to models used in other national and international locations.
- No peer-reviewed literature was identified that discussed future challenges associated with the NSW model of care.

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6 Appendices

Appendix 1: Research questions and scope

Research question 1: What is the evidence regarding the adequacy of the training pathway for OPs in NSW?

Scope of question 1:

- For the purpose of this question “training” is meant to include broadly the whole process of becoming an OP, including education, on the job training and certification.
- Premise the answer to this question with a description of the current training pathway for OPs in NSW.
- For the purpose of this question, the adequacy of a training pathway is defined broadly and it depends on what evidence is found in the literature. For example inadequate training may be a pathway that is overly complex in some areas and/or too superficial in other areas.
- Include evidence showing whether current training results in a workforce that has the skills necessary to satisfy the current or projected demand of services.
- If evidence from NSW is not available, researchers can use evidence from other Australian jurisdictions and/or from New Zealand.

Research question 2: What is the evidence regarding the factors that may determine the retention of the OP workforce in NSW?

Scope of question 2:

- Include factors such as limited opportunities for career and/or professional development, lack of appropriate mentoring or supervision and difficulties in accessing training location.
- If evidence from NSW is not available, researchers can use evidence from other jurisdictions or New Zealand.
- If there is no specific evidence for OPs, researchers can use evidence regarding allied health that is likely to apply to the OP profession. If so, the focus should be on general retention strategies and not on rural retention issues.

Research question 3: What is the evidence regarding how new technologies and a changing population composition are shaping the future role and scope of practice of OPs in NSW?

Scope of question 3

- For the purpose of this question, the role of the OP refers to the activities of the OP (such as developing treatment plans or casting orthoses) while the scope of practice refers to the areas of

the profession in which the OP can safely operate.

- Do not include technical articles that merely describe advanced technologies or have mostly clinical content. Rather, focus on articles that describe the skills and training expected to be brought by the new technologies.
- Include articles that can help to understand how the demand for OP services is expected to change in the future.
- Do not include articles that merely describe projected changes in the population composition if they cannot be related to the demand for OP services. For example, pure demographic projections are not useful to the agency because they cannot directly evaluate what are the implications for the OP workforce.
- Include articles describing how the OP profession is expected to overlap with other professions such as biomedical engineering or with other technical professions.
- Include evidence from other countries, such as UK, USA, Canada, NZ, and other OECD countries with socioeconomic composition similar to Australia.

Research question 4: What is the evidence regarding which OP models of care are currently in use and what drivers may affect these models in the future?

Research question 4a: What is the evidence regarding how the process of fabrication currently enters the OP workflow and what drivers may affect it in the future.

Scope of question 4

- For the purpose of this question, “models of care” refers to the way OPs operate within both public and private healthcare systems. For example, do they operate as part of a multidisciplinary team? In which setting do they mostly see their patients?
- Include papers that describe how the OP providers blend patient care with the design and fabrication of devices. For example, do OP providers in NSW, or other jurisdictions, fabricate the devices themselves or collaborate with technicians and or other professions (which ones?) to deliver the final product?
- Include papers such as *this*^b that outline the current model of care and its possible interaction with the National Disability and Insurance Scheme.
- Include evidence from other countries, such as UK, USA, Canada, NZ, and other OECD countries with socioeconomic composition similar to Australia.

^b www.pc.gov.au/inquiries/completed/disability-support/submissions/subdr0971.pdf

Research question 5: What is the evidence regarding additional factors, not outlined in questions 3 and 4, that may affect the future of the OP workforce?^c

Scope of question 5:

- Include in this section factors discovered while answering the previous questions that may help the agency to plan the type of resources and training the OP workforce may need in the future.
- Include factors such as anticipated changes to MBS/PBS funding policies or documented trends in products offered by private insurers.

^c Question 5 was not explicitly addressed in this report as all relevant information identified was included in the answers to questions 1-4.

Appendix 2: Methods

The challenge for this review was identifying evidence specific to NSW in the peer-reviewed literature. Given the paucity of such evidence, searches were extended to grey literature sources and general internet searches. The lack of NSW-centric evidence required a pragmatic stepwise approach to broadening the jurisdiction for evidence from NSW to Australia and New Zealand. If this was not successful, selection of evidence was extended to OECD countries with similar socioeconomic profiles to Australia.

Peer reviewed literature searches

The scope for each research question was confirmed with NSW Health. This was used to define the initial scoping searches on 3 July 2015. Articles that met the inclusion criteria were screened for appropriate text words and Medical Subject Headings (MeSH) terms. These were utilised to define a comprehensive search strategy using a range of relevant search terms optimised for the PubMed database ([Table 1](#)). Thereafter, search terms were adapted to the specific platform requirements of other databases.

Table 1: MeSH terms and Text words optimised for PubMed[†] searches

Concept	Terms (Boolean operator)
Profession	(Orthotist[Text Word] OR prosthetist[Text Word])
	OR
Workforce and training terms	((Orthotic*[Text Word] OR prosthetic*[Text Word]) AND (assistant[Text Word] OR trainee*[Text Word] OR "Inservice Training"[MeSH] OR student[Text Word] OR Students[MeSH] OR "Students, Health Occupations"[MeSH] OR technician[Text Word] OR "professional development"[Text Word]))
	NOT
Excluded devices / procedures	(Dental[Text Word] OR cardiac[Text Word] OR heart[Text Word] OR valve[Text Word] OR retina[Text Word] OR optic[Text Word] OR nerve[Text Word] OR mammary[Text Word] OR arthroplasty[Text Word])

[†] Optimised PubMed search was translated to other databases e.g. substitution of MeSH with EmTree terms for Embase

Searches for peer-reviewed literature were conducted in the bibliographic databases detailed in [Table 2](#). Searches were date limited to either 1990 to 3 July 2015 or from inception to 3 July 2015. All searches were limited to English language only articles. Finally, the bibliographies of all included studies were hand-searched for any additional relevant literature.

Table 2: Databases searched for peer-reviewed literature.

Database	Period covered
Cochrane Library – including Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, the Cochrane Central Register of Controlled Trials, the Health Technology Assessment Database, and the NHS Economic Evaluation Database (Ovid platform)	1990 to 3 July 2015
PubMed (incorporating Medline)	1990 to 3 July 2015
EMBASE (excluding Medline)	1990 to 3 July 2015
Web of Science (excluding Medline)	1990 to 3 July 2015
EBSCO (including CINAHL)	1990 to 3 July 2015
OVID including: Joanna Briggs Institute Evidence –based practice (JBI EBP), Medline, and PsychINFO)	Inception to 13 July 2015 1990 to 3 July 2015 1990 to 3 July 2015
Informit	1990 to 3 July 2015
Epistemonikos	1990 to 3 July 2015
Campbell Collaboration Library	1990 to 3 July 2015
Web of Science	1990 to 3 July 2015

Targeted searches (PubMed only)

Due to the paucity of peer-reviewed literature, two additional targeted searches were conducted to provide supplementary evidence for the research questions. These included: (a) a targeted search for relevant literature on retention issues in the allied health workforce, and (b) literature that detailed the orthotic and prosthetic models of care and OP provision of orthoses and prostheses in OECD countries. Searches were date limited from January 2010 to July 2015 and restricted to English language articles.

Internet searches

The list of grey literature resources was reviewed and confirmed by NSW Health. Internet searches for relevant reports, submissions, training course details and reviews were conducted across the websites listed in [Table 3](#). For websites with limited search functionality, the Google Advanced search function was used. All searches were performed from 8 July to 22 July with URLs and descriptions of contents being recorded prior to final selection and retrieval of full-text. Search terms describing workforce, occupation, vocation and profession were used (for example: orthotics, orthotic, prosthetics, prosthetic, orthotists and prosthetists). To increase the focus on OP literature the NOT operator was used to exclude results regarding implantable prosthetic devices (for example: dental, breast or heart valves).

Table 3: Specific websites search to identify relevant grey literature.

Website name	Location (URL)
National Disability Insurance Scheme	www.ndis.gov.au/
Australian Orthotic Prosthetic Association Ltd	www.aopa.org.au/
Enable NSW	www.enable.health.nsw.gov.au/
Amputee Association of New South Wales	www.amputeesnsw.org.au/
Australian Institute of Health and Welfare	www.aihw.gov.au/
Australian Government: The Department of Health	www.health.gov.au/
Health Education & Training Institute (NSW)	www.heti.nsw.gov.au/
Clinical Excellence Commission (NSW)	www.cec.health.nsw.gov.au/
Bureau of Health Information (NSW)	www.bhi.nsw.gov.au/
Agency for Clinical Innovation (NSW)	www.aci.health.nsw.gov.au/
APC Prosthetics	www.apcprosthetics.com.au/
La Trobe University, National Centre for Prosthetics and Orthotics	www.latrobe.edu.au/
Western Australian Limb Service for Amputees (WALSA)	www.health.wa.gov.au/walsa/home
Government of Western Australia: Department of Health	www.healthywa.wa.gov.au
Queensland Government: Queensland Health	www.health.qld.gov.au
Government of South Australia: SA Health	www.sahealth.sa.gov.au
Tasmanian Government: Department of Health and Human Services	www.dhhs.tas.gov.au
Northern Territory Government: Department of Health	www.health.nt.gov.au
Government of Victoria: Department of Health	www.health.vic.gov.au
VicHealth	www.vichealth.vic.gov.au/
National Association for the Advancement of Orthotics and Prosthetics (USA)	www.naaop.org/
Allied Health Professions Australia	www.ahpa.com.au
International Society for Prosthetics and Orthotics (Canada)	www.ispo.ca
National Commission on Orthotic and Prosthetics Education (USA)	www.ncope.org
Canadian Association for Prosthetics and Orthotics	www.pando.ca
The British Association of Prosthetists and Orthotists	www.bapo.com
American Academy of Orthotists and Prosthetists	www.oandp.org
American Orthotic and Prosthetic Association	www.aopanet.org
360 Orthotics and Prosthetics (USA)	www.360oandp.com/

General databases

In addition, databases that index grey literature (Table 4) were searched using the following terms: orthotics orthotic prosthetics prosthetic orthotists prosthetists AND workforce occupation vocation profession (- dental cardiac heart breast). Sites that did not use Boolean text were searched with the following terms: orthotics orthotic prosthetics prosthetic orthotists prosthetists.

