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Developing the multi-professional clinical academic workforce in Australia and New Zealand: a scoping review

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Implications for policy/practice: The review findings offer health service senior management a set of policy strategies relating to enabling research engagement and skills development of interested or already research-active clinicians. Lessons from rural and primary health care research capacity building programs in Australia could help to inform policy aimed at New Zealand, Maori and Pacific Island clinical academic workforce development. Future research and policy should ensure that issues of maldistribution are actively considered, to link workforce development policy to broader, equity-oriented, health system goals.

Abstract

In Australia and New Zealand (ANZ), clinical academics are an important part of the workforce needed to deliver social and economic returns from health and medical research investment. This review aims to examine the extent and nature of the empirical evidence base addressing the development of the multi-professional clinical academic workforce in ANZ and to synthesise policy-relevant findings. The review adopts a scoping review design. Literature searches were undertaken in February 2019 in Medline (Ovid), Scopus, and CINAHL, with reference lists and websites also searched for additional literature. Papers eligible for inclusion were those published in English in 2000–2018 that reported results of empirical studies that addressed factors relating to developing the ANZ clinical academic workforce size, composition or role through building, enabling or sustaining its research functions. Results were reported narratively using a labour market policy framework. A total of 43 studies representing a diverse range of health professions and study designs were included in the review, only two of which reported on the New Zealand context. The majority were focused on building, supporting and sustaining research capacity and engagement among groups of clinicians within clinical settings. Use of three labour market policy levers to frame analysis enabled identification of issues relating to rural/urban workforce maldistribution, in addition to more widely reported clinical academic workforce production and retention issues. The literature addressing the development of the clinical academic health workforce in ANZ frames this workforce either as clinicians who routinely engage in research activity, or as a workforce cadre comprised of distinct, formalised research-related clinical roles. As such, developing the clinical academic workforce requires both: i) policy attention to the availability of research training opportunities for health professional students and graduates and of dedicated research-related career pathways; and ii) structures and processes that enable or inhibit research engagement among clinicians at a mid-career level.

Keywords

Clinical workforce, clinical academics, medical research, clinical research.

Clinical academics – clinicians for whom research and teaching are a significant part of their professional role and career – are a central component of policy initiatives aimed at accelerating healthcare innovation and evidence-based practice (Deluca et al., 2016; Westwood, 2018; Windsor et al., 2015, 2017). Clinicians who combine clinical and academic work are ideally positioned to articulate clinically

relevant questions and use research in clinical practice (Van Oostveen et al., 2017). While policy and research on the role and development of the clinical academic workforce have historically focused on medically trained professionals, the clinical academic workforce is increasingly conceptualised as multi-professional; incorporating nurses, allied health and other health professionals with research and teaching qualifications and capacity (Van Oostveen et al., 2017; Westwood, 2018; Coombs et al., 2012; Girot, 2011; Wenke and Mickan, 2016).

In Australia and New Zealand (ANZ), research-capable clinicians are recognised by governments and professional groups as an important part of the workforce needed to deliver social and economic returns from health and medical research investment (Wills, 1998; McKeon, 2013; New Zealand Association of Clinical Research (NZACR), 2019). Arguably, the importance of these clinicians has increased over the recent decade within a policy context promoting health care innovation, research translation and embedding research capacity within health systems (McKeon, 2013; Department of Health, 2019a; State Services Commission, 2013). Several policy initiatives in Australia have sought to grow and support research capacity among health professionals (Webster et al., 2011) and to reward health service organisations for encouraging clinical and research leaders to "ensure that research knowledge is translated" into policy and practice (National Health and Medical Research Council (NHMRC), 2019). The ideal of embedding research within healthcare to drive translation (McKeon, 2013) relies on a research-capable clinical workforce. In New Zealand, the establishment of "health precincts" that combine clinical and academic staff and capabilities across academic and health service organisations, similarly highlights a policy aspiration to encourage and support research-trained clinicians to drive rapid translation of research findings into clinical practice (Te Papa Haurora Health Precinct, 2019). Policy aspirations in both countries exemplify the widespread expectation that clinically active health researchers are uniquely positioned to ground their research in the realities of their service and thus facilitate improvements to clinical care (Westwood, 2018).

Despite these high expectations, the composition, size and role of the clinical academic workforce in ANZ, especially in a multi-professional sense, is not clearly defined. "Clinical academic" as a formal (government) health workforce category has not yet been established in either country. In Australia, annual surveys are administered by the Australian Health Professional Regulation Agency (AHPRA) at the time of renewal of health professional registration (Department of Health, 2019b). While the data collected include a reported "job role" in teaching or research, the data do not differentiate researchers by place of employment (e.g. a clinical versus university setting). In New Zealand, annual workforce surveys are undertaken by the Medical and Nursing Councils of New Zealand, with only the nursing reports similarly identifying distribution of the nursing workforce by teaching or research (but not further differentiating by place of employment). Analyses of trends are patchy and report on different datasets in different ways, further inhibiting assessment and comparison of the size, features and role of this workforce. While the size of the Australian nursing workforce engaged in research as a primary or secondary role has reportedly increased over time (Rickard et al., 2011), an apparent decline in the proportion of clinical academics in the medical workforce in ANZ has been described as a "crisis" in need of urgent remedy (Windsor et al., 2017).

The limited formal characterisation of the clinical academic workforce, combined with the positioning of research-capable clinicians as central to policies promoting research translation and impact, suggest a policy imperative to more clearly define the clinical academic workforce in ANZ, its role within a policy context promoting health care innovation, and key factors enabling or inhibiting its development. As a step towards responding to these gaps, this scoping review aims to examine the extent and nature of the empirical evidence base addressing the development of the multi-professional clinical academic workforce in ANZ and to synthesise policy-relevant findings. The review addresses the following questions:

1. What is the extent and nature of the empirical evidence base addressing issues relating to the development of the multi-professional clinical academic workforce in ANZ?
2. What terminology is used to describe the clinical academic workforce?
3. What are the policy-relevant findings within the literature?

In this review, "clinical academic workforce" is interpreted using a research lens to reflect the growing emphasis in government policy in ANZ on innovation and research translation in healthcare. Research-capable clinicians are central to these innovation and translation goals, highlighting a particular need to explore the clinical workforce engaged in research within healthcare organisations. As such, the review does not focus on clinicians employed in universities

or independent research institutes, or on clinicians engaged in only clinical practice and teaching.

Methods

Design

Scoping reviews enable review of complex and heterogeneous (in terms of methods and discipline) bodies of literature to appraise the nature and extent of the evidence base on a topic (Grant and Booth, 2009; Peters et al., 2015). As scoping reviews also enable clarification of working definitions and conceptual boundaries of a topic, and report on the types of evidence that address and inform practice (Joanna Briggs Institute, 2015), a scoping review design was identified as most appropriate to the review aim. The PRISMA Extension for Scoping Reviews Checklist (Tricco et al., 2018) was followed for both conducting the review and reporting findings, and involved clearly stating the review objective, eligibility criteria, information sources, search strategy for at least one database, and processes of selection, extraction and results synthesis.

Search strategy

The search strategy involved database searching in Medline (Ovid), Scopus, and CINAHL, which were selected for their coverage of a range of health disciplines and literature relevant to the review topic. Database search terms included terms relating to both the populations and contexts of interest. As a range of terms appear to be used interchangeably with "clinical academic" to describe clinicians who adopt research (and teaching) functions as part of their professional role, index terms in Medline were used to identify additional keywords from an initial shortlist, derived from a subset of key papers.

