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Research knowledge and skills in primary medical training – a cross-sectional audit

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Abstract

Background: Internationally, medical education has either adopted, or is moving toward, a Masters level qualification at completion. This reflects the higher-level learning outcomes and potentially facilitation of thinking and decision-making required of medical graduates. In Australia, the main difference between bachelor and masters programs appears to be the level of research skills training. This study explores the characteristics of research training in medical schools and alignment with higher education qualification frameworks.

Methods: A cross-sectional audit was conducted of 22 medical schools in Australia and New Zealand, seeking information on: degree type, entry requirement, research knowledge and skills taught, teaching format, and barriers to offering students research experiences.

Results: Information about 15 medical programs was obtained, with Australian Qualifications Framework or New Zealand Qualifications Framework Level 7, 8 or 9E outcomes. All included a variety of teaching methods on biomedical ethics, principles of evidence-based practice, and search strategies for medical evidence, critical appraisal of the literature and disease surveillance/epidemiology. Small projects were available in all programs, although voluntary in Level 7/8 programs and mandatory in Level 9E programs.

Conclusions: There appear to be few differences in research training and learning outcomes from Level 7 and Level 9E programs, although Level 9E programs have a more systematic approach and assurance that all graduates can achieve the higher outcomes. Barriers to successful implementation relate to finding curriculum space and sufficient research training capacity for all medical students.

Keywords: Critical thinking, research knowledge, scholarship, medical graduate, Masters Degree, critical thinking, reserach knowledge, scholarship

Background

Primary medical education is now almost exclusively the domain of universities, where there is a strong tradition of grounding medical education in contemporary research that informs developments in medical science and practice. In most jurisdictions national standards of medical education have explicit requirements for medical graduates to have competencies in critical appraisal and participation in research. University qualifications reflect the development of thinking and judgement skills as an individual transitions from learner to teacher, with titles such as 'Bachelor', 'Master', and 'Doctor' [Lenartowicz, 2015], although there is substantial variation internationally in the title of primary medical qualifications. For example, the United Kingdom, Australia and New Zealand have traditionally used the term 'Bachelor', whereas in Europe and North America the degrees are called 'Medical Doctorate', yet all may represent equivalent learning outcomes and equivalent recognition. Some have argued that this academic focus has neglected the preparation of students for their work as junior doctors, suggesting that higher education should embrace a broader approach to scholarship that includes integration, application and workplace engagement as well as theory and discovery [Boyer, 1991].

A more recent view is that the dual goals of academic excellence and workplace readiness may be enhanced through better alignment. It is argued that higher order thinking, better clinical decision making and leadership may be facilitated by education design, even at undergraduate level [Cooke, Irby, & O'Brien, 2010]. Higher education reforms in several nations have developed explicit learning outcomes for each level

of qualification. Examples include the 'Bologna' three-cycle approach in Europe [Bologna Working Group, 2005], Quality Assurance Agency (QAA) levels in the UK [QAA, 2014], Ministerial Statement on Quality Assurance of Degree Education in Canada [CMEC, 2007], the Australian Qualifications Framework (AQF) [DET, 2013], and New Zealand Qualifications Framework (NZQF) [NZQA, 2010]. There is no equivalent national framework in the United States. While the names of degrees have not necessarily changed, primary medical qualifications in the United Kingdom, Europe and North America are formally regarded as being at Master's level.

The situation is more complex in Australia and New Zealand, where both countries share a common set of medical education standards [AMC, 2012]. Here, medical education has participated in several international curriculum innovations including: increasing curriculum integration through problem-based learning; expansion by establishing new programs; and developing evidence-based rural medical education [Geffen, 2014; Prideaux, 2009; Strasser, 2005; Bokey, Chapuis, & Dent OW, 2014]. Currently, the level of primary medical qualifications is being aligned to the similar AQF and NZQF 10-level structures, a process made more complex by the diversity of medical programs. Fifty years ago there were seven medical schools in Australia, all with very similar, six-year duration, school-leaver entry programs, whereas there are now 20 medical schools with four, five and six-year curricula and either graduate or school-leaver entry. As a result, there are currently medical qualifications at Levels 7 (Bachelor), 8 (Bachelor Honours) and 9 (Masters), although all are deemed to achieve the Graduate Outcome Statements required by the Australian Medical Council [9], which are not formally aligned to AQF /NZQF levels. There have since been controversial claims about a reduction in anatomy, pathology, clinical experience and research experience in Australian medical education, although this is variable and the impact is uncertain [Bokey, Chapuis, & Dent OW, 2014]. The main perceived difference between Level 7 and 9 degrees has been the level of research training provided.

