

Pharmacy education in Australia with a special focus on clinical pharmacy education

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ABSTRACT

In Australia, there are currently two types of pharmacy programs, a four-year Bachelor of Pharmacy program and a two-year graduate entry Master of Pharmacy Program, offered by 18 Pharmacy schools. Completion of either degree together with other requirements is the current basis for registration to practice as a pharmacist.

The quality of pharmacy education and training in Australia is regulated and monitored by several governmental and professional organizations to ensure its standard.

Postgraduate pharmacy training is also available from several universities in Australia to equip practicing pharmacists with advanced knowledge and skill in clinical pharmacy.

Overall, pharmacy education and training in Australia is of high quality and producing practicing pharmacists to fulfil the current need of the local healthcare system. However, the heightened expectation for pharmacist to contribute further in health care delivery will put pressure on pharmacy schools to be more proactive in updating their curricula to meet this need.

Key words: pharmacy, education, clinical pharmacy, post graduate training, Australia

1. Introduction

In Australia, pharmacy education is currently provided through a four-year undergraduate pharmacy program (that awards a Bachelor of Pharmacy degree) or a two-year postgraduate program (that awards a Master of Pharmacy degree) through accredited universities. At present, either the Bachelor of Pharmacy (BPharm) degree or the Master of Pharmacy (MPharm) degree are acceptable for registration as a practicing pharmacist.

2. Evolution of Pharmacy Education in Australia

Pharmacy education in Australia has evolved gradually over the past hundred year into the present form. In 1881, the Melbourne School of Pharmacy (later officially renamed Victorian College of Pharmacy) was established in Melbourne (Bomford, 2006; Feehan, 1981), followed by the Sydney Pharmacy School in 1899 (The University of Sydney School of Pharmacy, 2019) to provide training of pharmacists in the rapidly developing colony. In the pre-1960's, pharmacists were trained over a period of four years through a system of "Apprenticeship plus tertiary college academic component". This involved attending the college for tuition in chemistry, botany, materia medica and

pharmacy. Students could enter the course at any date and pursue an independent course of study, leading to a registration examination, conducted by the respective State Pharmacy Board. A compulsory syllabus was formalised within the Medical Act 1915 and subsequently led to a four-year apprenticeship and study requirement for registration.

In 1960, a three-year full time Bachelor of Pharmacy Program was formally introduced to replace the part-time apprenticeship system. After the introduction, pharmacy programs gradually evolve and provide training in fields including pharmacology, chemistry, pharmaceutical chemistry, pharmacy practice (including pharmacotherapeutics, disease state management, etc.), pharmaceuticals, ethics, pharmacy law, pharmacy management, physiology, anatomy, biochemistry, kinetics, and compounding medications.

In the 1990's, the three-year full time undergraduate pharmacy program was extended to four years to accommodate the expanded curriculum of greater pharmacy practice component.

During the early 2000s, two-year postgraduate Master of Pharmacy courses were established by several universities in response to a shortage of pharmacists, but to date these have accounted for a relatively minor proportion (~20%) of pharmacy graduates every year (Table 1).

Table 1. Evolution of Pharmacy Education in Australia.

Time Period	Status of Pharmacy Education
Pre-1960	Apprenticeship plus tertiary college academic component
1960's	Introduction of 3-year full-time Bachelor of Pharmacy program
1990's	Introduction of 4-year full-time Bachelor of Pharmacy program
2000's	Introduction of 2-year full-time graduate entry Masters of Pharmacy program as another option

Currently, there are 16 pharmacy schools offering four-year undergraduate pharmacy program (Table 2), and six universities offering two-year graduate entry Master of Pharmacy program (Table 3). Graduate entry Master of Pharmacy programs are simply an accelerated pathway to completion of a pharmacy degree in two years rather than the usual four years. These programs specially cater for those students with a Bachelor's degree in a related or other

discipline. The essential difference between the MPharm and BPharm program is that students enrolled in the MPharm program are assumed to possess sufficient knowledge of the basic science subjects taught during the first year of the BPharm program. Otherwise, the content of the two curriculums are practically identical.