The database search strategy in Medline used the following keywords (combined with "OR"): "clinical academic", "academic clinician", "clinical researcher", "clinician researcher", "physician scientist", "clinician scientist", "clinician-scientist", "clinical scientist", "clinician educator", "clinical research workforce", "allied health research*", "research nurse", and "nurse scientist". The terms "research capacity", "academic medicine" and "academic nursing", were also added to searches to increase the breadth of the search. The results from these searches were combined (using "AND") with the results from the country-specific searches which used the following keywords (combined with "OR"): "New Zealand", "Australia", "Australian", "Australasian", "Australasia", "Queensland", "Victoria", "New South Wales", Northern Territory", and "Tasmania". Database subject heading terms (MeSH) relating to the countries of interest were used in addition to keywords in the Medline and CINAHL searches. Following database searching, reference lists of potentially eligible studies were searched for additional studies and selected websites were searched for relevant empirical grey literature.

Eligibility

Papers eligible for inclusion in the review were those published in English in 2000–2018, which report the results of empirical studies that address factors relating to any aspect of developing the ANZ clinical academic workforce size, composition or role through building, enabling or sustaining its research functions. Studies not focused on practicing clinicians, and those evaluating programs that were not primarily concerned with building, enabling or sustaining research functions of clinical workforce, were therefore excluded. Studies were also excluded if they focused exclusively on building clinical training and education functions of clinical workforce, in the absence of a focus on also building research functions.

Selection

After removal of duplicates, the lead reviewer (AE) screened titles and abstracts and those that appeared to meet the eligibility criteria progressed to the next phase of eligibility assessment. Full text articles of these abstracts were retrieved and reviewed to confirm eligibility by the lead reviewer. Disagreements or uncertainties in eligibility assessment were resolved by consensus involving at least two reviewers.

Extraction

Characteristics of included studies were extracted into a table by the lead author with the following headings: author/s and year of publication; title; study participants and setting; health profession; main focus in relation to clinical academic workforce development; key findings relating to a labour market framework (described below); terminology used to describe clinical academic workforce; and any policy recommendations made in the paper.

Synthesis

Due to the heterogeneity of the literature, qualitative data and key findings from quantitative studies data

were analysed thematically and reported narratively (Daniels and Langlois, 2018). Thematic synthesis was undertaken to develop descriptive themes and these were then mapped against three of the workforce policy levers identified in a health labour market framework developed by Sousa et al. (2013): *policies on production* (factors relating to preparation, training and recruitment of health workforce); *policies to address inflows and outflows* (factors relating to health professionals entering and exiting health workforce); and *policies to address maldistribution and inefficiencies* (factors relating to productivity and performance, and to development and retention of workforce in underserved areas). The fourth lever in this labour market framework – *policies to regulate the private sector* – was deemed not as relevant to this study as the other levers because of its broader health system (rather than workforce development) focus.

Health workforce *production* policies are those that are concerned with the supply of labour, and primarily relate to the training of new health workers (Sousa et al., 2013). Examples of such policies include opening of new training institutions, provision of scholarships, financial incentives for teaching staff, and training new cadres of health workers (Sousa et al., 2013, 2014). Policies addressing *inflows and outflows* of health workers address their movement into and out of the health workforce and include increasing wages, providing extra allowances, improving working conditions, and offering training opportunities (Sousa et al., 2013, 2014). In relation to the clinical academic workforce, this policy lever refers to factors enabling or inhibiting the retention of clinical academics within the research-related roles that define their inclusion in this workforce. Policies addressing health workforce *maldistribution and inefficiencies* are aimed at addressing limitations to the capacity of health workers to deliver quality services that are acceptable and accessible to the entire population (Sousa et al., 2013). Examples of such policies include training local health workers, adoption of recruitment strategies to increase the supply of health workers in underserved or rural areas, and matching of health workers' skills with their tasks (Sousa et al., 2013).

These levers were used to frame the *Global Strategy on Human Resources for Health: Workforce 2030* (World Health Organization, 2016) and have been used to investigate factors that determine health workforce supply and demand, including policies being employed to address shortages and inefficiencies (Sousa et al., 2014). Use of the labour market framework in this review will therefore help to articulate findings relating to clinical academic workforce development in policy terms. The review will enhance utility of the findings for health sector managers and policymakers by also reporting relevant policy recommendations from the included papers.

Results

Description of dataset

Searching was completed in February 2019 and yielded 43 studies meeting the review inclusion criteria. Figure 1 shows the flow of information through the review, with the list of included studies and key information shown at Appendix 1.

Representation of professions

The largest proportion of studies (47%; 20 studies) were focused on development of the allied health clinical academic workforce, followed by the medical clinical academic workforce (21%; 9 studies). Three studies (7%) addressed clinical academic workforce development in nursing, and one study each addressed clinical academic workforce development for Aboriginal and Torres Strait Islander health workers, and for clinicians working in the field of complementary and alternative medicine (Figure 2). Other studies focused on multiple professions as groups; these were primary health care roles, which included medicine, nursing, allied health and other clinical and professional staff involved in primary health care (9%; 4 studies), unspecified multiple clinical professions (9%; 4 studies) and emergency department roles (2%; 1 study). Among the studies focusing on allied health professions, 12 studies reported on the broad allied health grouping while others focused more specifically on single allied health professions; these were occupational therapy (2 studies), podiatry (2 studies) psychology (1 study), speech language pathology (1 study), social work (1 study) and dietetics (1 study). No studies addressed clinical academic workforce development within the Maori or Pacific Island health workforces.

Geographic distribution

Despite the diverse representation of clinical professions among included studies, only two studies (Park et al., 2010a,b) were focused on clinical academic workforce development in the New

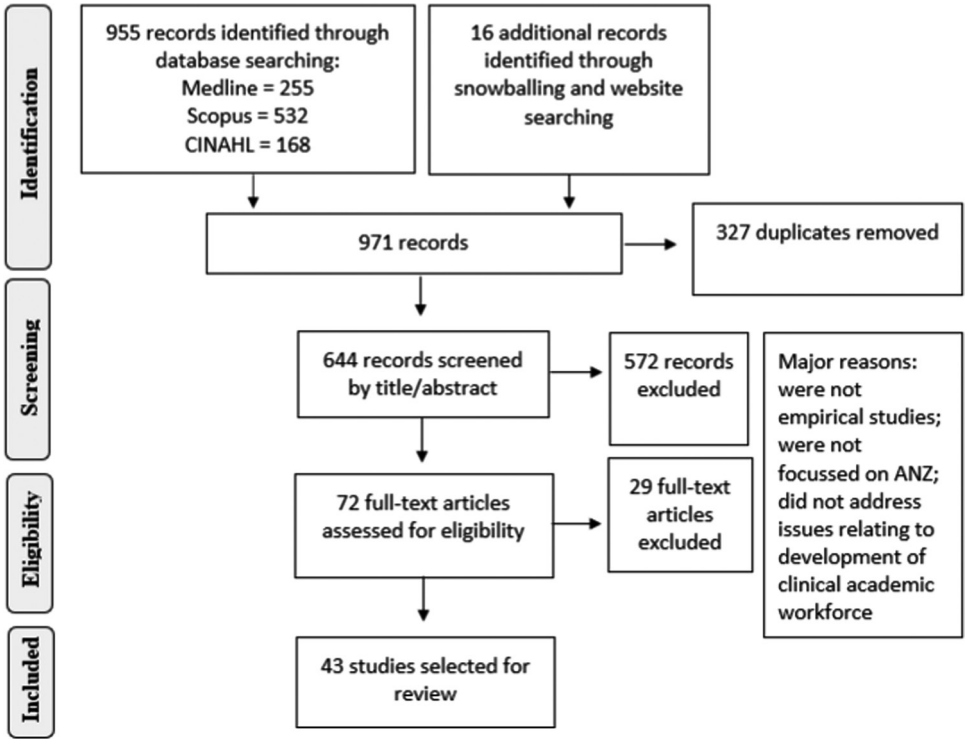

Figure 1: Flowchart showing flow of information through the scoping review.

