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Using knowledge brokering activities to promote allied health clinicians' engagement in research: A qualitative exploration

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7 **Using knowledge brokering activities to promote allied health clinicians' engagement in research:**
8 **A qualitative exploration**
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ABSTRACT

Introduction

Engaging clinicians in research can improve healthcare organisational performance, patient and staff satisfaction. Emerging evidence suggests that knowledge brokering activities potentially support clinicians' research engagement, but it is unclear how best they should be used.

Objectives

This study explores how embedded researchers utilised knowledge brokering activities to engage research interested clinicians in research.

Design

A longitudinal qualitative interview based study was designed to investigate how experienced research fellows utilise knowledge brokering activities to facilitate allied health clinicians' engagement in research.

Setting

In one large tertiary level, regional Australian health service research fellows were matched with research interested clinicians.

Methods

Qualitative analysis of three longitudinal interviews for each research fellow was undertaken. Initial descriptions of their utilisation of knowledge brokering activities were deductively coded. Reflexive thematic analysis was utilised to generate a shared explanation of clinicians' engagement in research.

Results

Three research fellows facilitated 21 clinicians' participation in and leadership of clinical research projects over 12 months. They utilised all ten key knowledge brokering activities with each clinician, with differing patterns and examples. Research fellows described using linkage and exchange activities of communicating and collaborating with key stakeholders, and they tailored knowledge management products for individual's engagement. Further, they described a broader mentoring relationship where they clarified and monitored individuals' capabilities, motivation and their contextual support for research engagement.

Conclusion

When research fellows chose and tailored knowledge brokering activities to align and extend clinicians' research capabilities and motivation, they created individualised learning curriculums to support clinicians' participation in and leadership of local research projects. Health and academic leaders should consider structuring embedded researcher positions to include knowledge brokering roles and activities, specifically for research interested clinicians who are ready to participate in and lead research projects.

Article Summary: Strengths and limitations of this study

- Embedded researchers were reflexively engaged in describing and justifying their use of knowledge brokering activities
- Embedded researchers co-designed individualised learning curriculums which included knowledge brokering activities with research interested clinicians
- Study conducted in one health service where there was managerial support for professorial and senior research fellows
- Study focused on individual engagement with research, independently of broader organisational analysis

INTRODUCTION

Engaging healthcare clinicians and organisations in research can improve healthcare organisational performance, patient outcomes, and staff satisfaction and retention¹⁻³. To date, most research has linked organisational research engagement, through collaborative partnerships, with improved healthcare performance. However, there is a growing interest in supporting clinicians' ability and willingness to use and participate in research³⁻⁵. Clinicians often have multiple competing priorities which may limit their engagement in research. Lack of time, organisational and managerial support are commonly reported barriers, while clinically relevant and personally meaningful research are noted facilitators. Further, clinicians' research knowledge and confidence can also influence their engagement⁵⁻⁹. Consequently, an increasing array of theoretical and practical activities have emerged to enhance the ability and willingness of health professionals to use, participate in and lead research^{10 11}. The concept of a linear pipeline between the creation and application of research has been superseded by systems and complexity thinking^{12 13}.

Within this complexity, embedded research positions show promise as a strategy to build the research capacity of clinical staff to produce relevant research and generate sustainable practice improvements^{11 14-20}. Specifically, when experienced researchers are employed in stable and accessible positions with leadership support and access to appropriate resources, they can enhance the workplace culture, support clinicians' professional development and generate clinical service improvements¹⁴. While the potentials and challenges of bringing researchers and clinicians together are being documented, it is still unclear how embedded researchers can best support clinicians to engage in research^{4 5 9 11}.

Knowledge brokering has been described as an iterative process of translation and tailoring of information, that can inform the work of embedded researchers^{9 21}. Knowledge brokering tasks include a range of capacity building, facilitation, engagement and support activities that emphasise the human component of engaging with research²²⁻²⁴. Three theoretical models inform the core functions of knowledge brokering^{22 23 25 26}. First, knowledge management theory emphasises the systematic creation and diffusion of knowledge, where information is organised and packaged so it is relevant for clinicians^{22 25}. Second, the linkage and exchange model highlights the dynamic interface between creators and users of knowledge. These tasks focus on interpersonal networks and highly developed communication and facilitation skills which facilitate collaboration between clinical and