Graduate numbers have increased approximately 250% with a dramatic increase from six pharmacy degree programs in 1997 to 21 such programs in 2008 (Marriott et al., 2008). This large increase in graduate numbers was due to introduction of the graduate entry MPharm programs and increased student intake of the BPharm programs in response to the severe shortage of pharmacists in Australia between 1995 and 2005 (Jackson, 2016).

After successful completion of one of these university-based Bachelor's or Master's degree programs, graduates must complete an internship in a practice setting. Hence, for those students undertaking a four-year BPharm program, the minimum time required from entry to registration is five years.

Table 2. Australian Universities offering four-year undergraduate entry BPharm Program.

Name of Institute	Program offered through	Location
Charles Darwin University	School of Psychological and Clinical Sciences	Northern Territory
Charles Stuart University	School of Biomedical Sciences	New South Wales
Curtin University	School of Pharmacy	Western Australia
Griffith University	School of Pharmacy	Queensland
James Cook University	School of Pharmacy and Molecular Sciences	Queensland
La Trobe University	School of Pharmacy and Applied Science	Victoria
Monash University	Faculty of Pharmacy and Pharmaceutical Sciences	Victoria
Queensland University of Technology	School of Clinical Sciences	Queensland
RMIT University	School of Medical Sciences	Victoria
University of Canberra	Faculty of Health	Australian Capital Territory
University of Newcastle	School of Biomedical Sciences & Pharmacy	New South Wales
University of New England	School of Science & Technology	New South Wales
University of Queensland	School of Pharmacy	Queensland
University of South Australia	School of Pharmacy & Medical Sciences	South Australia
University of Sydney	Faculty of Pharmacy	New South Wales
University of Tasmania	School of Pharmacy	Tasmania

Table 3. Australian Universities offering two-year graduate entry MPharm Program.

Name of Institute	Program offered through	Location
Curtin University	School of Pharmacy	Western Australia
Griffith University	School of Pharmacy	Queensland
University of Canberra	Faculty of Health	Australian Capital Territory
University of Sydney	Faculty of Pharmacy	New South Wales
University of Technology Sydney	Graduate School of Health	New South Wales
University of Western Australia	School of Medicine and Pharmacology	Western Australia

3. Professional registration requirement

Since July 2010, registration of pharmacists, like the registration of 10 other health professions in Australia, is managed by the Australian Health Practitioners Regulation Agency (AHPRA) (Australian Health Practitioner Regulation Agency, 2019). The Australian Health Practitioner Regulation Agency (AHPRA) is the organisation responsible for the implementation of the National Registration and Accreditation Scheme across Australia, and works with 15 National Health Practitioner Boards (including the Pharmacy Board of Australia) in implementing the Scheme.

To register with the Pharmacy Board of Australia, a person will need (Pharmacy Board of Australia, 2019):

- a recognized pharmacy degree from an accredited program,
- completed 1824 hours of approved supervised practice,
- undertook an Internship Training Program and
- passed the designated exams (oral and written) held by the Board.

The supervised practice must be under the direct supervision of a pharmacist who holds general registration (a preceptor), while the pharmacist is providing pharmacy services in pharmacy premises or other circumstances as determined by the Board.

In the latest statistics released by the Pharmacy Board of Australia, there were 1682 provisional registrations (mainly

for pharmacy graduates doing their internship) in 2018 (Pharmacy Board of Australia, 2018), compared to 1661 in the same period in 2017 (Pharmacy Board of Australia, 2017). In fact, the number of provisional registrants has been quite stable since 2012 (Pharmacy Board of Australia, 2013; 2014; 2015; 2016).

4. Curriculum for Bachelor of Pharmacy Programs in Australia

The curriculum of all pharmacy programs can be grouped into three categories: Pharmaceutical sciences, Pharmacy practice and Pharmacotherapeutics. Typically, the undergraduate program is moving towards adapting an integrated approach with a strong clinical focus all over Australia. Usually more pharmaceutical science subjects are delivered in the early part of the program, with a gradual increase in the pharmacy and pharmacotherapeutics components in later part of the program.