Zealand context; both of these were concerned with development of the medical research workforce. The remaining 41 studies (95% of included studies), were focused on the Australian context and represented a diverse range of states/territories and health service settings.

Types of evidence

Of the 43 studies, 22 (51%) were cross-sectional study designs using surveys, six of which involved some concurrent qualitative data collection either through including open-ended fields in the survey instrument

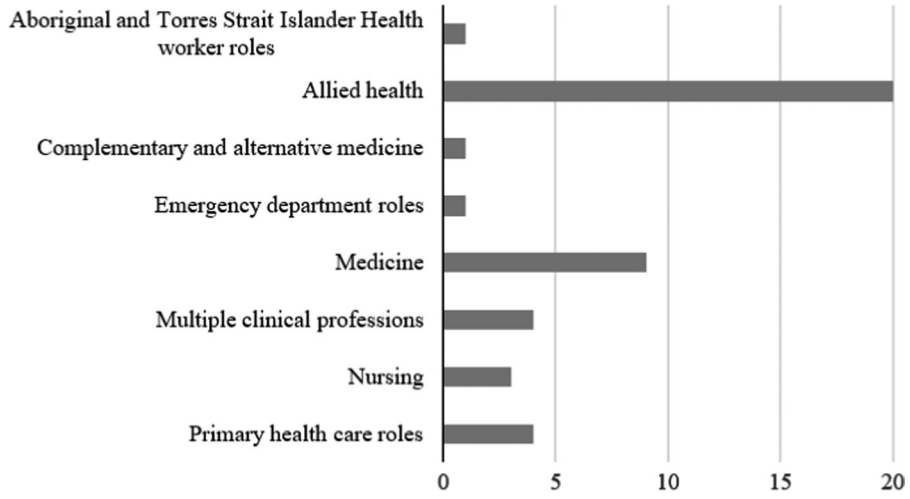

Figure 2: Number of included studies by reported health profession grouping (n = 43).

or by combining the survey with interviews. Fourteen studies (33%) were qualitative, most of which used interviews and/or focus groups as the main data collection methods. One of the qualitative studies was a two-round Delphi study (Morgan and Hughes, 2016) and another relied on a data collection tool to collect written reports (Ward et al., 2018). Of the remaining studies, four used quasi-experimental study designs, two were descriptive quantitative studies, and one was a cohort study.

Terminology used to describe clinical academic workforce

Despite all papers being relevant to clinical academic workforce development, only 10 out of the 43 studies used specific terminology to describe this workforce (Table 1). Notably, none of these studies used the term "clinical academic" to describe the workforce comprising clinicians who undertake research as part of their role, as used in this study. This was an important finding with potential implications for the utility of this nomenclature to describe such workforce in the ANZ contexts. Notwithstanding this finding, for consistency, this review maintains use of the term "clinical academic" to describe this workforce, unless referring to specific findings from studies that used the different terminology.

In the studies that used specific terminology, "clinician researcher" was the most widely used term, followed closely by "clinical researcher". Both terms were used very broadly to refer to any clinician who undertakes research activities in the clinical settings where they work; however, one study concerned with the medical workforce that used the term "clinician researcher" defined it more narrowly as a clinician who has also undertaken formal research training (Park et al., 2010b). Another study described distinct features of a journey towards adopting the "clinician researcher" role and title (Cusick, 2001). Both "clinician-scientist" and "physician scientist" were defined in two studies (Traill et al., 2016; Eley et al., 2017) as terms referring specifically to medical professionals who combine research with their clinical roles; both studies emphasised the need for formal research training. One of these (Traill et al., 2016) referred to the term "clinical researcher" as a

Table 1. Key terminology used to describe clinical academic workforce in ANZ.

Terminology	How term is defined/used in study
Clinician researcher	A clinician who actively: identifies research as significant, constructs action in relation to research, and evaluates the research experience (Cusick, 2001)
	A clinician who undertakes research activities such as writing for publication (Duncanson et al., 2018)
	A clinician who does research as part of their practice role (McInerney and Robinson, 2001)
	A clinician who is formally trained in research who works in the field of academic medicine (Park et al., 2010b)
	A clinician who does research as part of their clinical role in clinical settings (Short et al., 2009)
Clinical researcher	A clinician who has been given time to do research within a clinical setting as part of their role (Pain et al., 2018)
	A clinician who does research (Trevena and County, 2005)
Clinician-scientist	Clinically trained health professionals who have undergone additional training in research, typically a PhD, and who include research as a significant part of their professional career (Eley et al., 2017)
Nurse researcher	A distinct workforce category in the Queensland Health nursing award, as well as a term referring more broadly to nurses who both assist and lead research within clinical settings (Rickard et al., 2011)
Physician researcher	Any medically qualified practitioner contributing to medical research across a wide spectrum from the molecular level to trial participant management, who typically holds a higher research degree (Traill et al., 2016)

broader, multidisciplinary term, that encompassed the narrower role of "physician researcher". Only one study (Rickard et al., 2011) used the term "nurse researcher" and this study also discussed the abundance of terminology used to describe nurses engaged in research activity, which included "research nurse", "research fellow", "research coordinator", "trial coordinator" and "nurses in research". This study noted the existence of the term "nurse researcher" as a formal workforce category in the Queensland Health nursing award, but consciously defined and used the term in a broader way to refer to nurses engaged in research activity in clinical settings either as research assistants or research leads.

Factors affecting development of the clinical academic workforce

Three descriptive themes were identified as representing the main focus of the included studies in relation to workforce development. *Building and sustaining clinicians' research capacity* (Theme 1) was the main focus in 32 (74%) of the included studies, followed by *entry of students/graduates into clinical academic career pathways* (Theme 2) with 7 studies (16%), and *career pathways for clinical academics* (Theme 3) with 4 studies (9%). These themes are shown in matrix form in Table 2 against the three policy levers described by Sousa et al. (2013). Policy implications from the studies' findings were identified in some of the studies and are shown in Table 3 framed as policy recommendations. This table also lists the implied target policy stakeholders for these recommendations in each theme. Data in Tables 2 and 3 are discussed below against the three policy levers.

Production of workforce

The overwhelming majority of studies in this review (91%; 39 studies) addressed the issue of workforce production by identifying factors relating to facilitating entry either of practicing clinicians (who might already be engaged in teaching) into more research-focused clinical roles (Theme 1), or of undergraduate students or recent clinical graduates into clinical academic career pathways (Theme 2).

The 32 studies addressing Theme 1 in relation to *building and sustaining clinicians' research capacity*, were all focused on building the research capacity, involvement, engagement or activity of clinicians within clinical settings. The key term "research capacity" (used in 27 studies in this theme) was defined in one study as "the ability to carry out and produce research" (Alison et al., 2017). The studies in this theme examined levels of interest among clinicians in engaging in research and key motivators for commencing such engagement (Askew et al., 2002; Borkowski et al., 2017; Cusick, 2001; Finch et al., 2013; Harvey et al., 2013; Pager et al., 2012; Pighills et al., 2013; Stephens et al., 2009; Taylor et al., 2005), measured clinicians' research skills, experience and activity levels (Harvey et al., 2013; Howard et al., 2013; Finch et al., 2013; Lazzarini et al., 2013; Pain et al., 2015; Pighills et al., 2013; Short et al., 2009; Stephens et al., 2009; Taylor et al.,

Table 2. Number (%) of studies in each descriptive theme against three of Sousa et al.'s (2013) workforce policy levers (production, inflows/outflows, maldistribution)* (*n* = 43).

	Production of workforce 39 (91)	Inflows and outflows of workforce 34 (79)	Maldistribution and inefficiencies 8 (19)
Theme 1: Building and sustaining clinicians' research capacity 32 (74)	32 (74)	30 (70)	8 (19)
Theme 2: Entry of students/graduates into clinical academic career pathways7 (16)	7 (16)	0	0
Theme 3: Career pathways and support for clinical academics 4 (9)	0	4 (9)	0

*Note: some studies addressed more than one workforce policy lever.