Table 4: Databases that index grey literature as searched on 9 July 2015

Database	URL
Mednar Including: Administration and Aging, Am College of Physicians, ClinicalTrials.gov, Mayo Clinic, National Guidelines Clearinghouse, National Heart Lung and Blood Institute, National Inst. Of Aging, National Inst. Of Allergy, National Inst. On Drug Abuse, NLM, Natural Standard, NIH Medline Plus, NY Times Health, Substance abuse and mental health services admin., US Department of Health and Human Services, WebMD (Exclude PubMed and NLM)	www.mednar.com
National Guideline Clearinghouse	www.guideline.gov
NHMRC – Clinical Practice Guideline Portal	www.clinicalguidelines.gov.au
Productivity commission	www.pc.gov.au
Evidence Australia	www.evidenceaustralia.net
Health Direct Australia	www.healthdirect.gov.au
NZ Guidelines Group	www.health.govt.nz/about-ministry/ministry-health-websites/new-zealand-guidelines-group
NZ Ministry of Health	www.health.govt.nz
Trip Database	www.tripdatabase.com
NICE	www.nice.org.uk
Clinical Key	www.clinicalkey.com
World Wide Sciences Including: Agris, CERN, British Library, Directory of Open Access Journals, PAGES, ETDEWEB, IDRC, INIS, Joint Research Centre Publications Repository, LENUS, Library of Congress, OpenGrey, Science.gov, SciTech Connect, Trove	www.worldwidescience.org
Global Health Observatory	www.who.int/gho/en
Proquest	www.proquest.com

Study selection

The process for study selection for this review was conducted in four phases:

1. All reference citations retrieved from all literature sources were collated into an EndNote X7 database
2. Duplicate references were removed
3. Studies were excluded on the basis of the citation information, where it was obvious that they did not meet the pre-specified inclusion criteria. All other studies were retrieved for full-text assessment

4. Studies were included to address the research questions if they met the pre-specified criteria applied by the evaluator on the full-text articles. Those articles meeting the inclusion criteria formed the evidence base.

Study selection was performed by one reviewer and any areas of uncertainty were checked with a second reviewer. Any disagreement was resolved by consensus following discussion with a third researcher. The results of the process of study selection are provided in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart in [Figure 3, Appendix 3](#). Inclusion and exclusion criteria for both database and grey literature searches are shown in [Table 5](#).

Table 5: Inclusion and exclusion criteria for study selection

Research question	Inclusion criteria	Exclusion criteria
Question 1	OP Education	Education of patients
Question 2	Workforce retention Allied health workforce	Outside Australia
Question 3	Changing population relating to OP practice New technologies in OP Future of OP practice	Unrelated population changes History of OP profession
Question 4	Orthotic and prosthetic models of care Provision of orthoses and prostheses	Case studies

Data extraction

Data were extracted by one reviewer and checked by a second using standardised data extraction tables developed *a priori*. Any disagreements or discrepancies in the extracted data were resolved through discussion. Data were only reported if stated in the text, tables, graphs or figures of the article, or if they could be accurately extrapolated from the data presented.

Quality appraisal

Quality appraisal tools used in this Evidence Check are detailed in [Appendix 4](#).

- Systematic reviews were appraised using the AMSTAR tool⁷⁸
- Narrative reviews were appraised using the NOTARI tool developed by the Joanna Briggs Institute⁷⁹
- Qualitative research was appraised using the CASP checklist³⁵
- Grey literature was appraised using a fit-for-purpose appraisal tool developed *a priori* ([Appendix 4](#))
- Observational studies were appraised using STROBE Statement.⁸⁰

Quality appraisal was conducted by one reviewer and any areas of uncertainty were checked with a second reviewer. Any disagreement was resolved by consensus following discussion with a third researcher.

Appendix 3: PRISMA diagram

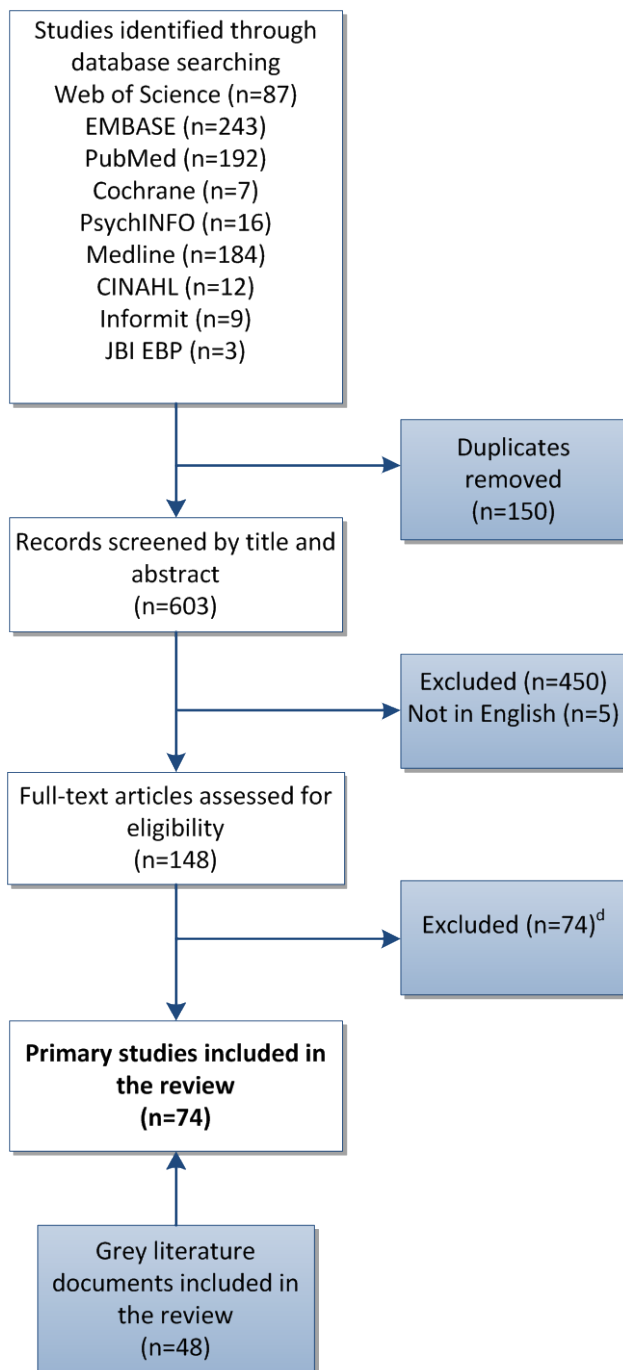


Figure 3: PRISMA diagram for the selection process for peer-reviewed and grey literature related to OP Workforce planning^d

^d Reasons for exclusion can be provided upon request.

Appendix 4: Quality appraisal tools

Table 6: Modified CASP checklist for appraisal of qualitative literature³⁵

Measure of quality	Notes	Y/N/?
Was there a clear statement of aims of the research?	<ul style="list-style-type: none"> • What was the goal of the research? • Why it was thought important? • Its relevance. 	
Was relevant literature reviewed?	<ul style="list-style-type: none"> • Is the need for the research clear and compelling? 	
Is the qualitative methodology appropriate?	<ul style="list-style-type: none"> • If the research seeks to interpret or illuminate the actions and/or subjective experiences of research participants • Is qualitative research the right methodology for addressing the research goal? 	
Was the research design appropriate to address the aims of the research?	<ul style="list-style-type: none"> • If the researcher has justified the research design (e.g. have they discussed how they decided which method to use)? 	
Was the recruitment strategy appropriate?	<ul style="list-style-type: none"> • If the researcher has explained how the participants were selected • If they explained why the participants they selected were the most appropriate to provide access to the type of knowledge sought by the study • If there are any discussions around recruitment (e.g. why some people chose not to take part). 	
Was data collected in a way that addressed the research issue?	<ul style="list-style-type: none"> • If the setting for data collection was justified • If it is clear how data were collected (e.g. focus group, semi-structured interview etc.) • If the researcher has justified the methods chosen • If the researcher has made the methods explicit (e.g. for interview method, is there an indication of how interviews were conducted, or did they use a topic guide)? • If methods were modified during the study. If so, has the researcher explained how and why? • If the form of data is clear (e.g. tape recordings, video material, notes) • If the researcher has discussed saturation of data. 	
Have ethical issues been taken into consideration?	<ul style="list-style-type: none"> • If there are sufficient details of how the research was explained to participants for the reader to assess whether ethical standards were maintained • If the researcher has discussed issues raised by the study (e.g. issues around informed consent or confidentiality or how they have handled the effects of the study on the participants during and after the study) • If approval has been sought from the ethics committee. 	
Was the data analysis sufficiently rigorous?	<ul style="list-style-type: none"> • If there is an in-depth description of the analysis process • If thematic analysis is used. If so, is it clear how the 	

Is there a clear statement of findings?	<p>categories/themes were derived from the data?</p> <ul style="list-style-type: none"> • Whether the researcher explains how the data presented were selected from the original sample to demonstrate the analysis process • If sufficient data are presented to support the findings • To what extent contradictory data are taken into account • Whether the researcher critically examined their own role, potential bias and influence during analysis and selection of data for presentation. 	
Is the research valuable?	<ul style="list-style-type: none"> • If the findings are explicit • If there is adequate discussion of the evidence both for and against the researchers arguments • If the researcher has discussed the credibility of their findings (e.g. triangulation, respondent validation, more than one analyst) • If the findings are discussed in relation to the original research question. 	

To meet the *a priori* determined minimum quality rating, a study must receive a 'yes' to ≥ 6 out of the 10 questions. Y = yes, N = no, ? = unclear

Table 7: Modified JBI NOTARI checklist for appraisal of narrative reviews⁷⁹

Measure of quality	Notes	Y/N/?
Is the source of the opinion clearly identified?	Is there a named author? Unnamed editorial pieces in journals or newspapers, or magazines give broader licence for comment, authorship should be identifiable.	
Does the source of the opinion have standing in the field of expertise?	The qualifications, current appointment and current affiliations with specific groups need to be stated in the publication and the reviewer needs to be satisfied that the author(s) has some standing within the field.	
Is the opinions' basis in logic/experience clearly argued?	In order to establish the clarity or otherwise of the rationale or basis for the opinion, give consideration to the direction of the main lines of argument. Questions to pose of each textual paper include: What are the main points in the conclusions or recommendations? What arguments does the author use to support the main points? Is the argument logical? Have important terms been clearly defined? Do the arguments support the main points?	
Is the argument that has been developed analytical?	Does the argument present as an analytical construct of a line of debate or does it appear that <i>ad hoc</i> reasoning was employed?	
Is there reference to other literature and any incongruence with it logically defended?	If there is reference to the extant literature, is it a non-biased, inclusive representation, or is it a non-critical description of content specifically supportive of the line of argument being put forward? These considerations will highlight the robustness of how cited literature was managed.	
Is the opinion supported by peers?	This relates to peer opinion that has been published rather than peers in the sense of a colleague. To ascertain if the opinion expressed has wider support, consider also if the author demonstrated awareness of alternate or dominant opinions in the literature and provided an informed defence of their position as it relates to other or similar discourses.	