An example of the curriculum of a four-year undergraduate entry Pharmacy program is shown in Table 4 (using the program from Monash University as the illustration) (Faculty of Pharmacy and Pharmaceutical Sciences Monash University, 2019).

Besides the didactic component, all pharmacy programs offered in Australia have significant components of clinical placement (experiential teaching). The placement usually require the students to be placed in community pharmacies,

Table 4. An example of a four-year undergraduate entry BPharm Program from Monash University.

Year 1	
Semester 1	Semester 2
Introduction to physiology Bioorganic and medicinal chemistry I Physicochemical basis of pharmacy Pharmacy, health and society I	Systems physiology Bioorganic and medicinal chemistry II Drug delivery I Pharmacy, health and society II
Year 2	
Semester 1	Semester 2
Biochemistry and molecular biology Cell function, communication and pathology Basis of drug action I Pharmacists as communicators	Basis of drug action II Drug delivery and disposition Pharmacy in a public health context <i>Integrated therapeutics: Introduction and cardiovascular</i>
Year 3	
Semester 1	Semester 2
Microbiology and immunology Drug delivery, disposition and dynamics Context for practice I <i>Integrated therapeutics respiratory and gastrointestinal disease</i>	Drug delivery II Context for practice II <i>Integrated therapeutics: Infectious diseases</i> One elective
Year 4	
Semester 1	Semester 2
Drug delivery and development Professional experience placement program <i>Integrated therapeutics: Endocrinology and renal</i> <i>Integrated therapeutics: Dermatology and pain</i>	Context for practice III <i>Integrated therapeutics: Neurology and oncology</i> <i>Integrated therapeutics: Psychiatry</i> Preparation for practice

Those in Bold = Pharm Science subjects; those in italics = Pharmacotherapeutics subjects; and the remaining = Pharmacy practice subjects

hospital pharmacies and other relevant settings for 12 weeks (Owen and Stupans, 2008).

The nature and content of experiential teaching varies among pharmacy schools. Some pharmacy programs have introductory experiential placements (externships) within the first years of the program intending to introduce the student to the range of professional activities undertaken by pharmacists. However, all programs have clinical placements incorporated into the final years after the students have acquired the appropriate level of knowledge.

In the curriculum development for both BPharm and MPharm programs, the Australian Pharmacy Council provides guidance through the accreditation standards required for curriculum development, curriculum management, experiential placement and educational outcomes. The latest standards document was published in 2012 and became effective since 2014 (Australian Pharmacy Council, 2012).

Another important development affecting pharmacy practice and pharmacy education is the release of the document “National Competency Standards Framework of Pharmacists in Australia 2016” (Pharmaceutical Society of Australia, 2016). This is an update of the “National Competency Standards Framework for Pharmacists in Australia 2010” after extensive and comprehensive review by the Pharmacy Practitioner Development Committee (PPDC). The PPDC is a profession-wide collaborative forum established to focus on the development of pharmacist practitioners through consideration of competencies and scopes of practice. The 11 Member organisations of the PPDC are: Australian Association of Consultant Pharmacy, Australian College of Pharmacy, Australian Pharmacy Council, Council of Pharmacy Schools: Australia and New Zealand Inc., National Australian Pharmacy Students’ Association, Pharmaceutical Defence Limited, Pharmaceutical Society of Australia, Pharmacy Board of Australia, Professional Pharmacists Australia, The Pharmacy Guild of Australia, and The Society of Hospital Pharmacists of Australia. The curriculum of the different pharmacy programs will need to be reassessed/changed to cater for the expected industry-endorsed higher pharmacy practice standards in the near future.

5. Quality Assurance of Pharmacy Education and Training

As previously mentioned, for quality assurance purpose, both universities and pharmacy programs that are being offered need to be accredited. This is to ensure that the pharmacy graduates meet the required professional practice and education standard as stipulated by the Government as well as the professional societies.