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3 academic settings ^{23 25}. Last, the social change framework informs capacity building, where activities
4 are designed to develop users' knowledge and skills, and their ability to access and apply knowledge
5 for evidence-informed decision making ^{22 25}. These three theoretical functions underpin ten key
6 knowledge brokering activities ^{22 23} (see Table 1). Different combinations of knowledge brokering
7 activities have been reported to be utilised together to achieve positive changes in organisations and
8 clinicians' knowledge, skills and practice ^{22 24 27-29}.
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15 Table 1: Key knowledge brokering activities mapped to theoretical domains ²²
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Knowledge brokering activities	Theoretical functions		
	Knowledge management	Linkage & Exchange	Capacity Building
Identify, engage and connect with stakeholders		x	
Facilitate collaboration		x	
Identify and obtain relevant information	x	x	x
Facilitate development of analytic and interpretive skills	x	x	x
Create tailored knowledge products	x	x	
Project coordination	x	x	
Support communication and information sharing	x	x	x
Network development, maintenance and facilitation		x	
Facilitate and evaluate change	x	x	x
Support sustainability			x

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40 While most research has investigated the organisational impact of knowledge brokering, this study
41 will investigate how embedded researchers use knowledge brokering activities to engage individual
42 clinicians in research ²⁴. Most research to date has focussed on encouraging clinicians to engage with
43 and to use research ³. Therefore, it is timely to explore whether and how knowledge brokering
44 activities can support clinicians' engagement in, that is participating in and leading research ^{3 9 22}.
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48 This study investigates how the ten key knowledge brokering activities are enacted by embedded
49 researchers and aims to explain how knowledge brokering activities support individual clinicians'
50 engagement in local research.
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METHODS AND ANALYSIS

Study design

This study was part of a larger mixed methods research project, that was designed to explore strategies for research engagement of clinicians in allied health³⁰. This longitudinal, qualitative interview-based study explored embedded researchers' personal reflections about using knowledge brokering activities, with the purpose of developing novel insights about supporting research interested clinicians' engagement with clinically important research. This study has ethical approval from Gold Coast Health (HREC16/QGC/96).

Setting

In one large tertiary level, regional Australian health service, experienced embedded allied health researchers (referred to as research fellows) were matched with research interested allied health clinicians (referred to as clinicians) who volunteered to participate in and/or lead a local clinically relevant research project^{14 30}. The first four activities described in the published protocol were adhered to and outputs documented³⁰. Individual case studies have yet to be published and this study represents the process evaluation from the research fellows' perspective, which may contribute to a future programme theory.

Participants

All three research fellows working in the health service at the beginning of 2016, were personally invited and provided written consent to participate in this study. They formed a unique purposive sample of clinically experienced allied health clinicians who had completed PhD studies within the last 3-7 years. They were all employed full time in the health service and spent 50% of their time on research capacity building activities. Over a period of 12 months, research fellows chose appropriate and complementary activities from the ten key knowledge brokering activities (Table 1), to facilitate clinicians' engagement in a local research project²².

To counter a small sample size, this study adopted a specific aim to explore the application of knowledge brokering theory and practice at a specific time and place. Strong dialogue and longitudinal in-depth exploration of multiple narratives were included to maximise its informational power³¹.

Data Collection

As active contributors to this study, all research fellows wrote reflective field notes for each interaction with their matched clinicians, including documenting their choice of knowledge

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3 brokering activities, and describing key decisions and behaviours observed²². They participated in
4 three longitudinal interviews of approximately 60 minutes duration, over a 12-month period (once
5 every four months).
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10 Face-to face interviews were conducted by an independent researcher (AB) who was an
11 experienced, trained interviewer, at a convenient workplace location chosen by each research
12 fellow, during 2016 -2017. The interviewer was known by the research fellows but there was no
13 history of collaborative research. The interview protocol consisted of key prompts to describe how
14 research fellows utilised all ten knowledge brokering activities, together with open ended questions
15 about how these activities supported clinicians' engagement with research. The interview protocols
16 were provided to the research fellows before each interview, as a preparatory guide for reflection
17 on their field notes.
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25 In the second and third interviews, research fellows were also asked to discuss changes in patterns
26 of their use of knowledge brokering activities over time and in response to clinicians' progress in
27 their local research projects. Additional open ended follow-up questions were used to gain deeper
28 insights as the interviewer took the stance of a naïve inquirer³².
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33 **Patient and public involvement**