To meet the *a priori* determined minimum quality rating, a study must receive a 'yes' to ≥ 4 out of the 6 questions.
Y = yes, N = no, ? = unclear

Table 8: Tool used to appraise grey literature (adapted from the JBI NOTARI tool and the AACODS checklist)^{79, 81}

Measure of quality	Notes	Y/N/?
Is the author clearly identifiable?	<ul style="list-style-type: none"> It should be clear who (individual or organisation) authored the piece. 	
Is the date of publication clear and recent enough that source is relevant?	<ul style="list-style-type: none"> Is the date of publication (and any updates) clearly identifiable? Have contemporary issues been considered in the publication? 	
Is the author or organisation reputable?	<p>For individual authors some factors to consider may include:</p> <ul style="list-style-type: none"> Is the author associated with a reputable association? Do they have professional qualifications or considerable experience in the field? Have they published peer-reviewed literature in the field? Are they a higher degree student under expert supervision? <p>For organisations:</p> <ul style="list-style-type: none"> Is the organisation reputable? Is the organisation an authority in the field? 	
Has the publication been peer-reviewed?	<ul style="list-style-type: none"> Should be able to tell this from the journal 	
Is the argument supported by peer-reviewed publications or credible sources?	<ul style="list-style-type: none"> Are any references provided? Are these peer-reviewed? Are they authored by reputable authors? 	
Does the reasoning support the conclusions?		
Does the publication seem balanced?	<ul style="list-style-type: none"> The publication will often be the authors' opinion, but the authors' standpoint should be clear and the work should seem balanced in presentation, i.e. should be in line with other published literature or provide a valid counterpoint. 	

To meet the *a priori* determined minimum quality rating, a study must receive a 'yes' to ≥ 4 out of the 7 questions.
Y = yes, N = no, ? = unclear

Appendix 5: Included studies and data extraction for Question 1

Table 9: Peer-reviewed publications regarding the adequacy of the training pathway for OPs in NSW

Study ID location	Purpose	Study design	Study setting	Key findings	Appraisal tool meets quality standard ✓/x
Spiers & Harris (2015) Australia ²⁴	Identify and synthesise challenges to student transition in allied health undergraduate education in the rural and remote context	Review	Rural and remote Australia	<ul style="list-style-type: none"> • One way to increase allied health practitioners into non-metro locations is to train local students • Rural and remote students accessing allied health education face barriers • Barriers: secondary education and financial disadvantage, social dislocation, lack of consideration of health careers • Barriers can be addressed by the following enablers: secondary completion, alternate pathways, financial incentives, transition support and health career promotion. 	NOTARI ✓
Al Qaroot & Sobuh (2014) Jordan ⁵	Find out if integrating research into OP undergraduate studies enhances clinical practice	Qualitative interview (7 participants)	University of Jordan	<ul style="list-style-type: none"> • The 'research-informed clinical practice' module helped students deal with their patients in terms of diagnosing, prescription and manufacturing prostheses • Students also expressed increased interest in using evidence in clinical decision making. 	CASP ✓
Funk (2007) USA ¹⁰	Describe the experiences of senior-level occupational therapy students in using learning portfolios as comprehensive learning tool in an O&P course	Qualitative questionnaire, focus groups, observation, and learning reflections (30 participants)	University of Texas at El Paso	<ul style="list-style-type: none"> • Students developed a learning portfolio containing evidence of completed learning objectives, self and peer assessments of work performed, and weekly learning reflections • Portfolios provided a global structure from which to meet established objectives, they assisted students in directing their education, staying accountable to their objectives, evaluating self and others, and developing higher-level thinking skills • Strengths include versatility and ability to assess students who do poorly in tests. A limitation is students being uncomfortable with a new learning style. 	CASP ✓

Hovorka et al. (2002a) USA ⁶	Highlight the need for responsive, contemporary, advanced OP education programs	Review	Orthotic and prosthetic graduate programs in USA throughout the past 50 years	<ul style="list-style-type: none"> • Curriculum has not kept pace with the new technologies in OP • Problems: lack of uniform vision of the future, no contemporary curricular design, lack of texts designed for comprehensive overview to teach about evolving, fragmented and complex subject matter • OP education is expensive compared to other academic programs involving significant laboratory space and inventory of equipment • It is questioned whether a four-year degree can produce a healthcare professional equipped to interact successfully with other professionals as part of a team. 	NOTARI ✓
Hovorka et al. (2002b) USA ⁷	Introduce the concept of an Entry-Level Interdisciplinary Graduate Degree preparing Orthotists for the future	Review	Orthotic and prosthetic graduate programs in USA	<ul style="list-style-type: none"> • For the advancement of this allied health profession, the research base it relies upon must expand and evolve • It is critical that OP courses are improved as technology and healthcare evolve • To address these issues, an interdisciplinary entry-level graduate degree program is proposed as well as a Master degree. 	NOTARI ✓
Wong (2007) Hong Kong, China ⁸	Report on a study on the development of critical thinking skills for student OPs	Prospective observational study	The Hong Kong Polytechnic University	<ul style="list-style-type: none"> • Training in developing critical thinking skills allows OPs to improve their practice. 	CASP ✓
Aminian et al, (2011) Australia ¹⁵	Compare current OP curricula from a range of regions including developed and developing countries	Review and Delphi process	Iran and Australia	<ul style="list-style-type: none"> • Programs from 10 regions of the world were studied • There was agreement that programs should improve student knowledge and understanding, fabrication and communication skills and student cooperation • Regional variability in clinical reasoning, integration of theory into practice and particular approaches to OP • Delphi process did not reflect complete preparation of professional skills with Bachelor level OP courses • There was variation in teaching methods and disagreement on effectiveness of various approaches. 	CASP ✓
Wong et al.	Explore if OP learning	Prospective	The Hong	<ul style="list-style-type: none"> • Implementing eLearning is able to produce equivalent or better 	CASP

(2004) Hong Kong, China ⁹	can be enhanced by eLearning technology and methodology	observational study	Kong Polytechnic University	<p>results on career relevance and problem solving measures, even with substantial hands-on content</p> <ul style="list-style-type: none"> • Students appreciated the easy access, integrated and interactive approach. 	✓
Ash et al. (2015) Australia ¹⁷	Describe the methodology used by AOPA to determine the minimum level for entry into the OP profession in Australia; validate entry-level Competency standards	Methods paper (focus group, Delphi review)	Members of AOPA, Australia	<ul style="list-style-type: none"> • Gaps in the current Competency standards were found to be: an emphasis on evidence-based and ethical practice with a client/patient focus; the need for continuing professional development; and mentoring to remain professionally current and identification of scope of practice • Performance indicators are: collaborative practice, providing clinical care, providing orthoses/prostheses, service management and improvement, professional behaviour, lifelong learning and reflective practice. 	CASP ✓

AOPA = Australian Orthotic Prosthetic Association Ltd, EBP = evidence-based practice, ICF = International Classification on Functioning, Disability and Health, OP = Orthotists/Prosthetists, UK = United Kingdom, USA = United States of America, WHO = World Health Organization. ✓ = meets minimum quality standards. X = does not meet minimum quality standards. NA = not applicable (resource was not quality appraised)

Table 10: Grey literature regarding the adequacy of the training pathway for OPs in NSW

Author, year Location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
La Trobe University (2015), Australia ⁸²	La Trobe University Orthotics and Prosthetics	Course outline page	<ul style="list-style-type: none"> Course includes clinical experience, some fabrication and a focus on evidence-based practice Workshops allow students to experiment with materials and equipment first hand Min. additional cost of \$890 for study resources. 	Grey literature tool ✓
Australian Health Workforce Advisory Committee (2006) Sydney, Australia ⁸³	Australian Health Workforce Advisory Committee, Sydney	Give an overview of allied health workforce planning issues in Australia	<ul style="list-style-type: none"> OP is considered an allied health occupation in Australia The training and education of allied health professionals should not be solely in the tertiary sector, consideration should be given to the role of the VET sector to alleviate pressure on allied health education and training. 	NA
AHPRA (2011), Australia ²²	AHPRA Registration Standards	Set the CPD registration standard for chiropractors	<p>Practising registrants must:</p> <ul style="list-style-type: none"> Complete at least 25 hours of CPD per annual registration period At least 50% of these hours must be 'formal' learning Hold a First Aid certificate in addition to CPD Maintain a portfolio of evidence of their CPD activities. 	NA
Mason (2013) Canberra, Australia ¹¹	Review of Health Workforce programs	Give a review of Australian Government Health Workforce Programs including analysis, research and consultation with stakeholders	<ul style="list-style-type: none"> Option of HECS forgiveness for some allied health professions The work leading to this report instigated the establishment of Health Workforce Australia, which has now been dissolved. 	NA

Advanced Education Research Training Initiatives (2004) USA ⁸⁴	Strategic Plan	A United States-based strategic plan to foster advanced scientific and research education in OP and to build the academic and scientific research capacity of the profession	<p>Recommendations:</p> <ul style="list-style-type: none"> • Institution or Program Grants for existing programs • Student Training Grants for advanced research degrees in OP • Career Development Awards for faculties to pursue advanced research degrees • Research Education Funds should be made available to improve the level of research education for entry-level clinicians and experienced practitioners. 	Grey literature tool ✓
EnableNSW (2010) Sydney, Australia ⁸⁵	EnableNSW	Outline the requirements for accreditation for Prosthetists and Prosthetic Centres under the Prosthetic Limb Service	<p>Prosthetists applying for accreditation will be required to:</p> <ol style="list-style-type: none"> 1. Have eligibility for full AOPA membership 2. Present references from two prosthetic prescribers (EnableNSW accredited or equivalent) dealing with the prosthetist's clinical and manufacturing skills 3. Be employed/contracted or have an agreement with an EnableNSW-accredited Prosthetic Service Provider 4. Participate in a professional development program, including supervision by an identified EnableNSW accredited prosthetist and ongoing education, commensurate with clinical skills and experience. This program should be documented and be aligned with the formal health accreditation system of the facility e.g. Australian Council of Healthcare Standards, or AOPA Continuing Professional Development program. 	NA
Australian Government Department of Education (2013) Canberra, Australia ⁸⁶	MyFuture	Career information and exploration service provides information on what is it like to be an OP	<ul style="list-style-type: none"> • Secondary school subjects that would provide a good foundation: Biology, Industrial Arts, Physics • Personal requirements: aptitude for technical tasks, good communication skills, enjoy helping people, able to work as part of a team. 	NA