Table 3. Selected policy implications of study findings in each key theme.

Theme	Selected policy implications (framed as recommendations)	Target policy stakeholders
Building and sustaining clinicians' research capacity	Build research capacity for allied health professionals by improving research culture, research support and research skills of clinicians (Alison et al., 2017) Fund and support writing-for-publication bootcamps for novice clinician researchers including provision for remote program delivery for rural clinicians (Duncanson et al., 2018) Resource research mentoring of clinicians and provide a network through which to explore research issues (Jones et al., 2003) Target resourcing of research capacity building initiatives to health professionals in rural areas (Pain et al., 2015) Implement a multi-strategy approach to research capacity building tailored to the particular skill and motivation levels of psychologists and their multidisciplinary working arrangements (Elphinston and Pager, 2015) Support small, achievable studies generated through reflective practice, enable practitioners to be released from clinical duties, and provide training and mentoring to address gaps in knowledge and skills (Harvey et al., 2013) Provide structural support for research and opportunities for skilled mentorship, and embed research into everyday practice to foster a positive research culture (Marshall et al., 2016) Allow clinicians who are already motivated to conduct research quarantined time to do research, potentially by establishing dedicated clinical researcher roles (Pain et al., 2018) Consider the mechanisms that may best support the outcomes of allied health research fellow positions, including the infrastructure, networks, and communication strategies that enhance and sustain the effects of the roles within a health service setting (Wenke et al., 2017a)	Health service senior management and department leads, as well as health service funding bodies (e.g. governments)
Entry of students/ graduates into clinical academic career pathways	Establish a national pathway that includes research training along the medical education continuum from undergraduate level through to specialty training (Eley et al., 2017) Purposefully nurture the research skills of midwives in partnership with research mentors through supporting graduates who are critical thinkers, willing to question, and prepared to advance knowledge (Hauck et al., 2015)	Universities, health service senior management and department leads, governments, professional colleges

	Integrate honours students' research into larger projects and enable them to work as members of a research team (McInerney and Robinson, 2001)	
	Support well-structured intercalated degree programs through adequate funding (Park et al., 2010b)	
Career pathways and support for clinical academics	Provide research nurses with mentorship, individual support, and professional validation; and provide better, more structured organisational support for nurse researchers (Rickard et al., 2011)	Universities, health service senior management and department leads, governments, professional colleges
	Provide more research funding for clinicians potentially from the Medical Research Future Fund, protect research time in clinical posts, create/support academic clinical centres, provide greater job security, reduce salary gaps, and provide a more supportive workplace culture for research engagement (Traill et al., 2016)	

2005; Ward et al., 2018; Williams and Lazzarini, 2015), evaluated interventions designed to increase research capacity among clinicians (Duncanson et al., 2018; Holden et al., 2012; Pain et al., 2018; Ried et al., 2007, 2008; Schmidt and Kirby, 2016; Webster et al., 2011; Wenke et al., 2017a,b; Williams et al., 2015), and/or identified factors affecting research capacity development among clinicians (Alison et al., 2017; Barnett et al., 2005; Elphinston and Pager, 2015; Jones et al., 2003). A further two studies in this theme used empirical methods to design research capacity building frameworks and tools aimed at particular clinician groups (Bailey et al., 2006; Grundy and Johnston, 2003).

Eight papers (Alison et al., 2017; Borkowski et al., 2017; Elphinston and Pager, 2015; Holden et al., 2012; Howard et al., 2013; Lazzarini et al., 2013; Williams et al., 2015; Williams and Lazzarini, 2015) employed the validated Research Capacity and Culture Tool to measure research capacity and culture at organisation, team and individual levels; one of these studies defined "research culture" as "an environment within an organisation that enables and supports research to generate new knowledge and opportunities to translate evidence into practice" (Alison et al., 2017). Research culture was identified in these studies as a key enabler of clinicians' research capacity development. Other enablers identified in this theme were clinicians' access to: opportunities for research-related skills development through provision of courses or workshops (Borkowski et al., 2017; Duncanson et al., 2018; Grundy and Johnston, 2003; Ried et al., 2008), support (including financial resources and time) to conduct small research projects close to practice (Holden et al., 2012; Jones et al., 2003; Ried et al., 2007), skilled mentorship (Marshall et al., 2016), and opportunities to present or publish research (Pighills et al., 2013). Three papers reported on initiatives to embed dedicated research positions into healthcare settings, finding that these positions enhanced research capacity and skills among clinical staff (Wenke et al., 2017a,b; Williams et al., 2015). Key barriers included inadequate time to do research (Barnett et al., 2005; Borkowski et al., 2017; Elphinston and Pager, 2015; Pager et al., 2012; Pain et al., 2018), limited research skills and confidence (Barnett et al., 2005; Borkowski et al., 2017; Harvey et al., 2016; Jones et al., 2003; Lazzarini et al., 2013; Short et al., 2009; Stephens et al., 2009), lack of funding (Elphinston and Pager, 2015; Jones et al., 2003) lack of access to technical expertise such as in statistical analysis (Pager et al., 2012; Pain et al., 2015) and lack of suitable backfill for clinical work (Elphinston and Pager, 2015). One study found differences in the motivators, enablers and barriers operating at individual versus team levels, with clinicians' individual research motivations more likely to be influenced by intrinsic factors such as an interest in research, and team motivations, by a desire to deliver the best service possible for patients (Pager et al., 2012).

The seven studies relating to workforce production that focused on *entry of students/graduates into clinical academic career pathways* (Theme 2) either explored health professional students' perspectives and preferences in relation to future clinical academic

careers and pathways (Eley et al., 2017; Park et al., 2010a), examined the experiences of students attempting to combine research and clinical learning (McInerney and Robinson, 2001), or evaluated particular programs aimed at developing pathways for undergraduates and recent clinical graduates to enter a research career (Hauck et al., 2015; Mullan et al., 2014; Park et al., 2010a). A further one study in this theme used empirical methods to develop research-related competency standards for health professional graduates in allied health professions (Morgan and Hughes, 2016). A range of barriers to embarking on clinical academic career pathways were identified in these studies. One study found that nursing honours students struggled to establish a legitimate space as researchers within a hospital setting, due to senior ward nurses' unfamiliarity with research and with the notion of combining research and clinical roles (McInerney and Robinson, 2001). Another study, focused on research training among medical students, found the extra time required to undertake a higher research degree, financial implications and a lack of clear pathways to career opportunities beyond medical school were obstacles to undertaking research during undergraduate training (Eley et al., 2017). A further two studies similarly found low uptake among medical students of an intercalated medical degree/higher research degree program due to perceived financial and social costs associated with participating in the program (Park et al., 2010a, b).

Workforce inflows and outflows

In the 34 studies that addressed this policy lever, nearly all (30 studies) were in the theme of *building and sustaining clinicians' research capacity* (Theme 1). These studies focused on sustaining research skills and activity among clinicians, as well as on building these skills and activity, and as such these studies simultaneously addressed issues relating to clinical academic workforce production.

The four studies in the theme of *career pathways and support for clinical academics* (Theme 3) were concerned with the research-related career opportunities and barriers for clinicians who were already engaged in research as part of their role. Two of these studies examined the current state of the clinical academic workforce in a specific profession; one found declines in research activity and project grant success rates of physician-scientists over time (Traill et al., 2016), and the other found that current research engagement levels of complementary and alternative medicine practitioners was low and largely driven by individual motivation and interest rather than strategic processes or enabling structures (Wardle and Adams, 2013). Another study examined the experiences of research nurses in relation to their research role within a clinical setting, finding that many research nurses felt isolated, undervalued and lacking in organisational support for their research careers, despite being enthusiastic about their role (Rickard et al., 2011). The final study in this theme examined impediments to higher degree training among clinical researchers in the general practice sector, finding that a lack of career return for investment in training and a lack of training options were factors potentially limiting career development for clinical researchers in the general practice sector (Trevena and County, 2005).