The organizations involved in the quality assurance of pharmacy education are the Australian Pharmacy Council (APC) (formerly New Zealand and Australian Pharmacy Schools Accreditation Committee, NAPSAC), the Australian

Qualifications Framework Council, and the Tertiary Education Quality and Standards Agency (TEQSA).

The Australian Pharmacy Council is directly responsible for (Australian Pharmacy Council, 2019):

- Accrediting pharmacy schools and programs; intern training programs; and accrediting agencies to accredit continuing professional development activities
- Conducting written examinations on behalf of the Pharmacy Board of Australia that must be passed prior to sitting the final oral competency assessment
- Assessing the qualifications and skills of overseas trained pharmacists and international students graduating from an Australian pharmacy program to determine their eligibility to apply to commence the registration process

In comparison, the main function of the other two organizations is in regulating education standard and quality in Australia. The Australian Qualification Framework Council is responsible for formulating the Australian Qualifications Framework (AQF) (Australian Qualifications Framework Council, 2019). The AQF framework is the national policy for regulated qualifications in Australian education and training; and incorporates the qualifications from each education and training sector into a single comprehensive national qualifications framework.

While the AQF framework applies from elementary to postgraduate level of education, the Tertiary Education Quality and Standards Agency (TEQSA) is responsible for two framework applicable to higher education providers (Tertiary Education Quality and Standards Agency, 2019). These are the (i) Higher education standards framework that register and evaluate the performance of higher education providers against the Higher Education Standards Framework, specifically, the Threshold Standards; and (ii) Regulatory Risk Framework that undertakes structured regulatory risk assessments of registered higher education providers.

Together, these three organizations ensure the quality of education and training of pharmacists in Australia will meet the required national practice and education standard.

6. Postgraduate Training for Clinical Pharmacy in Australia

With the changes in the health care environment over the years, there is the increased focus on expanding the role of the pharmacists in Australia to provide comprehensive patient-centred service. This is evident from the release of many clinical pharmacy practice standards by professional organizations such as Pharmaceutical Society of Australia, and Society of Hospital Pharmacists of Australia (Pharmaceutical Society of Australia, 2011; Society of Hospital Pharmacists of Australia, 2016).

To equip more pharmacists to fill the expanded clinical role, several pharmacy schools have offered postgraduate

Table 5. Master of Clinical Pharmacy Programs in Australia.

Institute	Duration of Study	Teaching mode	Admission requirement
University of Queensland	2 years full time (or part-time equivalent)	External	An approved degree and hold a current registration as a pharmacist in country of practice. Applicants must also have at least two years full-time relevant professional work experience and demonstrate recent experience of practice.
University of South Australia	1.5 years (full-time) or part-time equivalent	On campus/on-line	Bachelor of Pharmacy degree or equivalent; Registered Pharmacist with the Pharmacy Board of Australia Have experience in a direct patient care environment.
University of Tasmania	Minimum 1.5 Years, up to a maximum of 4 Years	Distance	Bachelor of Pharmacy degree and registration as a pharmacist. Have worked in the industry for a minimum of two years
Monash University	3 year part-time (up to a maximum 5 years)	Distance/on-line	Bachelor's degree in pharmacy plus registration as a pharmacist

Table 6. An example of a Master of Clinical Pharmacy Program from the University of South Australia.

First Year	
<i>Semester 1</i>	Applied clinical pharmacy Introductory epidemiology Advanced pharmacotherapeutics (Mental health) Advanced pharmacotherapeutics (Diabetes)
<i>Semester 2</i>	Advanced pharmacotherapeutics 1 Advanced pharmacotherapeutics 2 Advanced pharmacotherapeutics 3 Research methods and biostatistics
Second Year	
<i>Semester 1</i>	Medicines management clerkship Clinical pharmacy research project

pharmacy training in form of Graduate Certificate, Graduate Diploma, Master of Clinical Pharmacy (Table 5) and Doctor of Clinical Pharmacy (University of Western Australia). In fact, these post-graduate programs have been offered for several decades but with the content constantly updated to reflect the state-of-art pharmacy practice. These programs aim to advance the students' knowledge, skill and confidence to practice completely in the ever-changing health care environment. The curriculum of these programs contains pharmacotherapy and patient care, evaluation and research, leadership and management.