AOPA (2010) ⁸⁷ Melbourne, Australia	AOPA document	Submission from the OP profession for inclusion in the national registration scheme for health professionals	<ul style="list-style-type: none"> The current training of OPs in Australia. 	Grey literature tool ✓
Shaw et al. (2010) Sydney, Australia ²³	Sax document	Rapid review of tele-learning for health professionals	<ul style="list-style-type: none"> Tele-learning can be as effective as or equivalent to face-to-face learning in terms of outcomes Qualitative studies have clearly established the value of tele-learning. 	AMSTAR ✓
QUT (2015) Brisbane, Australia ¹⁹	Personal communication	What new courses are available to train fabricators?	<ul style="list-style-type: none"> A new international Master Degree in bio-fabrication will be jointly offered in Australia by QUT and the University of Wollongong Commencing in 2015 Graduates with degrees in science, mechatronics and materials engineering may apply 10 scholarships are available and non-funded positions may be made available. 	NA
University of Sunshine Coast, (2015) Sunshine Coast, Australia ²	Personal communication from the University and AOPA by email	What new courses are available to train OPs?	<ul style="list-style-type: none"> The Bachelor of Health Science (Prosthetics and Orthotics) is due to start in 2016 Expect to enrol 10 students per year with expansion in the future Aligned with the AOPA Competency standards. 	NA
AOPA (2015), Australia ⁴	AOPA Membership Information	How does the AOPA assess the skills of overseas trained OPs who wish to join the Association?	Overseas trained OPs must: <ul style="list-style-type: none"> Pay \$620 application fee Prove themselves to have equivalent qualification to the La Trobe Bachelor degree Achieve IELTS level 7 for students from non-English speaking countries. 	NA
AOPA (2014),	AOPA Document	Competency standards	<ul style="list-style-type: none"> The domains, activities, performance indicators and 	Grey literature

Australia ²⁰	range statements of OP Competency standards in Australia	tool ✓
	<ul style="list-style-type: none"> • Individuals who meet the Competency standards at entry to the profession are expected to develop beyond this level with work experience • These standards were first introduced in 1999, and revised in 2003 and 2014. 	

AOPA = Australian Orthotic Prosthetic Association Ltd, HECS = higher education contributions scheme, IELTS = International English Language Test System, NSW = New South Wales, NZALS = New Zealand Artificial Limb Service, OP = Orthotists/Prosthetists, QUT = Queensland University of Technology, VET = vocational education and training. ✓ = meets minimum quality standards. X = does not meet minimum quality standards. NA = not applicable (resource was not quality appraised)

Table 11: Curriculum for Bachelor of Applied Science and Master of Clinical Prosthetics and Orthotics at La Trobe University

First year			
Teaching period	Subject code	Subject title	Credit points
TE-SEM-1	ABS0WOM	Wominjeka La Trobe: Indigenous Cultural Literacy for Higher Education	0
TE-SEM-1	HLT1AIM	Academic Integrity Module	0
TE-SEM-1	HBS1HBA	Human Biosciences A	15
TE-SEM-1	HLT1IPP	Introduction to Professional Practice	15
TE-SEM-1	PHE1IDH	Individual Determinants of Health	15
TE-SEM-1	Elective	Level 1 – Subject may be taken from anywhere in the University. Any prerequisites must be met.	15
TE-SEM-2	HBS1HBB	Human Biosciences B	15
TE-SEM-2	HLT1RAE	Research and Evidence in Practice	15
TE-SEM-2	PHE1SDH	Social Determinants of Health	15
TE-SEM-2	Elective	Level 1 – subject may be taken from anywhere in the University. Any prerequisites must be met.	15
Second year			
Teaching period	Subject code	Subject title	Credit points
TE-SUMMER 3	POR2TPO	Trends in Prosthetics and Orthotics	15
TE-SEM-1	Elective	Level 2 or 3 – subject may be taken from anywhere in the University. Any prerequisites must be met.	15
TE-SEM-1	HLT2IEP	Integrating Evidence into Practice	15
TE-SEM-1	HBS2ALU	Anatomy: Lower and Upper Limbs	15
TE-SEM-1	POR2PGC	Paediatrics and Gerontology in Prosthetics and Orthotics	15
TE-SEM-1	HBS2SUM	Science and Use of Materials	15
TE-SEM-2	HBS3NPM	Normal and Pathological Movement	15
TE-SEM-2	POR3CAT	Clinical Assessment Techniques	15
TE-SEM-2	POR3SLF	Orthotic Management of Spinal and Limb Fractures	15
TE-SEM-2	HBS3PPO	Pathophysiology in Prosthetics and Orthotics	15
TE-SEM-2	Elective	Level 3 – subject may be taken from anywhere in the University. Any prerequisites must be met.	15

Third year			
Teaching period	Subject code	Subject title	Credit points
TE-SUMMER 3	POR3COF	Clinical Orthotic Management of the Foot	15
TE-SEM-1	POR3CTT	Clinical Transtibial Prosthetics	15
TE-SEM-1	POR3ETT	Evidence of Transtibial Prosthetics	15
TE-SEM-1	POR3EOF	Extended Orthotic Management of the Foot	15
TE-SEM-1	POR3ACR	Applied Clinical Research in Prosthetics and Orthotics	15
TE-SEM-2	POR4EFA	Evidence of Foot Ankle Orthotics	15
TE-SEM-2	POR4CFA	Clinical Foot Ankle Orthotics	15
TE-SEM-2	POR4SCR	Seminars in Clinical Research	15
TE-SEM-2	POR4MUL	Management of the Upper Limb	15

Fourth year			
Teaching period	Subject code	Subject title	Credit points
TE-W09-24	POR5CEA	Clinical Education in Prosthetics and Orthotics A	30
TE-W06-24 or W28-46	POR5ELP	Extended Lower Limb Prosthetics	30
TE-W06-24 or W28-46	POR5ELO	Extended Lower Limb Orthotics	30
TE-W31-46	POR5ECE	Extended Clinical Experience	30

Appendix 6: Included studies and data extraction for Question 2

Table 12: Grey literature used to describe the makeup of the OP workforce in NSW

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
AOPA (2014) NSW, Australia ²⁵	AOPA website	To provide a snapshot of the OP workforce in NSW between 2007 and 2012	<ul style="list-style-type: none"> The number of registered practitioners in NSW remained steady between 2007 and 2012 (48 registered OPs) while the state population increased, reducing the practitioner to population ration from 0.70 to 0.66 in the five-year period This is one of the lowest ratios in Australia (national average is 1.09) and below international figures (USA = 2.4 in 2002, UK = 1.48 in 2014) and the recommended figure for orthotists of 3.0 (REF: NHS Scotland, 2005) The percentage of rural/remote practitioners remained at 4% (2 OPs) over the same time period OP in NSW is a male-dominated industry (5:1 in 2007) although proportionately more women are entering the profession (ratio of 3.4:1 in 2012) The average age of practitioners in NSW 2012 was 45 years, compared to 48 years in 2007. The number of young practitioners doubled from 15% below 35 years in 2007 to 31% in 2012 The national average for registered OPs (39 years). 	Grey literature tool ✓
AOPA (2011) Australia ²⁸	AOPA website	Submission to the practitioner regulation subcommittee for inclusion in the National Registration and Accreditation	<ul style="list-style-type: none"> There are a disproportionate number of practitioners in and around Melbourne (likely due to proximity to training centre) There is national variation in clinical role of OPs; some jurisdictions provide OP services integrated in MDTs while in others access to OPs is isolated Practitioners prefer working in centres with a strong clinical 	Grey literature tool ✓

		Scheme	<p>focus</p> <ul style="list-style-type: none"> • Reduced workforce numbers may lead to increased selectivity about where practitioners work and result in only employer and locations 'of choice' having adequate staffing • Retention is particularly challenging in rural and remote areas • AOPA suggest national registration scheme would consistently define the role of OPs in Australia, remove barriers to workforce mobility and allow collection of workforce data to support planning. 	
AOPA (2015) Australia ⁴	Australian Government Department of Industry website	AOPA submission to Skills Australia for listing on the Skilled Occupation List	<ul style="list-style-type: none"> • Demand for OPs is expected to increase due to the NDIS. • The training capacity at La Trobe is currently capped at 40 students per year* • The AOPA is of the opinion that current training limits will not meet predicted shortfalls of OPs and list on the SOL is required to attract international OPs • The AOPA acknowledges that there is a cohort of unemployed graduates and that workforce shortfalls are in experienced practitioners • Following a 2012 submission, OPs were listed on the specialised occupation list (SpOL), eligible for example, for subclass 457 visas. 	Grey literature tool ✓
AOPA (2015) Australia ⁶⁹	AOPA website	AOPA federal budget submission 'Improving patient access to vital orthotic and prosthetic services'	<ul style="list-style-type: none"> • The preliminary workforce data suggests that the profession's demographics are shifting to be more in line with trends seen in other allied health disciplines • Preliminary data raises questions around possible issues in retention of female practitioners. 	Grey literature tool ✓
NAHPF (2012) UK ⁸⁸	Centre for Workforce Intelligence website	To highlight patient concerns over the shortage of OPs in the UK	<ul style="list-style-type: none"> • Patients are concerned there are significant shortfalls in the number of OPs (now and in the future) • OP numbers are declining as the need for services increases. 	Grey literature tool ✓

AOPA = Australian Orthotic Prosthetic Association Ltd, MDT = multidisciplinary team, NAHPF = National Allied Health Patients' Forum, OP = orthotists/Prosthetists