Maldistribution and inefficiencies

Although only a small proportion of studies (19%; 8 studies) directly addressed the *maldistribution and inefficiencies* lever, all studies in this review commenced with the premise that a research-capable health workforce is important for evidence-based practice and addressing health care problems. The development of the clinical academic workforce itself was therefore framed as a policy strategy to improve productivity and performance of the broader health workforce. Similarly, almost all papers addressed the issue of maldistribution at a global or national level by referencing, as part of the rationale for the study, previously reported lack of research capacity within a particular health profession relative to other professions, and/or low levels of clinician research capacity and relative lack of clinical academic career pathways in ANZ compared with other countries. Multiple papers specifically described low levels of research capability and support for clinicians in primary health care (Askew et al., 2002; Barnett et al., 2005; Grundy and Johnston, 2003; Jones et al., 2003; Ried et al., 2007, 2008; Trevena and County, 2005); these studies all discussed aspects of the Australian Government's Primary Health Care Research, Evaluation and Development (PHCRED) strategy which aimed to build primary health care research capacity and evidence base between 2000 and 2014 (Department of Health, 2014). A key finding in some of these studies was that many general practitioners would like to increase their research involvement but are inhibited by a range of practical and cultural barriers (Askew et al., 2002; Jones et al., 2003; Ried et al., 2008).

All eight studies that more directly addressed the *maldistribution and inefficiencies* policy lever were about research capacity building (Theme 1) among

particular groups of clinicians who worked in areas of high population health need. Seven studies were concerned with geographic distribution of multi-professional clinical academics and their access to supports between rural and urban locations in Australia. All but one of these studies highlighted unique challenges in developing rurally-based health professionals' research capabilities and in their access to enabling structures and resources (Grundy and Johnston, 2003; Pain et al., 2015; Schmidt and Kirby, 2016; Taylor et al., 2005; Webster et al., 2011); the one study that did not discuss these challenges found that geographic location was not a predictor of research engagement among an Australian speech-language pathology workforce (Finch et al., 2013). However, of those that did highlight these challenges, one found that metropolitan location of health services had a positive effect on research capacity and culture of the allied health workforce (Williams et al., 2015); another found that rural health professionals are younger, have less research experience, have fewer postgraduate qualifications and need more research support than those in regional cities (Pain et al., 2015); and two found that decentralised or distributed training models can develop the research capacity of rurally-based health workers (Schmidt and Kirby, 2016; Taylor et al., 2005). A further one study highlighted a need for research capacity building among Aboriginal and Torres Strait Islander health workers to meet a need for community-led research against a "chequered history" of poorly-designed, non-collaborative scientific research that negated Aboriginal and Torres Strait Islander peoples' agency (Bailey et al., 2006). This study presented an empirically derived community-based research capacity building framework that aimed to empower Aboriginal and Torres Strait Islander communities to drive the research agenda and process.

Discussion

This scoping review of the literature on clinical academic workforce development in ANZ identifies a diverse range of studies that position developing research-capable clinicians as an essential health workforce development strategy. The 43 included studies reflect three descriptive themes: building and sustaining clinicians' research capacity (Theme 1); entry of students/graduates into clinical academic career pathways (Theme 2); and career pathways and support for clinical academics (Theme 3). Use of three labour market policy levers (Sousa et al., 2013) to frame analysis of these themes enabled the review to examine the policy relevance and implications of the findings and to look beyond issues relating to clinical academic workforce production and retention towards issues relating to workforce maldistribution.

The overwhelming majority of studies in the review were focused on building, supporting and sustaining research capacity and engagement among groups of clinicians from a wide range of health disciplines within clinical settings. The findings of these studies highlighted the important role of health care organisations in investing in, and providing an enabling environment for, research engagement and skills development of interested or already research-active clinicians. Rather than being about clinical academics as a defined workforce cadre, therefore, these studies were about enabling clinicians' involvement in research as part of their clinical roles. These studies indicated that greater engagement of clinicians in research does not necessarily require formally designated research-related positions, or formal research qualifications. This finding suggests that developing the clinical academic workforce is as much about building the research capacity of clinicians as part of their existing clinical roles as it is about creating a distinct, auditable workforce cadre.

Reflecting the emphasis in the literature on research capacity building, most of the studies in the review centred on clinicians' mid-career transition to research-focused roles in Australia. This likely reflected Australian government program investments in research capacity building over recent decades that target practicing clinicians. For example, many of the studies in the review relate to institutions or activities funded by the Australian Government Department of Health in building research capacity within the rural and primary health care workforce. Funded programs have included the University Departments of Rural Health (1996–) and Rural Clinical Schools (2000–), as well as the Primary Health Care Research, Evaluation and Development (PHCRED) Strategy (2000–2014) mentioned above. New Zealand has had no such sustained program investment in research capacity building, which may account for the relative paucity of publications focused on the New Zealand context.

Studies that were more narrowly focused on distinct, formalised clinical academic roles and workforce cadres included those reporting on initiatives to embed dedicated research positions into healthcare settings (Wenke et al., 2017a,b; Williams et al., 2015) and those reporting on the entry of students/graduates into clinical academic career pathways (studies in Theme 2). These latter studies highlighted the important role of universities in working with health care organisations to equip graduates for a combined research and clinical career, and reflected a

linear "pipeline" notion of clinical academic workforce development, as often described in the medical workforce literature (Lopes et al., 2017). Broad medical workforce trends in Australia are likely to have an important bearing on the development of these more formal types of clinical academic roles and their likely contributions. For example, intensified competition for metropolitan specialist training opportunities among growing numbers of graduates (despite an initial expectation that more graduates would contribute to addressing regional shortages of medical labour (Murray and Wilson, 2017)) may be driving medical graduates to undertake research or research higher degrees to gain entry to a specialist training program. As such, medical graduates may be embarking on research training without this necessarily being an indication of interest in a clinical research career. This possible trend is supported by one of the studies in this review which found that the biggest reason for medical students' interest in pursuing a research career was improving their CV and chances of getting into their preferred specialty (Eley et al., 2017). Whether similar pressures to use research as a CV differentiator within a competitive labour market exist in other health professions is less clear, but this finding suggests that investments in research training, intended to support formal clinical academic career pathways, may not be sufficient on their own to result in commensurate (research-related) returns in later career stages.

Analysis of study findings against the *inefficiencies and maldistribution* policy lever also enabled the review to identify factors relating to intended contributions of clinical academic workforce development, including target populations. Despite representing the smallest proportion of studies in this review, the studies that addressed this policy lever showed that different approaches are needed to develop the clinical academic workforce in rural practice settings. Some of these studies also suggested a need to target clinical academic workforce investment to particular professions and geographies where there is demonstrable need for research-capable clinicians. Indeed, research capacity building is recognised in the broader literature as an important strategy to empower groups of clinicians, such as Aboriginal and Torres Strait Islander health workers, to conduct clinically impactful research on issues relevant to populations with higher health needs (Elston et al., 2013). With this in mind, it is notable that there were no studies in the review that addressed clinical academic workforce development among Maori and Pacific Island workforces.