Masters level program development in Australia follows different pathways. The initial developments were in the four-year graduate-entry programs, where all students commence with a Level 7 degree and after four years obtain a Level 9 degree. The Masters (Extended), or 9E, qualification differs from the Level 9 Masters degree by being the equivalent of three, rather than two academic years, including a prolonged professional placement, and achieves learning outcomes that relate to acquisition of some research skills to facilitate higher-level problem-solving. More recently, five and six-year school-leaver programs have also announced their intention to develop into Level 9E programs. This may be more difficult, although even five-year medical programs generally have more tuition weeks than six standard academic years. Further, the professional placements are of either similar or even longer duration. Hence it is possible to develop a Level 9E program within a five-year, school-leaver entry program.

Little is known about the current extent of research training amidst the variety of Australian medical programs. This paper reports an audit of Australian and New Zealand medical schools that explored the nature and extent of research training and how Level 9E learning outcomes were to be achieved.

Method

We collected information on degree type, entry requirement, research knowledge and skills taught, format of teaching, duration, assessment strategies, and barriers to students receiving quality research experiences from medical school websites, curriculum documents and directly from heads of medical schools in Australia and New Zealand. An audit form was developed and information from medical school websites was entered into a spreadsheet. Where there were gaps in publicly available information, the heads of medical schools were requested to either complete audit forms for their programs or send relevant curriculum documents to the researcher for data extraction. Audit forms were completed for 15 of the 22 medical schools. One school advised they could not map research components from a spiral curriculum. Audit forms could not be completed for six schools due to information not being available on websites, or schools not providing curriculum documents or completed audit forms. The analysis was essentially descriptive, with frequency counts and thematic analysis of written responses. The project was approved by the Tasmanian Higher Education Research Ethics Committee (H15283) on 30 September 2015.

Results

A total of 15 audits were completed for the 22 medical schools in Australian and New Zealand.

Curriculum models

Responding Australian and New Zealand medical schools reported that they offered a variety of curriculum models, with AQF/NZQF Level 7, 8 or 9E outcomes. Some schools currently offer a combination of these as they transition from Levels 7 to 9E. One program was at Level 8, with the degree named at Bachelor (Honours) level. Of the non-respondents there were four AQF Level 7 and three AQF Level 9 courses. These data are summarised in Table 1.

Three of the participating schools with AQF/NZQF Level 7-8 qualifications offered standard-entry six-year degrees; three offered standard-entry five-year degrees; and three offered graduate-entry four-year degrees. Of the participating schools AQF Level 9E qualifications, one offered a standard-entry, five-year degree and five offered graduate-entry, four-year degrees.

Research training descriptions

Research knowledge and skills taught and applied in student individual and group projects were fairly uniform across all programs (average of 11-12 discrete activities or components per program). Mentored projects (where students were allocated a research academic or clinician to guide them) were more frequent in the Level 9E programs (average 2.5 compared with 0.33 per program). However, these options were available as summer electives and curricular selectives in all three of the participant six-year programs. These data are summarised in Table 2.

Lectures, online learning or resources, individual assignments and presentation to peers were the favoured teaching formats reported in the Level 7 and 8 programs. In Level 9E programs, lectures, online learning or resources, and mentored projects were favoured teaching formats, while presentations to peers or broader audiences were also popular. More diverse teaching formats were reported in the six-year Level 7 degree (average of 10 formats compared with 5-7). These data are summarised in Table 3.

