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**Embedded researchers in Australia: Survey of profile and experience across medical, nursing and midwifery and allied health disciplines**

Mickan, Sharon; Coates, Dominiek

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1 **Embedded researchers in Australia: Survey of profile and**  
2 **experience across medical, nursing and midwifery and allied health**  
3 **disciplines.**

4  
5 **Abstract**

6 **Aims and Objectives**

7 This study explores embedded researcher's age, qualifications, research environment and  
8 experience in healthcare and academic organisations in Australia and makes comparisons across  
9 three core professional disciplines of nursing and midwifery, medicine and allied health.

10 **Background**

11 The embedded researcher model, where a researcher is embedded as a core member of the clinical  
12 team, offers promise to support the implementation of research evidence into practice. Currently,  
13 there is a lack of clarity about how the model has been adopted across the three largest professional  
14 disciplines in Australian healthcare.

15 **Design**

16 A cross-sectional survey was designed and reported, using the STROBE Statement.

17 **Methods**

18 A purposive sample of embedded researchers were invited to participate in an exploratory online  
19 survey. Embedded researchers worked, or had worked, for a minimum of 30% of their time, in a  
20 healthcare organisation doing research or building research capacity. Participant responses were  
21 extracted from the survey and imported into SPSS for analysis.

## 22 **Results**

23 Perspectives of 100 Australian embedded researchers were compared across nursing and midwifery  
24 (36%, n=37), allied health (35%, n=36), and medicine (26%, n=27). Professional differences are  
25 reported in respondents' qualifications and experience, employment conditions and their research  
26 cultures and environments. Comparatively most nursing and midwifery embedded researchers were  
27 older, more clinically experienced than allied health respondents, who were more research qualified.  
28 Medical embedded researchers are typically older, more clinically experienced and focussed on  
29 producing personally relevant clinical research. Nursing and midwifery embedded researchers  
30 reported doing clinical research within their teams, as well as research capacity building,  
31 management and clinical practice roles.

## 32 **Conclusions**

33 Embedded researchers describe different career trajectories across the three largest professional  
34 disciplines in Australian healthcare.

## 35 **Relevance to Clinical Practice**

36 Embedded researchers from different professional disciplines enact their work differently. It appears  
37 that when they engage in research capacity building via a range of management and networking  
38 roles, embedded researchers contribute to their organisation's research culture and receive greater  
39 recognition for their achievements

40 **Keywords:** Embedded research, clinician researchers, research culture, nursing, midwifery,  
41 medicine, allied health personnel, knowledge translation, research personnel

42

43

44 **Main text:**

45 **Background**

46 Engaging health professionals in research has the potential to improve healthcare organisational  
47 performance, patient satisfaction and staff retention (Hanney, Boaz, Jones & Soper, 2013; Harding,  
48 Lynch, Porter & Taylor, 2017). These benefits to patient care and service delivery can be enhanced  
49 when research is led by the health professionals who will use it (Blevins, Farmer, Edlund, Sullivan &  
50 Kirchner, 2010). Consequently, as clinicians identify clinical needs and collaborate with researchers  
51 to address them, resultant research has the potential to improve clinical practice (Hanney et al,  
52 2013). Conversely, the McKeon review of Health and Medical Research in Australia concluded that  
53 researchers should engage more directly with clinicians to ensure that research addresses key  
54 clinical needs and provides practical and implementable solutions (Commonwealth of Australia,  
55 2013). However, the literature about engaging health professionals in conducting and leading  
56 research is still evolving and many ongoing initiatives show promise (Blevins et al, 2010; Misso et al,  
57 2016; Mickan, Wenke, Weir, Bailocerkowski & Noble, 2017).