Future attempts to clarify the boundaries of the clinical academic workforce as a distinct workforce cadre is likely to be inhibited by feasibility considerations, perhaps indicating that only individuals holding defined research-related roles in clinical settings should be included in formal workforce categorisation. Outside of attempts to measure and define the characteristics of this formal workforce, however, a broad conception of the clinical academic workforce is likely to be important in providing a language to describe all clinicians who routinely engage in research as part of their clinical roles. This review offers some insights into the utility or otherwise of this terminology. Although the term "clinical academic" is sometimes used internationally to refer to clinicians from a range of professions who combine clinical and research work in healthcare settings (Van Oostveen et al., 2017), it was not used in any of the studies included in this review. Also relevant is the dominant usage of the term "academic" in the Australian context to refer to health researchers and educators who are not employed as clinicians (Barton et al., 2016; Morgan and Hughes, 2016). To therefore differentiate the ANZ health workforce comprised of clinicians engaged in research as part of their clinical roles from university-based academics, therefore, the findings of this review indicate that future studies and policy concerned with the former workforce should use the term "clinician researcher", rather than "clinical academic".

Implications for policy and research

Overall, the literature addressing the development of the clinical academic health workforce in ANZ frames this workforce as either clinicians who routinely engage in research activity or as a workforce cadre, comprised of distinct, formalised research-related clinical roles. This distinction between general capacity-building and specific, formal roles has implications for policy strategies aimed at developing the clinical academic workforce. Whilst growing the research capacity of the clinical workforce is predominantly concerned with enabling factors for research engagement of clinicians at the mid-career level, the creation of career pipelines more strongly emphasises the role of university-based education and training at a graduate/early career level. Common to both conceptions is the need for incentives and supports for clinicians to both enter, and remain in, roles that enable their involvement in research. As such, the findings indicate that developing the clinical academic workforce requires policy attention not only to the availability of research training opportunities for health professional students and graduates and of dedicated research-related roles and career

pathways, but also to structures and processes that enable or inhibit research engagement among clinicians at a mid-career level.

Specifically, the findings relating to *production* of workforce suggest a need to establish formal and purposeful career development structures that enable interested and capable students and recent health professional graduates to develop research capabilities alongside their clinical career. The targeted policy stakeholders therefore include: universities, health service organisations, and professional colleges in relation to undergraduate and professional training and career pathway development; and governments in relation to supporting the creation of these pathways and facilitating research through supportive funding models. Relating to both *production* and *inflows and outflows*, there is a clear need for further development of research-related career pathways for mid-career clinicians and establishment of structural supports for research within the clinical workplace, such as protected time for research, job security and adequate remuneration. Other organisational support strategies for ongoing research engagement among clinicians, targeting health care organisations as the key policy stakeholders, include facilitating access to mentoring programs and research education and training and fostering an organisational "research culture". To support these efforts, future research should investigate the factors enabling or inhibiting research capacity building within healthcare settings, particularly considering the implied premise of the studies in this review that urgent action is needed to remedy apparent long-standing research capacity deficiencies.

Relating to *inefficiencies and maldistribution*, the findings of this review clearly demonstrate a need for research-related workforce development investment to target clinicians working in areas with higher population health needs and in geographically remote and dispersed practice environments. For example, two studies in the review recommended that research capacity building strategies take account of the realities of clinical practice and cultural contexts (Grundy and Johnston, 2003; Schmidt and Kirby, 2016). Another study advocated for greater resourcing of research capacity building of health professionals in rural areas compared to their regional city counterparts to overcome the additional challenges associated with distance and complex practice characteristics (Pain et al., 2015). The findings relating to this policy lever demonstrate its value in helping to inform investment priorities, supporting the contention of the framework authors that policies addressing the single policy levers in isolation are unlikely to be sufficient to develop the health workforce and ensure it meets broader policy objectives and health needs (Sousa et al., 2014).

Strengths and limitations

This review represents one of the first attempts to examine the extent and nature of the literature addressing the development of the clinical academic workforce in ANZ. By adopting a multi-professional approach, the review conceptually extends previous reviews of the literature on clinical academic workforce, which were limited to individual professions (e.g. Wilcox, 2011; Windsor et al., 2017; Wenke and Mickan, 2016). In focusing on the research component of clinicians' roles, the review also contributes a synthesis of the literature on research capacity building in clinical settings across multiple health disciplines. In addition, the adoption in the review of a health workforce labour market framework (Sousa et al., 2013) helped in identifying policy implications of the findings. Limitations of the review include its deliberate omission of a critical appraisal process which, although appropriate to the scoping review design and broad mapping aim, limited the ability of the review to comment on the strength of the evidence underpinning the findings of included studies. In addition, the review identified only two studies meeting the inclusion criteria that focused on the New Zealand context, which may in part reflect the predominantly protocol-driven search strategy used in the review. This approach may have led to the omission of studies that could have been identified through the use of more purposive searching strategies.

Conclusions

This scoping review on the clinical academic workforce in Australia and New Zealand (ANZ) aimed to examine the extent and nature of the empirical evidence base addressing the development of the multi-professional clinical academic workforce in ANZ and to synthesise policy-relevant findings relating to development of this workforce. The findings highlight a widespread view that action is needed to remedy long-standing research capacity deficiencies in the ANZ health workforce, and that research-capable clinicians are essential to underpin innovation and evidence-based practice goals.

The literature in the review frames the clinical academic workforce as either clinicians who routinely engage in research activity or as a workforce cadre comprised of distinct, formalised research-related clinical roles. As such, the findings of the review indicate that the development of the clinical academic workforce

requires policy attention, not only to availability of research training opportunities for health professional students, graduates and of dedicated research-related roles and career pathways, but also to structures and processes that enable or inhibit research engagement among clinicians at a mid-career level.

The use of three policy levers in the review to interpret policy-relevant findings in the literature highlighted the importance for policy development of considering not only workforce production and inflows and outflows, but also issues of maldistribution to link workforce development policy with broader, equity-oriented health system goals. The findings of the review clearly demonstrate a need for research-related workforce development investment to target clinicians working in areas with higher population health needs and in geographically remote and dispersed practice environments. Work aimed at research capacity building among clinicians who are part of New Zealand, Maori and Pacific Island health workforces might draw lessons from rural and primary health care research capacity building programs in Australia.

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Appendix

Table A1. Characteristics and main findings of included studies (*n* = 43).

Source (year)	Title	Study type	Study population and setting	Health profession	Main focus in relation to workforce development	Key findings relating to health labour market policy levers
Alison, Zafiropoulos and Heard (2017)	Key factors influencing allied health research capacity in a large Australian metropolitan health district	Cross-sectional (survey)	276 allied health professionals, Sydney Local Health District, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Key factors affecting research capacity include research culture and infrastructure at an organisational level, research orientation and support at a team level, and research skills at an individual level.
Askew et al. (2002)	General practice research: attitudes and involvement of Queensland general practitioners	Cross-sectional (survey) and qualitative	467 (survey), 18 (interviews), general practitioners (GPs), Queensland, Australia	Medicine	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Although most GPs consider research necessary, they prefer clinical experience over research evidence when making clinical decisions. One third of GPs want to increase their level of involvement in general practice research.
Bailey et al. (2006)	Developing research capacity building for Aboriginal & Torres Strait Islander health workers in health service settings	Qualitative	Aboriginal and Torres Strait Islander communities and representatives, Australia	Aboriginal and Torres Strait Islander health worker roles	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* A practical, community-based research capacity building framework, developed through a participatory consensus process, offers six training modules to build research capacity of health workers. *Maldistribution:* A twin objective of the framework is to empower Aboriginal and Torres Strait Islander communities to drive the research agenda and process.