Barriers to research training

Three of the nine Bachelor programs listed barriers, the most common being: limited research project opportunities; limited research supervisors/mentors; financial constraints; and lack of time or curriculum overload. The most common barriers listed by four of the six Masters programs were: limited clinical and research mentors; communication about the scholarly component; availability of project options; managing large numbers of student projects; financial constraints; and managing a minority of students not wanting to 'do research'. Other challenges were raised, including: ethics approval and research governance workloads; establishing collaborative relationships with health organisations and the community; and timing projects appropriately within the course.

Discussion

Despite the differences in descriptions, degree names and AQF/NZQF levels of Australian and New Zealand medical programs, the results of this audit suggest that there are few differences in research training expectations and learning outcomes across the different program models. All responding medical schools reported substantial research training activity, although six-year Level 7 programs reported increased and more diverse research training content and formats. Level 9E programs reported more projects and project presentations, and were developing new learning activities such as systematic review workshops. However, some Level 7 programs either required projects and presentations or offered them as elective experiences for interested students. Online research learning resources were available in all programs. Barriers to research were similar across program descriptions, with Level 9E programs reporting an additional challenge existed in providing the capacity for all students to have a meaningful research experience.

A key difference between programs at the different levels is that only a proportion of students in Level 7 and 8 programs would achieve Level 9E learning outcomes through appropriate elective experiences, whereas this is mandated and provided for all students in Level 9E programs. It is interesting to note that six-year standard-entry programs appear closer with respect to research training to the graduate-entry programs, and also the Level 9 benchmark, than five-year, standard-entry programs. Whether this is due to a reduction in research training through compression to five years or to other factors is an issue that needs further exploration. At a time when curriculum over-crowding remains common, with ever-increasing curriculum requirements of medical graduates to be 'work ready' as junior hospital doctors, medical schools have sought to maximize flexibility of learning opportunities [Harden, 2006], with a 'core plus options' approach and a fostering of self-directed learning to maintain currency over a career [Cooke, Irby, & O'Brien, 2010;Harden, 2006]. Long term learning strategies are important – "*learning abilities that do not refer exclusively to content knowledge but rather concern 'habits of mind' and metacognitive skills that embody cognitive and social cognitive abilities that are useful…" (p326)* [Beck, Skinner, Schwabro, 2013].

The proposition that research training improves decision-making in complex clinical situations remains to be proven, although it is plausible that it facilitates critical appraisal skills and capacity to implement advances in healthcare over a long career [Cooke, Irby, & O'Brien, 2010;Harden, 2006;AMC, 2012; Young, Rohwer, Volmink, & Clarke, 2014]. Ultimately, expertise develops as a blend of training and experience, and it is possible that achievement of Level 9E learning outcomes may accelerate this.

While the barriers to providing research training are similar to those reported elsewhere [Siemen, Punnen, Wong, & Kanji, N, 2010; Park, Liang, Sherwin, & McGhee ,2010] the challenges of expanding research training to all medical students may be difficult to address without substantial investment in research infrastructure and supervision. While the depth of the required research experience may not be too demanding, providing meaningful research experiences for all students appears to be a difficult task. It is likely that most, if not all, medical programs in Australia will develop into Level 9E programs, and there may be a risk that research experiences will become diluted and less valuable.

Limitations

We were able to obtain information for only 15 of the 22 medical schools in Australia and New Zealand. All schools that completed audit forms had difficulty mapping their research training from integrated curricula, requiring the information to be gathered in different ways. It is

therefore possible that this study may not have captured adequately the breadth and, in particular, the depth of research training experience in all types of programs. The interpretation of some terms varied between schools. For example, academic writing was described variously as the standard expected in either written assignments or written research reports. Further, this study captured information about the planned curriculum, but did not capture the experienced curriculum.

Conclusion

Australian and New Zealand medical schools offer diverse medical programs for either school-leavers or graduate entrants, are of four, five or six-year durations, and achieve learning objectives formally benchmarked at either Level 7, 8 or 9E of the qualifications frameworks in both Australia and New Zealand. There may be few measurable differences in achievement possible across all program models, but rather more of an assurance that all, rather than some, graduates reach the higher level outcomes. Most programs in Australia are transitioning to Level 9E programs, amidst concerns about the need for higher-level judgment and decision-making to improve the quality of healthcare and foster leadership of change in health care systems. Barriers to successful implementation relate to finding curriculum space and sufficient research training capacity for all medical students.