*may change with addition of USC Bachelor's degree commencing 2016

Table 13: Peer-reviewed publications used to inform on factors that may determine the retention of allied health workers in Australia

Study ID location	Purpose	Study design	Study setting	Key findings	Appraisal tool meets quality standard ✓/x
Bell et al. (2014) Queensland ³³	To develop an allied health professional support policy to improve client outcomes, workforce satisfaction and clinical governance in the Queensland health system	Literature review and qualitative consultation	Queensland Health network of 178 hospitals and healthcare facilities	<ul style="list-style-type: none"> • Professional support contributes to high quality clinical practice, better client outcomes, enhanced workplace satisfaction, increased morale and better clinical governance • Uptake of professional support may be low – many supervisees indicate they have not had the opportunity to supervise • Implementation requires organisational support to market the concepts and benefits of supervision and increase participation • Implementation relies on organisation time and resources – organisational issues such as lack of choice of supervisor have been found to be key barriers to effective supervision • New graduates (less than 2 years since qualification) should participate in a minimum 1 hour per week of professional supervision • Professionals with 2–5 years’ experience should participate in 1 hour per fortnight • Professionals with >5 years’ experience should participate in 1 hour per month • At least 50% of professional support should be obtained from an appropriate supervisor within the same profession. 	CASP checklist ✓

Whitford et al. (2012) South Australia ³⁰	To collect data about the demographics, education, recruitment and retention of the allied health workforce SA (including metropolitan and rural practitioners)	Mixed methods approach – survey	Survey of all allied health professionals practising in SA	<ul style="list-style-type: none"> • Factors that attracted workers to their current position included: type of work/clients, work-life balance, career advancement and income • Reasons professionals cited for planning to leave their current employment included: better career prospects, higher income and retirement. Other common themes included a lack of recognition and family issues • Generation Y respondents (born 1982–2000) were more likely to indicate they were planning to leave their job within 2 years • The main reason for baby-boomers (born 1943–1960) cited for planning to leave their job was retirement (three-quarters of sample planning to leave within 10 years) • There appeared to be lower job satisfaction levels in mid-career practitioners (p = NS). Further strengthening job satisfaction and career advancement opportunities such as advanced practice roles or teaching/research positions may help improve retention. 	CASP checklist ✓
Dodd et al. (2009) Western Australia, Tasmania, Queensland ²⁹	To explore reasons for a lack of workforce continuity among allied health professionals in WA, TAS and QLD and to make recommendations addressing recruitment and retention issues	Mixed methods approach – survey	Survey mailed to 1685 allied health professionals working with children in the government and non-government paediatric disability sectors	<ul style="list-style-type: none"> • Generation Y respondents cited travel, to work with new patient group and lack of professional development as main reasons for leaving employment • Generation X cited the decision to have children and impact of work on family (work-life balance). • Reasons cited for beginning a new job included: broadening work experience, salary, professional development, flexible work hours, supportive supervisory structures, positive organisational 	CASP checklist ✓

				cultures, disillusionment with previous job and family-friendly working environments.	
Wilson et al. (2015) New South Wales ³²	To determine the aspects of the allied health professionals job that most contribute to job satisfaction and intention to leave	Mixed methods approach - survey	Metropolitan hospital in NSW	<ul style="list-style-type: none"> • A significant correlation was found between low job satisfaction measures (quality of supervision, level of competency to do job, recognition for doing job, advancement opportunities, feelings of worthwhile accomplishment, communication and support from manager) and intention to leave a workplace. 	CASP checklist ✓
Smedts et al. (2013) Northern Territory ³¹	To characterise the NT allied health workforce in order to understand the influence of student supervision on retention	Qualitative survey	All allied health professional in NT	<ul style="list-style-type: none"> • Factors that attracted practitioners to their current positions were: level of income, type of work and work-life balance • A strong relationship between low satisfaction and intention to leave current position was identified • Student supervision was not correlated to job satisfaction in this survey • Models of supervisor recruitment and retention should focus on professionals not currently teaching, complemented with strategies to overturn the perception that supervision leads to workload overburden • Student supervision should be incorporated into core business sand strategic planning. 	CASP checklist ✓
Harris et al. (2010) Australia ⁸⁹	To describe the development and implementation of an intervention to facilitate teamwork between general practice and allied and community health providers	Qualitative analysis	4 divisions of general practice and 26 urban practices	<ul style="list-style-type: none"> • All health professionals endorsed the need for greater communication with other health providers • Facilitating teamwork across organisational boundaries is challenging • Joint education and direct communication between healthcare providers helps enable working relationships • Practice nurses are a key link between general 	CASP checklist ✓

				practices and allied health services.	
Kilpatrick et al. (2007) Australia ³⁴	To explore solutions to current and projected skills shortages within the health and community services sector	Literature review and qualitative analysis	6 models of service delivery as case studies	<ul style="list-style-type: none"> Two main themes emerged in the review of models of service delivery – use of a partnership approach to address skills shortages and targeting specific groups for training and employment. <p>Partnership approaches:</p> <ul style="list-style-type: none"> Key example – the NSW Community Services and Health Industry Skills Council and Central Coast Health – Mental Health Services partnership. Strategies include strengthening role of Central Coast Consultative Committee, a professional development program that facilitates workplace learning opportunities and facilitation of a structure for agency collaboration Other key examples include partnership between government and training organisations. This may include: upskilling and extending the scope of practice for professionals, negotiating changes to training programs to meet current and projected skills shortages. <p>Targeted recruitment, training and employment approaches:</p> <ul style="list-style-type: none"> Targeting disadvantaged groups to address underemployment and fill skills shortages. This may include “the disabled, those over 45 years and those from culturally and linguistically diverse backgrounds” Other models target school students or workers in 	CASP checklist ✓

				<p>other professions looking for a “sea-change”. Most models incorporate flexible work arrangements, remedial education, careers counselling, supportive employers, financial assistance, appropriate funding structures and a career ladder</p> <ul style="list-style-type: none"> • Cultural appropriateness is a key ingredient of successful models – there are a number of models designed to attract Indigenous people to the health sector, for example, Mt Isa Rural Health School in QLD. <p>Overall:</p> <ul style="list-style-type: none"> • There needs to be balance between short-term solutions to skill shortages (training only) and medium-long term solutions (job redesign and holistic approaches) that will also address projected shortages through increased retention • Responsibility for addressing shortages is jointly shared between health sector, education and training organisations and government. 	
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✓ = meets minimum quality standards. X = does not meet minimum quality standards. NA = not applicable (resource was not quality appraised)

Appendix 7: Included studies and data extraction for question 3

Table 14: Peer-reviewed publications regarding how new technologies and a changing population composition are shaping the future role of OPs scope of practice of OPs in NSW

Study ID location	Purpose	Study design	Study setting	Key findings	Appraisal tool meets quality standard ✓/x
New technologies					
Marks & Michael (2001) Middlesex, UK; Minnesota, USA ³⁷	Describe technological innovations in prosthetic limbs currently available and future developments	Review	UK and USA	<ul style="list-style-type: none"> Prosthetic innovations are used sparingly at first, just for amputees with private funding, e.g. those who are competitive athletes As experience is gained, fabricators learn how to apply the same principles to moderate cost devices intended for less active individuals, and the performance of prostheses in general gradually improves as a result Financial constraints limit the rate of advancement in prosthetic rehabilitation as the vast majority of amputees reside in the developing world. 	NOTARI ✓
Wagner et al. (2008) UK ³⁶	Describe the effects of new technology adoption, namely rapid manufacture, on employee skills in the OP profession	Review	UK	<ul style="list-style-type: none"> With the emergence of new technologies in prosthetic provision, the main skill set at present will become obsolete. However, the skills change could be viewed as more realignment than loss, with potential for upskilling in some areas The main changes that rapid manufacture would bring, i.e. the 3D CAD model and scanning techniques, are already used in some cases to create the CNC milled cast and can be used with existing knowledge. CAD skills are more transferable to other jobs and may be more appealing to the younger generation Lowered skill requirements may help increase prosthetic 	NOTARI ✓

				services.	
Hovorka et al. (2002a) USA ⁶	Highlight the need for responsive, contemporary, advanced OP education programs	Review	Orthotic and prosthetic graduate programs in USA throughout the past 50 years	<ul style="list-style-type: none"> The rapidly expanding elderly population in need of orthotics and prosthetics care, encroachment by other health care providers delivering orthotics and prosthetics services, the advancement of medicine and technology and changes in managed health care all highlight the need for responsive, contemporary, advanced orthotics and prosthetics education programs. 	NOTARI ✓
Changing population					
Dillon, Kohley & Peeva (2014) ⁴²	Describe population-wide trends in incidence of lower limb amputations in Australian hospital from 2000 to 2010, and determine the effects of accounting for partial foot amputations	Descriptive study	All amputations reported by Australian hospitals in the time period	<ul style="list-style-type: none"> The proportion of partial foot amputations has grown in recent years as lower limb amputations decrease with resulting changing patient requirements Need for prosthetic services may decline, and need for high-risk foot clinics and wound care expertise may increase Highlights the growing need for specialisation and education in prosthetics with new trends in practice. 	STROBE ✓

CAD = computer-aided drafting, CNC = Computer Numerical Controlled, STROBE = Strengthening of Reporting in Observational studies in Epidemiology tool, USA = United States of America, UK = United Kingdom. ✓ = meets minimum quality standards. X = does not meet minimum quality standards. NA = not applicable (resource was not quality appraised)

Table 14: Grey literature regarding how new technologies and a changing population composition are shaping the future role and scope of practice of OPs in NSW

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
New technologies				
Centre for Workforce Intelligence, (2012) UK ³⁹	CFWI website	Establish workforce risks and opportunities for OPs	<ul style="list-style-type: none"> Advances in socket design will reduce demand on prosthetists as new sockets require less maintenance and fewer adjustments needing to be made Orthotists may experience a reduction in demand as a result of advances in orthoses and in production techniques. 	Grey literature tool ✓
Willow Wood Company, (2007) Ohio, USA ⁴⁰	Willow Wood brochure	Marketing information	<ul style="list-style-type: none"> Electronic 3D imaging will increase efficiency for OPs. 	Grey literature tool X
NCOPE, (2006) Virginia, USA ³⁸	NCOPE report	Demand study prepared for the National Commission on Orthotic and Prosthetic Education and American Orthotic and Prosthetic Association by Health Consulting	<ul style="list-style-type: none"> Coming advancements in technology will likely place an increased demand on OPs. These technological advancements should improve practitioner efficiencies creating a certain amount of counter-balance on supply and demand OP professionals will increase utilisation of CAD/CAM, and the time saved by scanning versus casting is approximately 50%, with an average three-hour procedure reduced down to 1.5 hours Bionic technologies are among the drivers in technological innovations revolutionising both prosthetic and orthotic care The revolutionising prostheses of the future will create a paradigm shift because of the neuro-control strategy. This will change the way prosthetists work with patients. In addition, it will greatly expand the time, need and demand for the prosthetist to serve as patient educator and trainer The growth rates of pre-fabricated device procedures vastly exceed that of custom-made devices and this has implications for 	Grey literature tool ✓