34 No patients involved in this study
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38 **Data Analysis**

39 Interviews were recorded, transcribed and coded by the independent researcher, AB, and first
40 author, SM. After each round of interviews, research fellows were sent their transcripts for
41 verification. They also discussed as a group, their comparisons within and between their work with
42 different clinicians. Reflexive thematic analysis was utilised across two phases, to generate a
43 thorough description and explanation of how research fellows engaged clinicians' in local research
44 projects over 12 months³³.
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52 First, the individual patterns of use of knowledge brokering activities were coded deductively against
53 the published knowledge brokering theory and practice²². The way in which each research fellow
54 utilised knowledge brokering activities with each matched clinician was documented. The strength
55 of this dialogue was enhanced as research fellows were encouraged to make comparisons about
56 working with different clinicians, and they included both similarities and differences in their
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3 narrative descriptions. This cross- case analysis was initially described for each research fellow and
4 then further developed through comparison across all research fellows. The aim was to generate
5 realistic and pragmatic descriptions of how research fellows utilised the knowledge brokering
6 activities ³¹.
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11 Second, a shared explanation was developed through deliberate and reflexive engagement between
12 researchers and research fellows after each series of interviews ³³. Discussion of the progressive
13 stories of clinicians' engagement in their research projects prompted inductive analysis of the use of
14 specific theoretical functions of knowledge management, linkage and capacity building ³⁴.
15 Comparisons were made within and between research fellows of their own explanations, informed
16 by their own internal comparisons between clinicians and their progress in their research projects.
17 This in-depth exploration across a range of different matched pairs of clinicians and research fellows
18 enabled deep narrative explanations with high informational power ³¹. Based on this discussion, a
19 conceptual explanation of how research fellows utilised knowledge brokering functions to engage
20 clinicians in local research projects was co-constructed.
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30 RESULTS

31 Three research fellows facilitated 21 allied health clinicians to participate in and lead clinical
32 research projects over 12 months. Clinicians represented the disciplines of dietetics, occupational
33 therapy, physiotherapy, social work and speech pathology. Research projects included systematic
34 reviews, audit projects and pilot clinical studies. Research fellows described using all ten knowledge
35 brokering activities with each clinician, with differing patterns and examples.
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41 First, descriptive summaries of the ten knowledge brokering activities are provided, as a
42 comprehensive summary. Second, a shared explanation of the way in which the theoretical
43 knowledge brokering functions facilitated clinicians' engagement in research has been developed.
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47 **Utilisation of knowledge brokering activities**

48 Detailed summaries follow of how research fellows used the ten knowledge brokering activities over
49 12 months with different clinicians/projects ²². Quotes from interviews with research fellows are
50 included in italicized text to substantiate this description but have not been attributed to individuals
51 to maintain their confidentiality.
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57 ***Identify, engage and connect with stakeholders***

58 Research fellows described being like an internal stakeholder, in scoping and establishing the best
59 research team possible, based on the clinical project and the clinicians' expertise. At the outset, they
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3 initiated meetings to recognise and align stakeholders. During the projects, they facilitated critical
4 discussion and often identified additional and strategic stakeholders. They also described guiding
5 clinicians to engage with stakeholders, through preparatory and de-briefing meetings, and made
6 explicit the value of connecting. One participant commented: *“you don't always have the perfect
7 research team to begin with [but]...identifying key stakeholders early would be more effective.”*
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13 **Facilitating collaboration**

14 Research fellows described setting up and facilitating regular research team meetings, to inform and
15 engage stakeholders, build consensus and make decisions. They ensured that all members knew
16 what was happening, had clear roles and expectations: *“my role is to encourage them to think about
17 when they should be engaging with this person”*. Over time, clinicians took ownership of these team
18 meetings and began to set agendas.
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24 **Identify and obtain relevant information**

25 Initially, research fellows described providing access to relevant and practical information and
26 resources: *“gently giving people readings to do along the way...explaining these are the reasons why
27 this is important”*. Research fellows reminded clinicians about evidence-based practice and
28 encouraged clinicians to use critical appraisal skills. As clinicians engaged in the research process,
29 research fellows continued to connect them with relevant information and described facilitating
30 clinicians to use and interact with appropriate and timely resources: *“it's trying to shortcut things for
31 them, because we've got such short timeframes [and] you want to make sure they get a good
32 outcome so that they're not disenchanted.”*
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42 **Facilitate development of analytic and interpretive skills**

43 Research fellows described making assessments of clinician's knowledge and skills, and then
44 tailoring specific guidance at the appropriate level and time, for each clinician, to meet the needs of
45 their project: *“they're time poor and when they want to do something, they just want to make it
46 specific to their project.”* They helped clinicians to address their own knowledge and skill gaps by:
47 *“identifying what they need to know, then developing strategies to help them to meet those learning
48 needs.”* Research fellows described facilitating analytical and interpretive skills throughout the
49 lifetime of each project, with more time focused on data analyses and writing up phases.
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57 **Create tailored knowledge products**

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3 Research fellows created an individualised learning curriculum of research knowledge and skills for
4 each clinician. They shared templates, checklists, online tutorials, guides and examples of previous
5 work (e.g., ethics applications), and aligned these to the clinician's knowledge and skills set in a
6 timely manner: *"you have to go back to your original experiences and your own journey and [suggest
7 the] tools and strategies that worked for you."* When using existing resources, research fellows
8 described providing specific assistance: *"even though there were steps, we tailored those to make it
9 even more user-friendly"*. They also described a need to design their own resources: *"I need a suite
10 of handouts around critical analysis tools and some worksheets that I could use all the time."*