58

59 The model of embedded researchers has received recent attention and describes researchers who  
60 work in both academic and healthcare institutions (Vindrola-Padros, Pape, Utley & Fulop, 2017). As  
61 they are embedded in a healthcare organisation, they can access local contextual information not  
62 readily available to outsiders and better understand local pressures, problems and priorities (Lewis &  
63 Russell, 2011; Marshall et al, 2014). Consequently, embedded researchers have greater access for  
64 data collection and have better organisational insights into policies and practices affecting  
65 healthcare practitioners, managers and service users. With similar access to academic knowledge  
66 and networks, they can co-design and produce research that is both relevant and practical for  
67 clinicians and other end users, while incorporating clinical practice changes (Marshall et al, 2014;  
68 McGinity & Salokangas, 2014). In addition, embedded researchers are able to facilitate and build the

69 healthcare organisation's research capacity by establishing a research culture and teaching  
70 evaluation and research skills (Marshall et al, 2014).  
71  
72 In Australian healthcare, the three largest professional disciplines have developed distinct models of  
73 care and career structures which impact their engagement with research. The largest profession of  
74 nursing and midwifery has transitioned during the 1980's in Australia, from hospital-based  
75 apprenticeship training to university degrees. Consequently, the infrastructure for nursing research  
76 is still developing and many nurse researchers work across complex research, clinical practice and  
77 teaching roles (Hafsteindottir, van der Zwaag & Schuurmans, 2017). In Australia, nurse practitioner  
78 and clinical nurse consultant positions both have research expectations in their roles. However,  
79 health service managers are reported to value clinical service of nurses and midwives over their  
80 research contribution (Gullick & West, 2016). In medical practice, clinical academic positions are  
81 usually associated with Consultant level appointments. In a recent documentary analysis of the  
82 intended research curriculum from 58 Australian medical specialist colleges, it was concluded that  
83 research productivity was important for career progression. Specialists were expected to lead  
84 research, despite reports of limited supervision, superficial research training and limited  
85 participation in multi-disciplinary research teams (Stehlik et al, 2020). Allied health professionals  
86 constitute approximately one-third of the health workforce and include a broad range of health  
87 disciplines, excluding doctors, nurses and midwives, dentists, and complementary therapists. Most  
88 Australian allied health professionals have university degrees and are research literate (Slade, Philip  
89 & Morris, 2018). Dedicated research positions in allied health have been shown to enhance  
90 individual and team based research skills, and to build research culture (Wenke & Mickan, 2016;  
91 Wenke et al, 2017).  
92  
93 Embedded researchers have largely supported the practice and application of evidence based  
94 medicine, which developed initially to integrate doctors' clinical expertise with current best research

95 evidence to make decisions about the care of individual patients (Sackett, Rosenberg, Gray, Haynes  
96 & Richardson, 1996). Early descriptions of best available evidence were described as clinically  
97 relevant research, often from the basic sciences of medicine. Early research in evidence-based  
98 practice included both doctors and nurses as study populations (Knopps, Vermeulen, Legemate &  
99 Ubbink, 2009). As the professions of nursing and midwifery developed, it was recognised that  
100 nurses needed to both use evidence-based clinical information and generate new knowledge about  
101 patient care beyond the specific disease contexts prevalent in medicine (Hickman et al, 2018). At the  
102 same time in Australia, a distinct allied health professional community emerged with new  
103 organisational structures that managed a broad range of clinical professionals together (Boyce,  
104 2006). These allied health professionals often worked in multidisciplinary teams, community settings  
105 and focussed on patient centred outcomes. As they became interested in evidence-based practice,  
106 allied health professionals required broader research paradigms, beyond basic sciences, to provide a  
107 substantial clinically relevant research base (Bennet et al, 2003; Heiwe et al, 2011; Pickstone et al,  
108 2008).