Barnett et al. (2005)	What's needed to increase research capacity in rural primary health care?	Qualitative	134 clinicians, administrators, and educators in health and academic organisations, rural NSW, Australia	Primary health care roles	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* The most popular methods for building research capacity were courses and one-to-one support. Common barriers were time and low confidence in communication technology; a key enabler was a discipline-specific focus.
Borkowski et al. (2017)	Research culture in a regional allied health setting	Cross-sectional (survey)	136 physiotherapists, occupational therapists, social workers, psychologists, speech pathologists, dietitians, podatrists, exercise physiologists, and audiologists in a regional Victorian health service, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Motivators for conducting research included providing high quality service, developing skills, and increasing job satisfaction; barriers included other work roles taking priority, lack of time and limited research skills.
Cusick (2001)	The experience of clinician-researchers in occupational therapy	Qualitative	15 occupational therapists in metropolitan university-affiliated acute care hospitals, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production:* The role change from clinician to clinician-researcher involves identifying research as significant, constructing actions in relation to research, and evaluating the experience. The findings have implications for research support strategy design.
Duncanson et al. (2018)	Impact of a remotely delivered, writing for publication program on publication outcomes of novice researchers.	Cohort study	112 employees in the public hospital system who were Health Education and Training Institute Rural Research Capacity Building Program graduates, NSW, Australia	Multiple clinical professions	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* The writing for publication bootcamp was effective in increasing the knowledge, experience, and confidence of novice clinician researchers, showing that writing for publication skills can be increased substantially with modest investment.

Eley et al. (2017)	What will it take? Pathways, time and funding: Australian medical students' perspective on clinician-scientist training.	Cross-sectional (mixed methods survey)	418 medical students, The University of Queensland's Faculty of Medicine, Australia	Medicine	Entry of students into clinical academic career pathways	*Production and inflows/outflows:* Students indicated time, funding and pathway as major themes, highlighting obstacles to undertaking research during medical school. The biggest reason for students' interest in pursuing a research career was improving their CV and chances of getting into their preferred speciality.
Elphinston and Pager (2015)	Untapped Potential: Psychologists Leading Research in Clinical Practice.	Cross-sectional (survey)	60 psychologists working in clinical roles in a large metropolitcan public health setting, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Barriers to doing research were other work roles taking priority, and lack of time, funding and suitable backfill for clinical work. Although respondents reported relatively high individual research capacity, being part of a team and organisation that has a culture of research is necessary to apply these skills in an ongoing way in the workplace.
Finch et al. (2013)	Factors influencing research engagement: research interest, confidence and experience in an Australian speech-language pathology workforce	Cross-sectional (survey)	137 speech language pathologists, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Respondents reported higher levels of interest in particular research tasks than confidence and experience, suggesting a need for formal research capacity building strategies. *Maldistribution:* Geographic location was not a predictor of research engagement.
Grundy and Johnston (2003)	Building research capacity in primary health care settings in the Northern Territory	Qualitative	Primary health care stakeholders, Northern Territory, Australia	Primary health care roles	Building and sustaining clinicians' research capacity	*Production, inflows/outflows and maldistribution:* Three strategic directions were identified for research capacity building: strengthening research collaborations, trialing models of care that take into account the social determinants of health, and developing the research skills of primary health care professionals.

Hauck et al. (2015)	Research capacity building in midwifery: Case study of an Australian Graduate Midwifery Research Intern Programme	Qualitative	6 graduate intern midwives, King Edward Memorial Hospital, Western Australia	Nursing	Entry of students/ graduates into clinical academic career pathways	*Production:* A graduate intern program offering midwifery graduates the opportunity to engage in research activities increased graduates' understanding of how research works and its role in knowledge generation, and opened their thinking to future research-related study.
Harvey et al. (2013)	Practitioner Research Capacity: A Survey of Social Workers in Northern Queensland. Australian Social Work	Cross-sectional (survey)	103 social workers, public sector health service, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Respondents reported high levels of interest in research, but lack of confidence, limited knowledge and skills, and practical constraints impeded research activity.
Holden et al. (2012)	Evaluating a team-based approach to research capacity building using a matched-pairs study design	Quasi-experimental study	69 multi-disciplinary allied health professionals with a primary healthcare role, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Research capacity-building interventions targeted at teams, involving provision of support to conduct a small research project close to practice, results in considerable improvements in the research skills held by individuals within the teams.
Howard et al. (2013)	Involvement in research activities and factors influencing research capacity among dietitians.	Cross-sectional (survey)	130 dietitians, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Research involvement within dietetics is low. Participants with more years of experience and designation of research in their role description had a higher level of research engagement.
Jones et al. (2003)	Building research capacity: an exploratory model of GPs' training needs and barriers to research involvement	Qualitative	11 general practitioners, South Australia	Medicine	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Clinicians' research needs and barriers were categorised at individual and systems levels, and included research training/experience and access to resources. Until GPs embark on their own research, they may not be fully aware of gaps in their knowledge and skills.

Lazzarini et al. (2013)	Research capacity and culture in podiatry: early observations within Queensland Health	Quasi-experimental study	37 podiatrists (first survey), 33 podiatrists (second survey), Queensland Health, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Podiatrists had the individual skills to search and appraise relevant literature, but lacked the skills to then initiate and perform a research project. The second survey conducted a year later showed significantly higher skill ratings, with the increase coinciding with implementation of research capacity building strategies across Queensland Health.
Marshall et al. (2016)	Survey of research activity among multidisciplinary health professionals	Cross-sectional (survey and interviews)	151 health professionals (survey), 22 health professionals (interviews), multiple health services, Queensland, Australia	Multiple clinical professions	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Three-quarters of survey respondents reported actively participating in research over the past 6 years, and interviewee responses highlighted opportunities for a research-infused health service, including collaborative academic-clinical partnerships, skilled mentorship, embedding research into practice and organisational support.
McInerney and Robinson (2001)	Honours in nursing: the struggle of students as clinicians/ researchers in practice	Qualitative	6 students enrolled in the Tasmanian School of Nursing Honours program, Australia	Nursing	Entry of students/ graduates into clinical academic career pathways	*Production:* Students struggled to establish a legitimate space as Honours students within the culture of an acute hospital ward, highlighting nurses' unfamiliarity with research and the difficulties of establishing new and innovative programs in practice contexts.
Morgan and Hughes (2016)	Research and Evaluation Competency Expectations for Allied Health Graduates in Australia: A Delphi Study Among Allied Health Academics.	Qualitative	67 allied health educators, universities across Australia	Allied health	Entry of students/ graduates into clinical academic career pathways	*Production:* 30 research- and evaluation-specific competency elements were considered essential for physiotherapy, speech pathology and dietetics graduates.

Mullan et al. (2014)	Investigating the impact of a research-based integrated curriculum on self-perceived research experiences of medical students in community placements: a pre- and post-test analysis of three student cohorts	Quasi-experimental study	207 (pre-test), 219 (post-test), medical students, University of Wollongong, Australia	Medicine	Entry of students/ graduates into clinical academic career pathways	*Production:* The authentic learning experience of conducting supervised research projects as part of an integrated research and critical analysis curriculum within a medical school program can significantly improve medical students' self-perceived research experiences and have a positive impact on their research capability.
Pager et al. (2012)	Motivators, enablers, and barriers to building allied health research capacity	Cross-sectional (mixed methods survey)	85 allied health professionals, Queensland Health, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Respondents are more likely to report being motivated to do research by intrinsic factors such as a strong interest in research, and the barriers they identify are more likely to be extrinsic factors, such as lack of time. The study also identified differences in the motivators, enablers, and barriers that operate at individual and team levels.
Pain et al. (2018)	Building allied health research capacity at a regional Australian hospital: a follow-up study	Quasi-experimental study	248 (pre survey), 234 (post survey) allied health professionals, regional hospital, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* A significant increase in allied health professionals' research experience and need for support coincided with a period of research capacity building in the health service. Time availability was the greatest barrier suggesting that investment in clinician-researcher career pathways may increase research capacity.