			<p>the practice of OPs</p> <ul style="list-style-type: none"> Those procedures that could be performed by other medical professionals are rising much higher than OP-only procedures. 	
Nielsen (2002) USA ⁴¹	Nielsen (2002) report	Explore issues affecting the future demand of OPs in the USA	<ul style="list-style-type: none"> A key issue which will affect the number of certified OPs required in the future is health insurance policies for particular categories of providers In this fluctuating reimbursement environment, research, public relations, and educational efforts are essential to demonstrate the high quality and cost effectiveness of patient care by certified OPs. 	Grey literature tool ✓
Changing population				
Department of Health, Western Australia, (2010) Perth, Australia ⁴³	High Risk Foot Model of Care	Describe prevalence and model of care for high-risk diabetic foot	<ul style="list-style-type: none"> Diabetic foot disorders are the leading cause of non-traumatic lower extremity amputation. It is estimated that patients with diabetes have 10–40 fold higher prevalence of amputation than people without 70–85% of these amputations are precipitated by a foot ulcer. Lower limb amputation is associated with significant morbidity and mortality, as approximately 50% experience foot ulceration or amputation of the contralateral limb within 2 to 5 years Approximately 15% of all patients with diabetes will develop an ulcer during their lifetime. This is significant given the exponential increase in the incidence of diabetes in recent decades There are an estimated 246 million people with diabetes internationally and this is projected to increase to 380 million by the year 2025 A national Australian study showed an average of 2673 amputations per year as a result of diabetes in the mid 1990s. The AIHW estimated that this had increased to 3400 lower limb amputations in the 2004/2005 period. 	NA

NCOPE = National Commission on Orthotic and Prosthetic Education, OP = Orthotists/Prosthetists, UK = United Kingdom, USA = United States of America. ✓ = meets minimum quality standards. X = does not meet minimum quality standards. NA = not applicable (resource was not quality appraised)

Summary of new skills and technologies in orthotic and prosthetic provision (Table 14 and Table 15)

- CAD – computer aided design
 - 3D imaging
- Material science – use of new materials e.g. carbon fibre
 - New lightweight materials have issue of manufacture – need for greater precision in manufacture
- Adaptive prostheses/orthoses – this would include seating and high performance devices
- Novel prosthetic designs for recreation/vocational pursuits e.g. the Cheetah (C-leg) for running.
 - Devices designed for high performance
 - This will require knowledge of biomechanics or ability to work with professionals versed in the art of biomechanics
- Motion analysis
 - Use of surrogates to map typical motions/gaits – important for microprocessor controlled devices
- Increasing knowledge of robotics
- Novel control systems for prostheses
 - Myoelectric control
 - Neuro implants for control of prosthetic movement (future)
- More life-like coverings of prostheses
- Gel liner technology
- Rapid manufacture technologies
 - 3D printing (future)
- Artificial muscles (future)
- Osseo-integration (future).

Epidemiological data

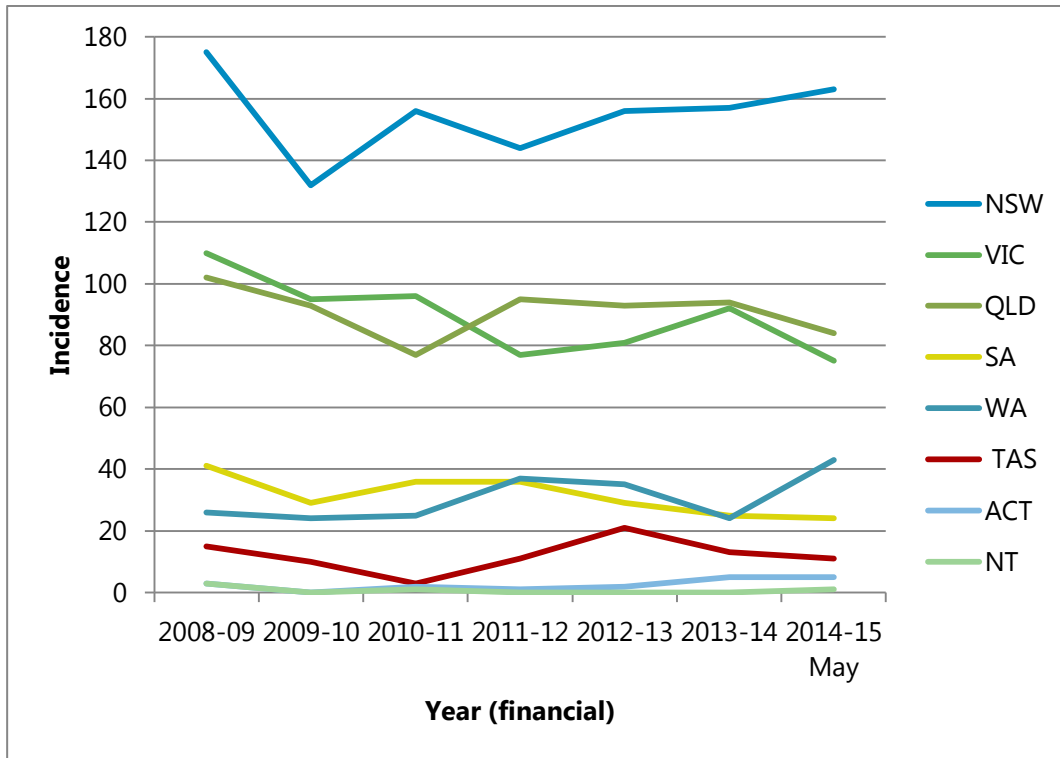


Figure 4: Amputations for all states from Jul 2008 to May 2015

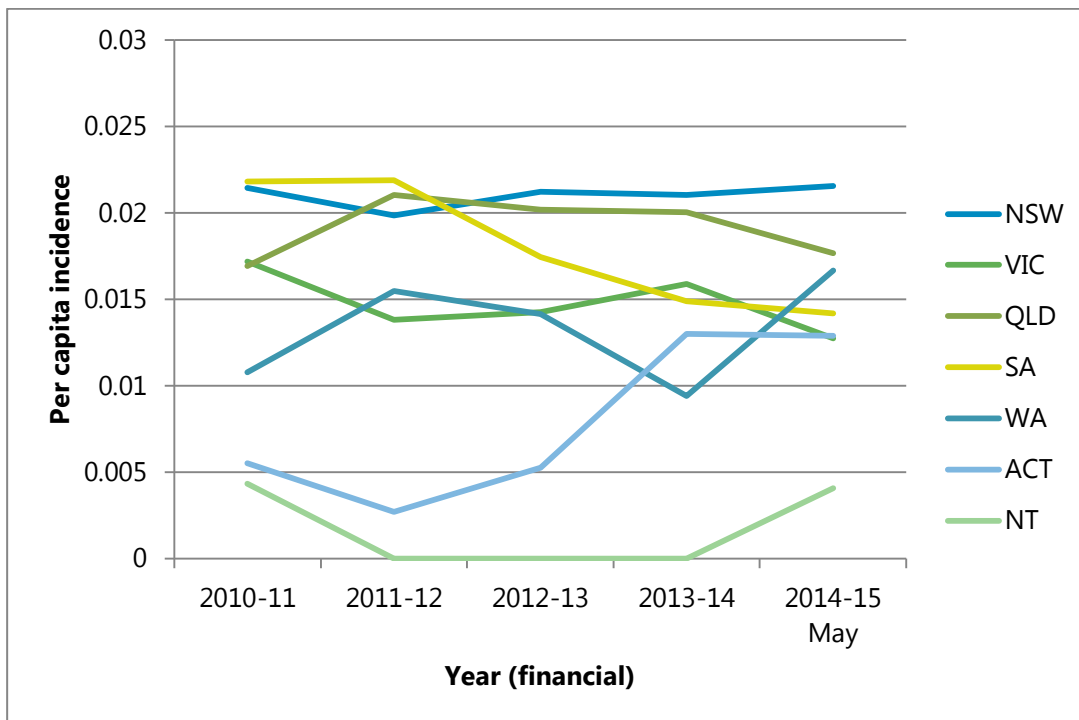


Figure 5: Per capita amputations all states from Jul 2010 to May 2015 – excluding Tasmania

Table 15: NSW amputations by item from July 2010 to May 2015, MBS data

NSW	2010–11	2011–12	2012–13	2013–14	2014–15 May
HAND, MIDCARPAL OR TRANSMETACARPAL, amputation of	3	2	2	3	1
HAND, FOREARM OR THROUGH ARM, amputation of	3	0	0	0	0
AMPUTATION AT SHOULDER	0	0	0	0	1
FOOT AT ANKLE (Syme, Pirogoff types), amputation of	2	1	1	2	0
FOOT, MIDTARSAL OR TRANSMETATARSAL, amputation of	24	11	20	11	10
AMPUTATION THROUGH THIGH, AT KNEE OR BELOW KNEE	124	128	133	141	150

Table 16: Diabetes in Australia 2011–12 to 2012–13, AIHW

Principal Diagnosis in ICD-10-AM	1999–2000	2012–13	Increase
E11 Type 2 Diabetes Mellitus	12,983	26,197	100%

Table 17 : Most commonly used O&P diagnoses – Principal Diagnoses ICD-10-AM, AIHW

Principal Diagnosis in ICD-10-AM	2008–09	2009–10	2010–11	2011–12	2012–13
R26.0 Ataxic gait	346	330	292	363	361
R26.1 Paralytic gait	8	9	10	0	0
R26.8 Other and unspecified abnormalities of gait and mobility	1559	1580	1820	2050	2616
Q67.0 Facial asymmetry	26	16	25	0	0
G80.9 Cerebral palsy, unspecified	480	544	501	530	567
S06.8 Other intracranial injuries	328	294	317	339	318
Q66.6 Other congenital valgus deformities of feet	56	47	43	48	43
M41.1 Juvenile idiopathic scoliosis	141	147	141	177	190
M41.2 Other idiopathic scoliosis	114	106	127	119	137
M43.6 Torticollis	249	261	282	302	310
Q66.89 Other congenital deformities of feet	629	638	555	685	726
S88 Traumatic amputation of lower leg	25	23	21	15	19