109

110 As the embedded researcher model has developed, there is a lack of clarity about the experience,  
111 expertise and specialisation of the researcher (Marshall, 2014; Vindrola-Padros et al, 2017). In  
112 particular, it is not clear how the model has been adopted across the three largest professional  
113 disciplines in Australian healthcare; represented by doctors, nurses and midwives, and allied health  
114 professionals. Each professional discipline group has different disciplinary knowledge and research  
115 practices and is informed by different research paradigms and literature (Weaver & Olson, 2006).  
116 Within a broad mixed-methods study designed to describe the characteristics and experiences of  
117 embedded researchers in Australian healthcare settings at the beginning of 2019, this paper will  
118 describe the investigation and comparison of embedded researchers' experiences across different  
119 professional disciplines.

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## **Materials and Method**

An online survey was developed by the authors for embedded researchers to describe key aspects of their role and to document perspectives of their experience. A range of questions were developed and piloted for quick responses, including Likert scales, drop-down menus, and open-ended questions.

### **Survey description and development**

For Likert scale questions, respondents were asked to rate eight statements in relation to their role as embedded researchers on a Likert scale from never (1) to always (5), eight statements in relation to the research culture of the healthcare organisation on a Likert scale from disagree (1) to agree (4), and four statements in relation to their dual affiliation on a 3 item scale from disagree (1) to agree (3). The survey took approximately 15 minutes to complete.

### **Participants**

A purposive sample of current and former embedded researchers were invited to participate. Embedded researchers were defined as individuals with research qualifications who worked, or had worked, for at least 30% of their time in a healthcare organisation doing research or research capacity building. The survey was administered via an online link emailed to potential participants, with supporting information about the study. Both authors invited colleagues from their relevant local and national networks to participate. Using a modified snowball sampling strategy (Bryman, 2001), this initial group of respondents were asked to share the email invitation with other embedded researchers that they knew.

## 146 **Analysis**

147 Data was described using Excel and analysed using SPSS. Initially data were described and analysed  
148 as a whole, and then responses of embedded researchers were compared based on professional  
149 discipline. Responses are presented using whole numbers and percentages. The mean of 4 or 5 item  
150 Likert scale responses were calculated, after removal of “don’t know” responses.

151

152 To test for differences in Likert scale responses (ordinal data) between respondents based on  
153 professional affiliation, a Mann-Whitney u test was used because the data was not normally  
154 distributed. The normality of the data was tested using the A Shapiro-Wilk’s test ( $p>0.5$ ), a visual  
155 inspection of their histograms, and skewness and kurtosis z-values. Significance was set at 0.05.  
156 Ethics approval for this study was received by University of Technology Sydney human research  
157 ethics committee (HREC reference number ETH18-2901). The study conforms to the provisions of  
158 the Declaration of Helsinki. Respondents provided informed consent. The Strengthening the  
159 Reporting of Observational studies in Epidemiology (STROBE) statement has been completed (see  
160 Supplemental File 1).

161

## 162 **Results**

163

164 Of the 104 embedded researchers who completed the online survey, a third were from nursing and  
165 midwifery (35.6%,  $n=37$ ), a third from allied health (34.6%,  $n=36$ ), and a quarter from medicine (26%,  
166  $n=27$ ). The remaining 4 respondents described themselves as a Library Services Manager, Clinical  
167 Research Centre Manager and Research Officers, and their responses have been removed from the  
168 following data analysis to focus on comparisons between the three core professional disciplines.

169



170 The majority of respondents were in a current embedded researcher role (n=71, 68%). Of the 37  
171 embedded researchers from nursing and midwifery, 30 (81%) were in a current embedded  
172 researcher role and 7 reported on a previous role (19%). Of the 36 embedded researchers from  
173 allied health, 23 (64%) were in a current embedded researcher role and 13 reported on a previous  
174 role (36%). Of the 27 from medicine 16 (59%) were in a current embedded researcher role and 11  
175 reported on a previous role (41%).