Pain et al. (2015)	Comparison of research experience and support needs of rural versus regional allied health professionals	Cross-sectional (survey)	723 allied health professionals, northern Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production, inflows/outflows and maldistribution:* Rural health professionals in northern Queensland need more research support, are younger, have fewer postgraduate degrees and have less experience in publishing research compared to those in regional cities. Barriers to conducting research were insufficient time, lack of staff and no statistical support.
Park et al. (2010a)	Completing an intercalated research degree during medical undergraduate training: Barriers, benefits and postgraduate career profiles	Cross-sectional (survey)	30 graduates, School of Medicine, University of Auckland, New Zealand	Medicine	Entry of students/ graduates into clinical academic career pathways	*Production:* Despite extremely low uptake into the intercalated degree option, 90% of graduates felt it was a 'worthwhile endeavour', 90% had been involved with research since graduation, and one-third had received additional higher research degrees.
Park et al. (2010b)	Medical students' attitudes towards research and a career in research: an Auckland, New Zealand study	Cross-sectional (survey)	558 medical students, University of Auckland, New Zealand	Medicine	Entry of students/ graduates into clinical academic career pathways	*Production:* 70% of students expressed interest in participating in research during medical school, but only 8.6% expressed interest in undertaking an intercalated research degree option. The opportunity to do research was seen to be less important than lifestyle and earning potential when choosing a specialty.
Pighills et al. (2013)	Positioning occupational therapy as a discipline on the research continuum: results of a cross-sectional survey of research experience	Cross-sectional (survey)	86 occupational therapists, state health department, northern Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Despite a high proportion being interested in engaging in research, respondents had little experience producing research and required research support in developing research questions, writing research proposals and ethics applications, applying for funding, research methodologies, and presenting and publishing.

Rickard et al. (2011)	Towards improved organisational support for nurses working in research roles in the clinical setting: a mixed method investigation	Cross-sectional (survey and interviews)	11 research nurses and a physiotherapist (survey), 10 research nurses (interviews), acute care hospital, Queensland, Australia	Nursing	Career pathways for clinical academics	*Inflows/outflows:* Research nurses were enthusiastic about their role but many felt isolated, undervalued and lacking organisational support for their research careers. Research employment opportunities generally occurred through word-of-mouth.
Ried et al. (2007)	Bursaries, writing grants and fellowships: a strategy to develop research capacity in primary health care	Qualitative	34 primary health care professionals who were PHCRED funding recipients, Australia	Primary health care roles	Building and sustaining clinicians' research capacity	*Production:* A small grant and mentoring scheme through a University Department can effectively enhance primary health care practitioners' research skills, confidence, output, and interest in research.
Ried et al. (2008)	General practice research training: impact of the Australian Registrar Research Workshop on research skills, confidence, interest and involvement of participants, 2002-2006	Cross-sectional (survey)	77 general practice registrars who were participants in a registrar research workshop, Australia	Medicine	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* A registrar research workshop aimed at building research capacity among general practice trainees had a positive impact on participants' capacity, confidence and interest in research.
Schmidt and Kirby (2016)	A modular approach to rural and remote research education: a project report	Cross-sectional (survey)	19 rural or remote health workers who were trainees in a research capacity building program, Australia	Primary health care roles	Building and sustaining clinicians' research capacity	*Production, inflows/outflows and maldistribution:* A decentralised research capacity building training model can develop research skills in rural or remote health workers and create potential for ongoing research activity.
Short et al. (2009)	Enhancing research interest and collaboration in the interdisciplinary context of emergency care	Cross-sectional (survey) and qualitative	67 (survey), 14 (focus groups) and 7 (interviews) emergency department clinicians, tertiary hospital, Australia	Emergency department roles	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* 89% of participants reported that they needed help with developing their research skills, with little or no skills reported in reviewing literature, research methods, and publishing. An interprofessional research capacity building model is proposed to identify support clinician researcher career development.

Stephens et al. (2010)	Research experience and research interests of allied health professionals		132 allied health professionals, outer metropolitan health care network, Victoria, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Respondents reported having little research experience, and 85% had little or no interest in key aspects of research. Highly interested clinicians may benefit from intensive research support and training.
Taylor et al. (2005)	Unique issues in research and evaluation in rural and remote locations: is there a place for specific research training?	Cross-sectional (survey)	60 clinicians and professionals working in rural and remote locations, South Australia	Multiple clinical professions	Building and sustaining clinicians' research capacity	*Production, inflows/outflows and maldistribution:* 80% of respondents undertook research as part of their professional roles and 52% said they would be interested in studying a formal course rural research and evaluation course. A topic highly ranked by respondents was 'understanding evaluation methodologies' and online delivery and rural research background of lecturers were important course attraction factors.
Traill et al. (2016)	Time to research Australian physician-researchers	Descriptive quantitative	Documentation on: 303 medical practitioners awarded a University of Sydney PhD; NHMRC project grant applications; NHMRC, University of Sydney and public hospital pay scales, Australia	Medicine	Career pathways for clinical academics	*Inflows/outflows:* PhD completions by clinicians increased since 1989, however ongoing research activity among graduates is low, NHMRC project grant success rates declined significantly to 2014, and the proportion of physician-led funded grants also declined. Medical practitioner salaries from the NHMRC and universities is less than in public hospitals.
Trevena and County (2005)	Impediments to higher degree training for Australian clinical researchers in general practice	Qualitative	16 primary health care researchers, New South Wales, Australia	Medicine	Career pathways for clinical academics	*Inflows/outflows:* Career development for clinical researchers in the general practice sector may be limited by a lack of training options relevant to general practice and lack of career return for investment in training.

Ward et al. (2018)	Research engagement and activity in an allied health workforce: insights into departmental and organisational strategies	Qualitative	22 allied health departments, a large public hospital and health service, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Over 80% of the departments are producing traditional research outputs, and all departments were engaged in activities to foster a culture of research engagement.
Wardle and Adams (2013)	Are the CAM professions engaging in high-level health and medical research? Trends in publicly-funded complementary medicine research grants in Australia	Descriptive quantitative	NHMRC grants data, Australia	Complementary and alternative medicine	Career pathways for clinical academics	*Inflows/outflows:* Complementary and alternative medicine professions have a low level of research engagement, with practitioners playing a minor role in complementary and alternative medicine research in Australia. Current engagement levels are driven by individuals rather than strategic process.
Webster et al. (2011)	Rural research capacity building program: capacity building outcomes	Qualitative	25 rural health professionals, New South Wales, Australia	Multiple clinical professions	Building and sustaining clinicians' research capacity	*Production, inflows/outflows and maldistribution:* A research capacity building program developed research skills in candidates undertaking the program through teaching, mentoring and networking. Resources were useful for candidates but practicalities such as availability of replacement staff limited effectiveness.
Wenke et al. (2017)	Allied health research positions: a qualitative evaluation of their impact	Qualitative	44 allied health professionals, public health services, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Embedding allied health research positions into healthcare settings led to clinician skill development, increased research activity and culture, development of research infrastructure and professional development of the individuals in the research positions.

Wenke et al. (2017)	Effects and mechanisms of an allied health research position in a Queensland regional and rural health service: a descriptive case study	Qualitative	2 (interviews) and 6 (focus groups) allied health professionals, regional and rural health service, Queensland, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Introduction of an allied health research fellow to the health service led to enhanced research culture and skills among clinical staff.
Williams et al. (2015)	Research capacity and culture of the Victorian public health allied health workforce is influenced by key research support staff and location	Cross-sectional (survey)	520 allied health professionals, public health allied health departments, Victoria, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Increased research activity was reported in health services with a research lead compared with those without. *Maldistribution:* Metropolitan location of health services had a positive effect on research capacity and culture.
Williams and Lazzarini (2015)	The research capacity and culture of Australian podiatrists	Cross-sectional (survey)	232 podiatrists, Australia	Allied health	Building and sustaining clinicians' research capacity	*Production and inflows/outflows:* Podiatrists reported low levels of research success or skill, with those working in multi-practitioner workplaces and those in the public sector or non-clinical roles reporting higher success or skills than sole-practices or private sectors.