These postgraduate courses are specialised designed for pharmacists working full-time in a clinical environment, and

usually offered as part-time, off campus distance learning with optional face-to-face weekends to provide the opportunity for in-depth practical application. For admission into these postgraduate programs, the applicants are required to have Bachelor of Pharmacy or equivalent with at least two years of practicing experience as well as recent practicing experience.

The pharmacist can start with the Graduate Certificate, then progresses stepwise to the Graduate Diploma and Master of Clinical Pharmacy. An example of the curriculum of a Master of Clinical Pharmacy Program from the University of South Australia is shown in Table 6 (University of South Australia, 2019).

Currently, most enrolling for the M Clin Pharm Programs are hospital pharmacists who are working in specialised areas (such as ICU, oncology, pediatric etc.) or training to work in specialised areas.

As previously mentioned, there is a Doctor of Clinical Pharmacy Program offered by the University of Western Australia (University of Western Australia, 2019). This program is designed to allow practising clinical pharmacists to obtain a research-orientated qualification in a specialty area of clinical pharmacy practice. It combines a research thesis with coursework units appropriate to the area of study; and aims to equip the graduates to conduct pharmacy practice research. The uniqueness of this program can be illustrated by its curriculum (Table 7).

Table 7. Curriculum of Doctor of Clinical Pharmacy, University of Western Australia.

Option Group A	Option Group B	Option Group C
Biostatistics I (6)	Small Business Management (6)	Doctoral Thesis (full-time) (120); or
Epidemiology I (6)	Foundations of Clinical Science (6)	Doctoral Thesis (part-time) (120)
Clinical Epidemiology (6)	Current Developments in Nutrition, Health and Biotechnology (6)	
Biostatistics II (6)	Fundamentals of Genetic Epidemiology (6)	
Introductory Analysis of Linked Health Data (6)	Foundations of Public Health (6)	
	Health Systems and Economics (6)	
	Health Promotion I (6)	
	Health Promotion II (6)	
	Health Survey Research Methods (6)	

Take unit(s) to the value of 12 points from Group A; and take unit(s) to the value of 12 points from Group A or Group B.

7. Discussion

Pharmacy education and training in Australia has evolved over a long period into its current form. Generally speaking, Australia has a well-developed pharmacy education system to educate and train pharmacists to fulfil the needs of its unique healthcare environment. The quality of education and training of pharmacist is regulated and monitored by various governmental and professional bodies.

Like many other countries with well-developed pharmacy education and practice, the pharmacy curriculum offered in Australia aim to integrate education, practice and research. The curriculum aims to equip the pharmacy graduates with a body of knowledge, skill and experience necessary for the practice of pharmacy taking into consideration of the local health care environment. To date, it would appear that the curriculum offered by the pharmacy schools in Australia is responding well to the need of the local health care environment in equipping the pharmacy graduates with the required knowledge and skills.

However, with the increased need for Australian pharmacists to undertake more active role in delivering comprehensive pharmacy service, there is a constant need to revise the pharmacy curriculum to prepare the students as well as upskilling pharmacists. To achieve this, many factors will need to be considered; and these should at least include how to establish a linkage between the pharmacy schools and the health care system, how to prioritize health problems, how to provide the contextual knowledge appropriate to the local setting as well as to the contextual practice of pharmacy. This is a challenge faced by all pharmacy educators and not unique to Australia.

8. Conclusion

Australia is performing reasonably well in providing high-quality pharmacy education and training. The current system has sufficient mechanism in place to monitor and regulate the process and outcomes. However, with heightened expectation for pharmacists to contribute further in health care delivery, pharmacy schools should be more proactive in updating the curriculum to meet this need.