176

177 Almost half of current embedded researchers had been in their role for less than 2 years (n=28,  
178 40%). This was most pertinent for nursing and midwifery (n=14, 47%) and allied health (n=10, 43%)  
179 respondents. In contrast, medical respondents had a longer history in their roles, with over half  
180 having more than 6 years' experience. Former embedded researchers generally had more  
181 experience than current incumbents, with almost half of previous medical embedded researchers  
182 having over 16 years' experience in their role (n=5, 45%).

183

#### 184 **Embedded Researcher's Age, Qualifications and Experience**

185 Most embedded researchers were aged between 51 and 60 years (n=41, 39%), a third were aged  
186 between 41-50 (n=30, 29%), with 16% aged 31-40 (n=17), 12% aged over 60 (n=12) and 2% aged  
187 between 20-30 (n=3). Comparatively, these proportions looked very different by profession. More  
188 than half of all medical and nursing and midwifery respondents were aged over 50 years, while most  
189 allied health respondents were less than 50 years old.

190

191 With this age maturity, embedded researchers were also highly qualified and experienced in both  
192 clinical and academic positions. The majority of embedded researchers had been awarded a PhD  
193 (n=78, 75%) or research masters (n=10, 10%) on average eleven years ago. However, there were  
194 comparative differences between professions. Allied health respondents reported the highest  
195 proportion of PhDs (n=30, 83%), awarded on average 13 years ago. Nursing and midwifery

196 respondents reported the lowest proportion of PhDs (n=26, 70%), awarded 10 years ago. There were  
197 20 (74%) medical respondents with a PhD, awarded on average 11 years ago.

198

199 More than half of current embedded researchers reported over 16 years of experience in clinical  
200 positions (n=37, 55%). This is consistent for medical (n=10, 67%) and nursing and midwifery (n=18,  
201 64%) respondents but more than half of allied health respondents reported less than 5 years clinical  
202 experience.

203

204 In comparison, only a third of current embedded researchers reported over 16 years of experience in  
205 academic positions (n=22, 33%). This proportion is higher for medical (n=7, 47%) and allied health  
206 (n=9, 39%), compared to nursing and midwifery respondents (n=6, 21%). However, the patterns of  
207 developing academic experience are similar across the professional groups.

208

### 209 **Embedded Researchers' Employment Conditions**

210 Half of the embedded researchers reported they were primarily employed by a healthcare  
211 organisation and half by an academic organisation. Practically, individuals need to adhere to the  
212 human resource and work practices of one organisation. This even distribution between healthcare  
213 and academic organisations was maintained for each profession. Most respondents reported having  
214 a formal 'conjoint appointment' (n=59, 60%). Comparatively more allied health respondents (n=24,  
215 67%) reported a formal 'conjoint appointment' than medical (n=15, 56%) and nursing and midwifery  
216 respondents (n=22, 59%).

217

218 Nearly half (n=43, 46%) of embedded researchers had only 30% of their salary paid for by their  
219 healthcare organisation and over a third (n=36, 39%) were fully paid for by a healthcare  
220 organisation. These proportions varied between professions. A higher proportion of nursing and  
221 midwifery respondents (n=42, 45%) were fully paid for by their healthcare organisation, whereas

222 most allied health respondents (n=56, 60%) were only paid at minimum levels by their healthcare  
223 organisation.

224

225 Of embedded researchers whose primary affiliation was academic (n=52), the majority were  
226 employed at Professor level (n=27, 52%), followed by Research Fellow/Senior Research Fellow or  
227 Lecturer/Senior Lecturer level (Assistant Professor) (n=19, 36.5%), and Associate Professor level  
228 (n=6, 11.5%). This profile is relatively consistent for medical and nursing and midwifery respondents.  
229 However, allied health respondents reported a higher proportion of Associate Professors (n=4, 21%).