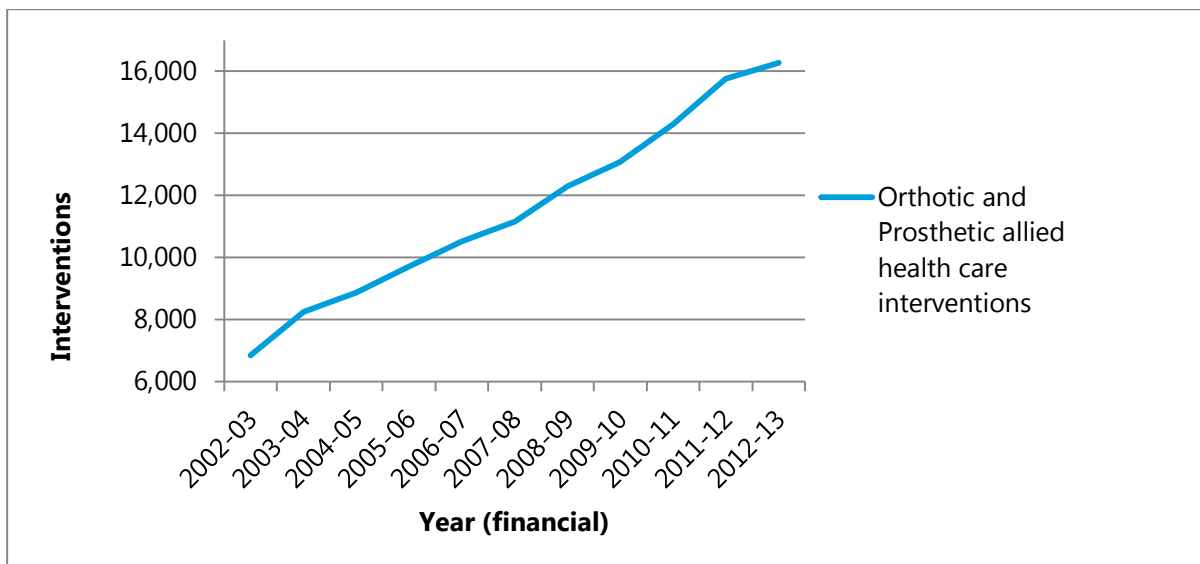


Figure 6: Orthotic and Prosthetic allied healthcare interventions ACHI 7th edition – AIHW

Appendix 8: Included studies and data extraction for question 4

Prosthetics

Table 18: Peer-reviewed publications used to inform the model of care for prosthetic provision in NSW

Study ID location	Purpose	Study design	Study setting	Key findings	Appraisal tool meets quality standard ✓/x
Gordon et al. (2010) NSW ⁵⁵	To compare outcomes for an interim prosthetic program in the public and private models of service provision	Case series – observational study	2 NSW hospitals (large metropolitan teaching hospitals) between 2006 and 2008	<ul style="list-style-type: none"> In the public model (prosthetists employed as salaried staff members of the hospital) labour logs showed 31% of the prosthetists time was spent on limb fabrication and fitting the prosthetists. Sixteen per cent was spent on service provision (ward rounds, case conferences, and education sessions). In the private model, the ALS funded 14 hours per transtibial prosthesis which covered all aspects of fabrication, gait analysis, fitting and patient education. The public model of service provision had lower costs overall (\$1391.11 per-participant vs. \$1917.19 per-participant in the private model). Patient outcomes were equivalent between the two models. 	CASP ✓

ALS = artificial limb scheme

Table 19: Grey literature used to inform the model of care for prosthetic provision in NSW

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
EnableNSW: NSW Health Support Services (2011) NSW ⁶⁶	EnableNSW website	Prescription and provision guidelines for titanium components for limb prostheses	<p>Titanium components can only be prescribed by an eligible prescriber if:</p> <ul style="list-style-type: none"> • The consumer has an activity level of K3 or K4 (ability to walk with variable cadence beyond simple walking or potential for prosthetic use exhibiting high impact, stress or energy levels) • Or if the consumer has a body weight >125 kg (any activity level, prescription by an accredited prescriber not required). 	NA
EnableNSW: NSW Health Support Services (2010) NSW ⁵⁰	EnableNSW website	Guidelines for accreditation of amputee units, prescribing medical specialists, prosthetists, prosthetic service providers	<ul style="list-style-type: none"> • This guideline contains detailed criteria for primary and re-accreditation with EnableNSW • This document was used to inform the 'Model of care diagram' for prosthetic limbs (Figure 2). 	NA
EnableNSW: NSW Health Support Services (2013) NSW ⁵¹	EnableNSW website	How to obtain a prosthetic limb through EnableNSW	This document was used to inform the 'Model of care diagram' for prosthetic limbs (Figure 2)	NA
EnableNSW: NSW Health Support Services (2013) NSW ⁵²	EnableNSW website	Information for consumers: New prosthetic limbs contract	This document was used to inform the 'Model of care diagram' for prosthetic limbs (Figure 2)	NA
EnableNSW: NSW Health Support Services (2015) NSW ⁵³	EnableNSW website	Prosthetic limbs – funding guidelines	This document was used to inform the 'Model of care diagram' for prosthetic limbs (Figure 2)	NA
AOPA (2011) Australia ⁶⁴	Productivity Commission	Submission to the Productivity Commission:	There are three phases amputee patients go through following loss of a	Grey literature tool ✓

	website	response to disability care and support inquiry	limb: <ul style="list-style-type: none"> • Acute – pre- and post-amputation hospital care (23 weeks). • Rehabilitation – stabilisation, mobilisation, gait training and physical conditioning (next 60 days of care). Occurs in a rehabilitation hospital then as an outpatient. • Lifelong care – ongoing care for the amputee’s life. 	
Limbs 4 Life(2011 Australia) ⁹⁰	Productivity Commission website	Submission to the Productivity Commission: response to disability care and support inquiry	<ul style="list-style-type: none"> • In Australia there are >10 funding models for prosthetic provision • The current model is underfunded and there is no parity between states • Current funding does not support developments in technology • Funding needs to be tailored to suit individual patients • High-end equipment is only available to patients who are supported by compensable insurance programs or those who are willing to pay out-of-pocket costs. 	Grey literature tool ✓
NDIS (2014) Australia ⁶⁷	NDIS website	Guideline to describe what supports for prosthetic limbs will be covered by the NDIS	<ul style="list-style-type: none"> • It is expected that NDIS will fund entry level or standard grade prostheses up to K2 classification and will consider higher prostheses for people of K3 and K4 classification. • Repairs, ancillary costs and limbs external to osseo-integrated implants will likely be funded. • It is unlikely that interim limbs, the delivery and cost of surgery and implants for osseo-integrated limbs will be funded by the NDIS. 	NA
Limbs for life(2006), Australia ⁵⁴	Limbs 4 Life website	Describes current funding arrangements in Australia for prosthetic limbs	How prostheses are funded will depend on the cause of the amputation. Generally speaking the following categories apply: <ul style="list-style-type: none"> • If limb loss is due to a workplace accident, then rehabilitation costs, which includes all the costs of the prostheses will be met by WorkCover • Most work accident claims are met by a number of different insurance companies, with WorkCover providing the overall legislative framework. These companies are required to meet 'reasonable costs', so complex componentry can be justified and be fitted if required. 	Grey literature tool ✓

			<ul style="list-style-type: none"> • If limb loss is due to a transport accident the patient is to contact the relevant authority in their state or territory where they reside to make a claim • If limb loss is due to disease or illness, the patient will be covered by public funding in their state or territory of residence • Government funding via the public health system is available to all Australian citizens • In most cases the prosthesis provided will depend on funding allocations per state. Often the more sophisticated prosthetic items cannot be provided • Veterans who either lost their limb as a result of injuries received while serving, or who have a Gold Card, will have their prostheses paid for by the Department of Veterans Affairs (DVA). 	
Limbs 4 Life(2015), Australia ⁶⁸	Limbs 4 Life website	Describes future funding under the NDIS	<ul style="list-style-type: none"> • The patient will meet with an NDIS planner to develop a participant plan design to meet their individual goals. Patients can access NDIS registered providers as required in their participant plan • OPs will need to be registered providers with the NDIS • The NDIS will improve equity across the country and standardise processes • Recreational limbs or specialised limbs (for example for showering) may be covered under the NDIS for some patients. 	Grey literature tool ✓
AOPA (2014), Australia ⁵⁶	AOPA website	Submission to the Community Services and Health Industry Skills Council: Technicians and support workers	<ul style="list-style-type: none"> • Many OPs have a high level of technical involvement in prosthetic and orthotic manufacture • AOPA believes OPs should be freed from technical activities to allow for increased patient care • Fabrication can be performed by technical staff although there are training and retention issues with this workforce that should be considered. 	Grey literature tool ✓

AOPA = Australian Orthotic Prosthetic Association Ltd. DVA = Department of Veterans Affairs. K0-K4 describes the function levels for prosthetic users, see [Table 21](#) OPs = orthotists and/or prosthetists

Table 20: K Classification for describing functional levels of prosthetic users

K	Functional level	Description
K0	Functional Level 0	The patient does not have the ability or potential to ambulate or transfer safely with or without assistance and a prosthesis does not enhance their quality of life or mobility.
K1	Functional Level 1	The patient has the ability or potential to use a prosthesis for transfer or ambulation on level surfaces at fixed cadence. Typical of the limited and unlimited household ambulator.
K2	Functional Level 2	The patient has the ability or potential for ambulation with the ability to traverse low-level environmental barriers such as curbs, stairs or uneven surfaces. Typical of the limited community ambulator.
K3	Functional Level 3	The patient has the ability or potential for ambulation with variable cadence. Typical of the community ambulator who has the ability to traverse most environmental barriers and may have vocational, therapeutic or exercise activity that demands prosthetic utilisation beyond simple locomotion.
K4	Functional Level 4	The patient has the ability or potential for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress or energy levels. Typical of the prosthetic demands of the child, active adult, or athlete.