References

- Australian Health Practitioner Regulation Agency (AHPRA). About APRA. Available from: <https://www.ahpra.gov.au/About-AHPRA.aspx> (accessed on 5 Feb 2019).
- Australian Pharmacy Council. About APC. Available from: <https://www.pharmacycouncil.org.au/about-apc/> (accessed on 5 Feb 2019)
- Australian Pharmacy Council. Accreditation Standards for Pharmacy Programs in Australia and New Zealand. December 2012. Available from: https://www.pharmacycouncil.org.au/policies/standards_pharmacyprograms2014.pdf (Accessed on 13 March 2019)
- Australian Qualifications Framework Council. Australian Qualification Framework. Available from: <https://www.aqf.edu.au/> (accessed on 5 Feb 2019)
- Bomford JM. The Victorian College of Pharmacy: 125 years of history, 1881–2006. Parkville, Vic.: Victorian College of Pharmacy 2006.
- Faculty of Pharmacy and Pharmaceutical Sciences Monash University. What you'll learn. <https://www.monash.edu/pharm/future/courses/pharmacy/what-youll-learn> (accessed on 5 Feb 2019)
- Feehan HV. Birth of the Victorian College of Pharmacy. Parkville, Vic.: Victorian College of Pharmacy 1981.
- Jackson J. The Need for a Pharmacy Workforce Strategy. Aust J Pharm. 2016. Available from: <https://ajp.com.au/features/need-pharmacy-workforce-strategy/> (accessed on 13 March 2019)
- Marriott JL, Nation RL, Roller L, Costelloe M, Galbraith K, Stewart P and Charman WN. Pharmacy Education in the Context of Australian Practice. Am J Pharm Educ 2008; 72(6): Article 131.
- Owen S and Stupans I. Experiential Placements in Pharmacy 'Quality Indicators for Best Practice Approaches to Experiential Placements in Pharmacy Programs'. Australia: The Carrick Institute for Learning and Teaching in Higher Education Ltd. 2008.
- Pharmacy Board of Australia. Registration. Available from: <https://www.pharmacyboard.gov.au/registration.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: September 2012. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: October 2013. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: September 2014. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: September 2015. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: 1 July 2016–30 September 2016. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: 1 July 2017–30 September 2017. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmacy Board of Australia. Registration Data: Reporting period: 1 July 2018–30 September 2018. Available from: <https://www.pharmacyboard.gov.au/about/statistics.aspx> (accessed on 5 Feb 2019)
- Pharmaceutical Society of Australia. Standard and Guidelines for pharmacists performing Clinical Interventions. March 2011. Pharmaceutical Society of Australia, Canberra, Australia.
- Pharmaceutical Society of Australia. National Competency Standards Framework of Pharmacists in Australia 2016. Available from: <https://www.psa.org.au/wp-content/uploads/2018/06/National-Competency-Standards-Framework-for-Pharmacists-in-Australia-2016-PDF-2mb.pdf> (accessed on 14 March 2019)
- Society of Hospital Pharmacists of Australia. Standards of Practice for Clinical Pharmacy Services. Published 26 October 2016. Available from: <https://www.shpa.org.au/resources/standards-of-practice-for-clinical-pharmacy-services> (accessed on 7 Feb 2019)
- Tertiary Education Quality and Standards Agency. What we do. Available from: <https://www.teqsa.gov.au/what-we-do> (accessed on 5 Feb 2019)
- The University of South Australia. Master of Clinical Pharmacy. Available from: <https://study.unisa.edu.au/degrees/masters-of-clinical-pharmacy> (accessed on 13 March 2019)
- The University of Sydney School of Pharmacy. History of Sydney Pharmacy School: Over 100 years of excellence in pharmacy education and research. Available from <https://sydney.edu.au/medicine-health/schools/sydney-pharmacy-school.html> (accessed on 5 Feb 2019)
- University of Western Australia. Doctor of Clinical Pharmacy. Available from: <https://study.uwa.edu.au/courses/doctor-of-clinical-pharmacy> (accessed on 7 Feb 2019).