230

231 For embedded researchers whose primary affiliation was a healthcare organisation, the majority  
232 identified as a 'clinician researcher' (n=34, 68%). The remaining respondents were employed in  
233 middle management roles (n=6, 12%), senior/executive management (n=5, 10%), mixed  
234 management/clinical practice (n=4, 8%), and project management (n=1, 2%). A large range of role  
235 titles corresponded to these reported roles, and they often identified professional affiliations as well  
236 as hierarchical level e.g. Research Fellow–Nursing. Nursing and midwifery respondents most closely  
237 matched the proportions of the whole group (Figure 1). In contrast, most medical respondents  
238 (n=11, 85%) identified as clinician researchers and there were comparatively less allied Health  
239 respondents identified as clinician researchers (n=9, 53%).

240

241 Insert Figure 1: Clinical role profile, by profession

242

243 Most embedded researchers reported clear reporting lines within their organisation. Many different  
244 role titles of line managers were reported, and they often identified professional affiliations as well  
245 as hierarchical level. There appeared to be as many differences within professions as between them,  
246 for this sample of respondents. Most embedded researchers also managed staff (n=59, 59%).

247 Proportions varied between professions, with most medical respondents (n=22, 85%) managing

248 larger numbers (2-26) of staff. Half of allied health respondents (n=20, 56%) also managed teams of  
249 up to 30 research, administrative and clinical staff. In contrast, a lesser proportion of nursing and  
250 midwifery respondents (n=14, 41%) managed smaller groups (1-13) of staff.

251

252 Most medical and nursing and midwifery respondents reported belonging to teams, named by the  
253 clinical or diagnostic group e.g. respiratory or endocrinology team. In contrast, most allied health  
254 embedded researchers reported belonging to allied health service teams, with some identifying a  
255 specific professional team e.g. physiotherapy. This suggests that allied health respondents maintain  
256 a strong professional identity.

257

## 258 **Research Environment**

259 Although most embedded researchers reported that research was a strategic objective of their  
260 healthcare organisation, agreement was highest amongst allied health (n=34, 94%) and nursing and  
261 midwifery respondents (n=30, 91%), and lowest for medical respondents with only 17 (65%)  
262 agreeing.

263

264 Overall, most embedded researchers engaged in personal research (89%), clinical team/group's  
265 research (89%), linking people and networking (82%), capacity building (81%) and project  
266 management (71%), while only a third reported engaging in information management (34%).

267 However, the way in which embedded researchers enacted their role differed by professional  
268 discipline. Comparatively, most medical respondents engaged in personal research (n=25, 96%) and  
269 reported variable levels of engagement in networking (n=18, 69%), project management (n=14, 54%)  
270 and information management (n=4, 15%). In contrast, most nursing and midwifery and allied health  
271 respondents engaged in their team's clinical research and the majority of allied health respondents  
272 also engaged in capacity building (n=33, 92%). Comparatively nursing and midwifery and allied

273 health respondents also engaged in more tasks around information management, networking and  
274 project management than medical respondents (Figure 2).

275

276 Insert Figure 2: Engagement in research activities by profession

277

278 Embedded researchers were asked to rate their experience of working as an embedded researcher  
279 in relation to 8 statements on a 5-point Likert scale from never to always (Table 1). High and  
280 consistent agreement was reported around building collaborative relationships between clinical and  
281 academic teams. However different patterns were evident between professional disciplines.

282 Statistically significant differences in mean responses were noted between medical and allied health  
283 respondents. Medical respondents reported least experience of working with clinicians to identify  
284 clinically important research questions and apply research findings in their practice, and they  
285 reported least recognition for building clinicians' research capacity and least support by their clinical  
286 managers. For these statements, nursing and midwifery respondents offered mean responses  
287 between medicine and allied health. However, for the statement where embedded researchers  
288 design research with stakeholders so it will be relevant to end users, medical respondents reported  
289 significantly lower mean responses than nursing and midwifery and allied health respondents.