Table 21: Peer-reviewed publications used to inform the model of care for prosthetic provision internationally

Study ID Location	Purpose	Study design	Study setting	Key findings	Appraisal tool meets quality standard ✓/x
Wyss et al. (2013), International ⁹¹	To compare issues relating to prosthetic provision across different economies.	Qualitative survey	International survey of prosthetic practitioners	The top five primary drivers of provision care as cited by OPs in high income countries are: <ul style="list-style-type: none"> • Cost, component weight, prosthetic appearance, practitioner training/skills, standardised techniques and residual limb condition. 	CASP ✓

OPs = orthotists and/or prosthetists

Table 22: Grey literature used to inform the model of care for prosthetic provision in Victoria, NZ, the UK and the USA

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
VDH (2014) Victoria ⁹²	Victorian Government website	To describe policy and funding guidelines for the Victorian Health Services	<ul style="list-style-type: none"> The VALP funding is provided as a block grant to health services This is a non-admitted subacute service Services expected to provide artificial limbs under the VALP in 2014–15 are the Royal Children’s Hospital, Peninsula Health, Melbourne Health, Alfred Health, Barwon Health, Ballarat Health Services, Austin Health, St Vincent’s Health, Latrobe Regional Hospital, Bendigo Health and South West Healthcare Hospitals are able to charge a co-payment for the provision of non-basic prostheses. 	NA
NZ Artificial Limb Service (NZALS) (2014) New Zealand ⁶⁰	NZALS website	To brief incoming Minister on the NZALS	<ul style="list-style-type: none"> The NZALS is the national provider of artificial limbs in NZ to approximately 4300 amputees NZALS is an autonomous Crown entity The NZALS provides an individualised service to amputees at multidisciplinary clinics at 5 limb centres and 13 regional clinics. 	NA
NZALS (2013) New Zealand ⁵⁹	NZALS website	Statement of intent 2013–2016	<ul style="list-style-type: none"> NZALS is the sole national provider of prostheses Prosthetists are employed by the NZALS at multidisciplinary limb centres with medical specialists and physiotherapists. Bulk funding from Ministry of Health Some patients are covered under ACC, for these patients funding works on a case management model, the NZALS charges ACC for actual services to the individual Services are needs focused balanced with available funding Proactive collection of statistics on the amputee population and hospitals to ensure: regional clinics meet demand for clinics; all suitable amputees are referred for service and workforce planning Collects clinical assessment data on mobility, independence and 	NA

			<p>QOL annually. Independent client survey on experiences with the service conducted at least every 3 years</p> <ul style="list-style-type: none"> • Eighty-five per cent of clients report being satisfied with their most recent limb. Satisfied clients are more likely to be mobile, independent and employed in paid or voluntary work. 	
NHS (2015) UK ⁶¹	NHS website	Schedule 2 – Service specifications: prosthetic specialised services for people of all ages with limb loss	<ul style="list-style-type: none"> • The NHS funds all prosthetic provision • Rehabilitation and re-ablement of patients is provided by a multidisciplinary team. Appointment should be flexible and available out of working hours if patients require • The service is provided through a National Network of Specialist Rehabilitation Service Centres • Prosthetic services may be provided by prosthetists employed directly by the hospital or by appropriate providers contracted to the NHS. Prosthetists should be seen as equal members of the MDT and foster collaborative innovations in technologies and systems • Service provision can be through a tertiary centre, a standard centre or a satellite centre. In all cases, prosthetists should be part of the MDT. 	NA
BICN (2013) USA ⁶²	National Institute of Standards and Technology website	Limb prosthetic services and devices. critical unmet need: market analysis	<p>Limb prosthetic services and devices are provided by a third party reimbursement model. Principal sources of reimbursement are:</p> <ul style="list-style-type: none"> • Private insurers (including individual's insurance companies, HMOs PPOs, hospitals, workers' compensation programs) • Medicare (federally funded insurance for people aged 65 or over and certain disabled persons) • Medicaid (joint funded insurance by federal and state governments for certain persons in financial need) • Department of Defence and DVA • Government reimbursements account for 40% to 50% of payments for prosthetic devices. These payers have maximum 	Grey literature tool ✓

			reimbursement levels set and adjusted each year based on the CPI <ul style="list-style-type: none"> • Private insurers have caps on prosthetic devices range from \$500 to \$3000. Lifetime restrictions range from \$10,000 to one device for life • Coverage is reportedly poor and access is getting worse over time. 	
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ACC = Accident Compensation Corporation. BICN = Bioengineering Institute Centre for Neuro-prosthetics. CPI = Consumer Price Index. HMO = Health Maintenance Organisation. MDT = Multidisciplinary Team. NHS = National Health Service. NZALS = New Zealand Artificial Limb Scheme. OPs = orthotists and/or prosthetists. PPO = Preferred Provider Organisation. QOL = Quality of Life. VALP = Victorian Artificial Limb Program. VDH = Victorian Department of Health

Orthotics

Table 23: Grey literature used to inform the model of care for orthoses provision in NSW

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
AOPA (2015), Australia ⁴	AOPA website	Federal budget Submission 2015–16: Improving patient access to vital orthotic and prosthetic services	<ul style="list-style-type: none"> Describes the model of care for orthotic provision in Australia in the public health system The AOPA is lobbying for an MBS item number under Chronic Disease Management arrangements. 	Grey literature tool ✓
EnableNSW (2015) NSW ⁷⁰	EnableNSW website	Aid and Equipment program – clinical criteria	<ul style="list-style-type: none"> EnableNSW will fund orthoses which improve the safety, independence or participation of patients and that are required directly as a result of the consumer’s permanent or indefinite disability The orthoses should allow functional capacity that cannot be provided without the orthoses NSW Health requires that the prescription and supply of equipment are appropriately separated to guard against conflicts of interest. 	NA
AOPA (2015), Australia ⁷¹	AOPA website	Response to the ACCC report to Senate of Private Health Insurance	<ul style="list-style-type: none"> It is not uncommon for private health insurers to reimburse for orthotists’ supply of orthotic devices (only custom devices, not of the shelf devices) but not for the clinical service which must be provided by another allied health professional The AOPA believes insurance reimbursement should be available for orthotists to assess, prescribe and supply devices. 	Grey literature tool ✓
Australian Government Department of Health (2015), Australia ⁹³	DoH website	To provide information on Chronic Disease Management individual allied health services	<ul style="list-style-type: none"> Medicare rebates are available for some allied health services for patients with chronic conditions and complex care needs who are on a GP coordinated Chronic Disease Management plan Orthotists services are not eligible for Medicare rebates. 	NA

		under Medicare		
NSW Agency for Clinical Innovation (2013) NSW ⁷⁷	ACI website	Standards for High Risk Foot Services (HRFS) in NSW	<ul style="list-style-type: none"> • Guidelines to support a broad implementation of HRFS in NSW • Introduction of MBS item numbers for podiatrists has increased access for patients with diabetes to receive podiatry care privately, leaving hospital-based care to focus on care of patients who are at high risk of foot ulceration, complications and amputations • The guidelines outline 'minimum standards' and 'best practice' • Best practice describes dedicated staffing with a multidisciplinary team including the services of an orthotist and an onsite orthotic laboratory. 	Grey literature tool ✓

ACCC = Australian Competition and Consumer Commission, AOPA = Australian Orthotic Prosthetic Association Ltd. HRFS = High Risk Foot Service. GP = General Practitioner. MBS = Medicare Benefits Scheme. OPs = orthotists and/or prosthetists

Table 24: Grey literature used to inform the model of care for orthotic provision in Victoria, NZ and the UK

Author, year, location	Source/website	Purpose	Summary of key points	Appraisal tool meets quality standard ✓/x
Victorian Aids and Equipment Program Guidelines (2014), Victoria ⁷³	SWEPE website	To describe the available aids and equipment subsidy available to Victorian residents	<ul style="list-style-type: none"> The Victorian Government will fund orthoses for patients with a permanent or long-term disability and who are not eligible for other funding options The prescriber must be a State-Wide Equipment Program (SWEPE) registered prescriber (including orthotists) The supplier then prepares a quote which must be approved by SWEPE before the device is manufactured. 	NA
Victorian Department of Health (2014), Victoria ⁷⁴	VDH website	Hospital Admission Risk Program (HARP) To describe the HARP program	<ul style="list-style-type: none"> HARP was developed to address increased demand on acute health services Patients at risk or already experiencing frequent emergency department presentations or hospital admissions are provided with alternative interventions Patients with diabetes who are experiencing foot problems meet the HARP eligibility screen and are therefore eligible to enter HARP provides access to publicly-funded high-risk foot clinics with hospital-based multidisciplinary teams including orthotists and/or community clinics as required. 	NA
Orthotic Centre NZ (2015), New Zealand ⁷⁵	Orthotic Centre NZ website	To describe the NZ model of care for orthotic provision	<p>There are three pathways under which patients in NZ can access orthotic devices:</p> <ul style="list-style-type: none"> Public health referral – private orthotic clinics have a contract with the District Health boards, patients are referred from the hospital to an orthotic clinic. Patients do not pay for treatment (except in some cases there is a small charge for footwear and insoles) ACC referral – for patients who require orthotic devices due to an accident (pre-approval may be required), patients require a referral from a specialist (not a GP) to an orthotic clinic, ACC then covers all costs associated with orthotic provision 	NA

			<ul style="list-style-type: none"> • Private referral – patient can be referred by a GP, private specialist, and other health professional or can self-refer. Patients are responsible for the full costs • In addition, GPs and other health professionals can refer patients with long-term disabilities to orthotic clinics to be assessed by an orthopaedic surgeon and an orthotists and obtain required treatment. There is no cost to the patient for this. 	
Centre for Economics and Business Research, (2011) UK ⁷⁶	North Staffs Orthotics Campaign website	To review the financial and economic aspects of orthotic service provision	<ul style="list-style-type: none"> • A more integrated approach to orthotic provision could result in significant savings to the NHS and the UK as a whole by increased mobility, quality of life, independence and reduced demand for other health services (amputations, orthopaedics). 	Grey literature tool ✓

ACC = Accident Compensation corporation. AOPA = Australian Orthotic Prosthetic Association Ltd. GP = General Practitioner. HARP = Hospital Admission Risk Program. OPs = orthotists and/or prosthetists. SWEP = State-Wide Equipment Program