Table 1 – Characteristics of medical programs offered at 22 Australia and New Zealand medical schools in 2016+

Degree Name	Programs	AQF/NZQF level	Total respondents
Bachelor's Degree (MBChB, MBBS, MBBS(Hons), BMed)	13[+]	7[†]	9
Doctor of Medicine (MD, MChD)	9	9E	6

[+] Includes one school commencing 2017

[†] Includes one school AQF Level 8

Table 2 - Research knowledge and skills taught in 15 medical schools in Australia and New Zealand

AQF/NZQF level	AQF 7[†]			AQF 9e
Entry Type	Graduate 4 year n = 3	Standard 5 year n = 3	Standard 6 year n = 3	Graduate 4 yr (n=5) Standard 5 yr (n=1) Total n = 6
Research Knowledge and Skills				
Principles of biomedical ethics and professional practice	3	3	3	6
Principles of Evidence-based practice	3	3	3	6
Search strategies to find the best medical evidence	3	3	3	6
Critical appraisal of the literature	3	3	3	6
Reflective practice	3	2	3	5
Quantitative methods	3	2	3	5

Qualitative methods	3	2	2	5
Disease Surveillance/epidemiology	3	3	3	4
Biostatistics	2	3	3	6
Academic writing	2	3	3	6
Oral presentation	2	3	2	5
Multi-media, conference, other presentation	1	1	1	2
Research design, formulating question	1	1	-	-
Interview/survey design	1	1	-	-
Outbreak investigation	-	1	1	-
Audit project	-	1	1	1
Various projects/assignments unspecified	2	1	2	4
Total research components	**35**	**36**	**36**	**67**
Total Research components/n	**11.67**	**12**	**12**	**11.17**
Application of Knowledge and skills (mentored projects)				
Community research project	-	1	-	-
Research electives and selectives	-	-	2	2
Research project	1	-	1	6
Scholarship project	-	-	-	2
Capstone project	-	-	-	2
Various advanced studies projects unspecified	-	-	-	3
Total research components	**1**	**1**	**3**	**15**
Total Research components/n	**0.33**	**0.33**	**1.00**	**2.5**

[†]**Includes one AQF Level 8**

Table 3 - Formats used to teach research knowledge and skills

	AQF 7 or 8			AQF 9e
Teaching format	4 year n = 3	5 year n = 3	6 year n = 3	4 or 5 year n = 6
Lectures	3	3	3	6
Tutorials	1	2	2	3
Online Learning/ resources	2	3	1	5
Interactive workshops	1	1	2	2
Feedback	1	-	-	-
Seminar	1	1	1	3

	-	1	2	3
Skill workshops -library, project plan, systematic review	-	1	2	3
Individual Projects	2	3	2	2
Small group learning	-	1	2	-
Interview with/visit to researcher/research team	-	1	1	-
Presentation to peers	2	2	3	2
Presentation to broader audience	-	1	2	4
Journal club	-	0	1	-
Mentored projects	1	1	1	6
PBL/CBL sessions	1	-	2	3
Virtual hospital cases	-	-	-	1
Cultural safety training	-	-	2	1
Clinical placements	-	-	1	3
Optional extracurricular research opportunities - mentored	-	1	3	-
Total number of teaching formats used	15	21	31	44
Total teaching formats/n	5.00	7.00	10.33	7.33

Take Home Messages

Notes On Contributors

CC made substantial contribution to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting and revising the work and final approval of the version to be published; and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

RH made substantial contribution to the conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting and revising the work and final approval of the version to be published; and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

PA made substantial contribution to the conception and design of the work; the analysis, and interpretation of data for the work; drafting and revising the work and final approval of the version to be published; and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

JS made substantial contribution to the analysis and interpretation of data for the work; and revising it critically for important intellectual content; and final approval of the version to be published; and agrees to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Appendices

Declaration of Interest

The author has declared the conflicts of interest below.

Professor Richard Hays is the current Editor of AMEE MedEdPublish.