290

291 Insert Table 1: Mean responses to embedded researcher experience, by profession

292

293 Embedded researchers were asked to rate their level of agreement with 8 statements describing the  
294 research culture of their healthcare organisation on a 4-point scale from disagree to agree. The  
295 highest responses and most consistent agreement were for clinical practice being informed by  
296 research. There was also relatively consistent agreement across the two lowest rated statements,  
297 that resources are available to support researchers and that research is initiated or informed by  
298 epidemiological and qualitatively determined priorities of the healthcare organisation. However,

299 mean responses varied between professions (Table 2). Significant differences were noted where  
300 medical respondents rated their organisations' commitment to research, and its recognition and  
301 value for health services research lower than nursing, midwifery and allied health respondents did.  
302 In both of these statements, allied health respondents rated the research culture most positively.  
303 Another difference was noted where medical respondents rated most highly research that was  
304 initiated by their own personal/career agenda. In contrast, nursing, midwifery and allied health  
305 respondents rated most highly research that was co-produced with academic partners.

306

307 Insert Table 2: Mean responses of healthcare organisation's research culture, by profession

308

### 309 **Embedded Researcher's Experience of Dual Affiliation**

310 Two-thirds of embedded researchers (n=69, 66%) reported having a dual affiliation, of which 59  
311 reported a formal conjoint appointment. They rated their experience of a dual affiliation across 4  
312 statements using a 3-point Likert scale from disagree to agree (Figure 3). Consistently, half of all  
313 respondents reported struggling to manage the demands of both clinical and academic  
314 organisations, despite over half agreeing that co-production of research is valued by both  
315 organisations. Comparatively, nursing and midwifery respondents reported higher levels of conflict  
316 between expectations of both organisations, and lower levels of value by the academic institution of  
317 their research achievement in the clinical organisation.

318

319 Insert Figure 3: Responses describing dual affiliation experience, by profession

320

321

## 322 **Discussion**

323 This study reports perspectives of 100 Australian embedded researchers representing three core  
324 professional disciplines; of nursing and midwifery (37), allied health (36), and medicine (27). Most  
325 respondents reported on their current positions, however almost half reported less than 2 years'  
326 experience in their current role, and medical respondents reported the longest time in previous and  
327 current roles.

328

329 Professional differences in qualification and experience have been tracked through employment  
330 conditions into research cultures and environments, to demonstrate how different professional  
331 disciplines have experienced embedded researcher roles. Comparatively most medical, nursing and  
332 midwifery embedded researchers were older, more clinically experienced and reported a higher  
333 proportion of their positions paid for by healthcare organisations than allied health respondents.  
334 Notable variations were reported between affiliation and professional group. Over half of  
335 respondents who had a primary academic affiliation had a professorial title, and while this was  
336 consistent between professional disciplines, there were comparatively more allied health  
337 respondents with a PhD and research master's qualifications and with an associate professor title.  
338 For the embedded researchers with a clinical affiliation, most medical respondents were focussed  
339 clinician researchers. However, up to a third of nursing and midwifery clinician respondents and a  
340 half of allied health respondents reported complementing their clinician researchers' roles with a mix  
341 of management and clinical practice roles.

342

343 This study describes how different professional disciplines have discrete trajectories and experiences  
344 of research. Medical embedded researchers, who were older and clinically experienced reported a  
345 strong focus on their own clinical research, which was initiated by their own personal/career agenda.

346 This likely reflects the focus of their specialist education in leading research (Stehlik et al, 2020).

347 They reported limited experience in building the capacity for research in their peers and they were

348 more critical of their healthcare organisations in being able to strategically and practically support  
349 collaborative research. Their research activities may reflect the more traditional origins of evidence-  
350 base medicine and the funding priorities of the National Health and Medical Research Council  
351 (NHMRC) for basic biomedical science and clinical medicine (Dyke & Anderson, 2014).

352

353 In comparison, the younger, more research qualified allied health embedded researchers in this  
354 study reported stronger academic associations and more formal conjoint appointments. They  
355 reported working across a greater mix of management and clinical positions in the healthcare  
356 organisations, collaborating with clinical teams to engage and co-produce research and building  
357 clinicians' research capacity. Consequently, they rated their healthcare organisation's research  
358 culture most positively and reported recognition and value for their research achievements. While  
359 traditional funding allocation for allied health clinical research has been low and imbalanced  
360 compared to that of other professions internationally, there has been an enthusiasm for  
361 understanding the complexities of research capacity building (Golenko, Pager & Holden, 2012; Pager,  
362 Holden & Golenko, 2012). Additional research fellow positions have been employed in some health  
363 services to specifically build research capability and engagement (Mickan et al, 2017; Wenke et al,  
364 2017). Further, allied health clinicians have recognised the need to engage healthcare managers to  
365 influence and support clinicians research capabilities, in order to use research to inform practice.  
366 Promoting research as an organisational core value, with support from senior managers can  
367 establish structures, processes and systems to facilitate research and reinforce evidence-based  
368 practice (Golenko et al, 2012; Wenke et al, 2017).

369

370 In between, nursing and midwifery embedded researchers in this sample represent an older and  
371 clinically experienced workforce, with least research qualifications and academic experience. They  
372 described stronger alignment with and financial reimbursement from their healthcare organisation,  
373 in which they occupy a range of clinician researcher and management roles. This concurs with the



374 history of nursing as a practice-based discipline that values practical and theoretical knowledge  
375 (Hutchinson, Higson, Cleary & Jackson, 2016). It also reflects reported research priorities for nurses  
376 in areas of practice related to improving patient care (Wilkes, Cummings & McKay, 2013). Nursing  
377 and midwifery respondents' reports of conflicting expectations and lower value for their research  
378 achievements may in part represent their profession's history. It may also represent the  
379 longstanding imbalances between research and teaching expectations in academic environments,  
380 persistent funding inequities and limited resources and infrastructure to support research (Tranmer  
381 et al, 2020). In Australia, comparatively fewer nurses and midwives choose research degrees over  
382 clinical qualifications and subsequently, this limits their capability and engagement in research, and  
383 ultimately to conduct and publish research (Smith, Gullick, Ballard & Perry, 2018). Studies in  
384 Australia also revealed that clinical nurse consultants cited lack of management support and high  
385 clinical workloads as reasons for their limited engagement in research (Wilkes et al, 2013). Further,  
386 the broad concept of evidence-based nursing aims to improve patient safety, reduce health care  
387 costs and support patient care (Mackey & Bassendowski, 2017).

388

389 A key limitation of this study is that we do not know how representative our sample is because we  
390 do not know how many embedded researcher positions there are in Australia. There is no consistent  
391 national strategy for designing and introducing these positions that could provide a baseline for this  
392 study. This limits this study's generalisability and emphasises the need for more consistent reporting  
393 mechanisms and continued research. However, with recent increases in the number and range of  
394 positions (as observed by both authors within their networks), it is important and timely to describe  
395 emergent patterns. The comparisons between disciplines of this study provides insights for  
396 maximising the benefits of these positions and for future research. Further, the online survey was  
397 designed specifically for this study and can only be descriptively reported. Future research is  
398 required to understand any underlying mechanisms and to better explore the correlations described.

399

400 Practical recommendations from this study reinforce the importance of building research capacity  
401 within clinical teams. Embedded researchers are well placed to co-design research that is clinically  
402 important and to support peers to implement practice improvements. When individuals in clinical  
403 teams have developed their research skills, they can help ensure research is viewed favourably and  
404 used within the healthcare organisation, independently of any embedded researchers (Vindrola-  
405 Padros et al, 2017). These research capacity building skills may be more amenable to allied health  
406 and nursing and midwifery embedded researchers. However, it is worth noting the dual aims of the  
407 National Health and Medical Research Council (NHMRC) in Australia to support discovery research  
408 and achieve community benefits of research (Dyke & Anderson, 2014). While medical embedded  
409 researchers may be leading discovery research, nursing, midwifery and allied health embedded  
410 researchers may be most able to apply new knowledge quickly for the benefit of the community.

411

412

## 413 **Conclusions**

414

415 The diversity of professional disciplines' experiences as embedded researchers in Australia early in  
416 2019 has been described. The model of the embedded researcher as a core member of healthcare  
417 organisations' research teams underpins different professional trajectories across the three largest  
418 professional disciplines in Australian healthcare; notably doctors, nurses and midwives, and allied  
419 health professionals. Each professional discipline's experiences are likely influenced by their own  
420 profession's research histories and paradigms. Medical embedded researchers are typically older,  
421 more clinically experienced and focussed on producing personally relevant clinical research.  
422 Conversely, allied health embedded researchers are younger, more research qualified and have  
423 stronger academic associations. They work across management and clinical positions and  
424 collaborate with clinical teams to engage and co-produce research. In between, nursing and

425 midwifery embedded researchers are typically older and clinically experienced but have the least  
426 academic qualifications and experience. They experience conflicting expectations between both  
427 organisations and perceive a lower academic value for their research achievement. It may take time  
428 to align all professional disciplines across scientific and humanist research paradigms to be able to  
429 achieve enhanced research uptake across academic and health service organisations.

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515 **Table 1: Mean responses to embedded researcher experience, by profession**

Statement	Mean Medicine (N=25)	Mean Nursing and Midwifery (N=32)	Mean Allied Health (N=36)	P- value
I establish collaborative relationships between clinical and academic teams	4.08	4.09	4.17	.813
I engage clinicians to explore problems where clinical practice is not consistent with research findings	3.48	4.09	4.19	.013
I design research with stakeholders so that it will be relevant to local end users	3.72	4.34	4.33	.016
I work with clinicians to identify clinically important research questions	3.76	3.88	4.36	.009
I suggest strategies for clinicians to apply research findings in their practice	3.32	3.97	4.08	.003
I am recognised for building research capacity of clinicians I am working with	3.4	3.53	4.33	.001
I feel supported by clinical managers to pursue research activity	3.24	3.66	3.97	.045
I feel valued and respected by clinical colleagues for my research contribution	3.72	3.5	4.11	.055

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518 **Table 2: Mean responses of healthcare organisation's research culture, by profession**

Statement	Mean Medicine (n=25)	Mean Nursing and Midwifery (n=32)	Mean Allied Health (n=36)	p-value Kruskal- Wallis
Clinical practice that is informed by research is valued	3.35	3.42	3.69	.137
Co-production of research with academic partners is valued	2.91	3.13	3.45	.106
There is a commitment to research in this organisation	2.91	3.29	3.74	.000
Health services research is recognised and valued	2.83	3.42	3.44	.044
Research is initiated by personal/career agenda of the researcher	3.61	3.03	3.29	.084
Research is a regular topic of discussion at the executive	2.61	2.94	3.33	.101
Resources are available to support individual researchers	2.39	2.55	2.71	.303
Research is initiated or informed by epidemiological and qualitative determined priorities of the healthcare organisation	2.48	2.74	2.74	.782

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- 521 Figure Legends
- 522 Figure 1: Duration in embedded researcher role, by profession
- 523 Figure 2: Age of embedded researchers, by profession
- 524 Figure 3: Qualification profile of embedded researchers, by profession
- 525 Figure 4: Clinical experience of embedded researchers, by profession
- 526 Figure 5: Academic experience of embedded researchers, by profession
- 527 Figure 6: Payment proportion by healthcare organisation, by profession
- 528 Figure 7: Academic role profile, by profession
- 529 Figure 8: Clinical role profile, by profession
- 530 Figure 9: Engagement in research activities, by profession
- 531 Figure 10: Responses describing dual affiliation experience, by profession