17 18 **Project Coordination**

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20 Research fellows noted that most clinicians had not led a research project before. Therefore, they
21 initially adopted a coordinator role, overseeing the whole project and guiding clinicians to use
22 project and time management tools. They helped clinicians manage tasks that operate concurrently
23 and sequentially: *"if you give them [project management] tools and say, we're going to go one step
24 at a time, then they can actively work on different areas and come back to you [as they complete
25 each step]"*. Research fellows emphasised their role in helping clinicians manage their time: *"I assist
26 clinicians by making them aware of the next stages that they need to plan for, and how long it might
27 take"*. They recognised that timely guidance ensured success at each stage and increased clinicians'
28 confidence, so they could understand: *"where we are on our timeline and what's got to happen
29 next"*.

36 37 **Support communication and information sharing**

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39 Research fellows described initiating regular meetings and gradually sharing with clinicians the
40 importance and purpose of regular communication. Specific and timely guidance was noted as
41 important to prevent new researchers from becoming overwhelmed: *"I think research is something
42 that has to be engaged with at a micro level to achieve macro stuff.... otherwise it's too
43 overwhelming."* They recommended clinicians share information about progress with key
44 stakeholders, and over time, revisited their priorities to maintain engagement. Research fellows
45 reminded clinicians to provide positive feedback to key stakeholder groups throughout the project:
46 *"I'm mindful of highlighting positive things that are happening and acknowledging everyone's
47 contribution, to keep the motivation"*.

54 55 **Network development, maintenance and facilitation**

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3 Research fellows often introduced clinicians to researchers from their own networks: *"I tailored their*
4 *network to achieve their goal of doing this research project within their everyday practice"*. They
5 encouraged clinicians to develop new networks through working and learning together: *"so by*
6 *working on something together you're learning from and with each other"*. Research fellows
7 emphasised the value of networks for sharing and building resources: *"helping people understand*
8 *that if we don't share this, someone else is going to do exactly the same... and waste resources doing*
9 *what we already know"*. Further, research fellows facilitated clinicians to balance competing
10 demands, motivation and responsibilities within their networks: *"everyone's got different*
11 *motivations, goals, responsibilities; you have to be mindful of that...someone might have a lot of*
12 *other responsibilities"*. They encouraged clinicians to present locally, to create awareness of their
13 work and to recognise that these discussions can lead to future collaborative opportunities.
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23 **Facilitate and evaluate change**

24 Research fellows described needing to know clinicians well to align opportunities to facilitate
25 individual change: *"if you're introducing them to something new, you have to monitor where they're*
26 *at and how ready they are"*. They described their crucial role in helping clinicians set realistic
27 research goals for their projects and using these goals to monitor and evaluate change: *"by relooking*
28 *at those goals with clinicians and seeing which goals we are making good progress with ... that's*
29 *been helpful with ongoing evaluation of learning"*. Bringing clinical practice improvements to the
30 attention of peers and their managers made it real and motivating to clinicians: *"making sure we're*
31 *acknowledging to the clinician or to people around them, that they have had a change in skill set,*
32 *and ... we've effected a change [in practice] because of the work that they've done"*. Later in the
33 research projects, research fellows also helped clinicians to assess readiness to change within their
34 local context, before implementing research findings in practice.
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45 **Support sustainability**

46 Research fellows described supporting individual sustainability through encouraging critical thinking,
47 and reflective practice: *"it's easy when people ask you a question, to just give them the answer*
48 *straight away.... but that doesn't help with their learning...instead, hold back a little and encourage*
49 *them to reflect and think"*. They described multiple challenges to sustaining a clinician's
50 engagement in their research project over time as an: *"interplay between having the motivation,*
51 *opportunities and capability"*. It was acknowledged that sometimes both research fellows and
52 clinicians were unsure of the organisational support for specific research projects and that some
53 clinicians lacked the intrinsic motivation compared to those completing a research higher degree.
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3 Research fellows emphasised that sustainability is more likely if clinicians have a successful research
4 experience: *“positive outcomes motivate you and enhance sustainability”*. Therefore, they felt
5 responsible for co-designing the research project for success in the local context: *“you’ve got to*
6 *work out in this clinical setting, what is reasonable in the time frame that we have... you’ve got to*
7 *make sure that we get [the clinician] through to the end, as a good experience”*. Further, clinicians
8 needed to understand the progression of research within a clinical area: *“a good example of the*
9 *progression from systematic review to survey of practice, to a clinical trial”*.
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16 **Shared explanation of how research fellows supported clinicians’ engagement in research**

17 Following these descriptive summaries of the ten knowledge brokering activities, research fellows
18 described using an overarching mentoring and facilitation approach to co-construct a unique
19 learning journey for each clinician, while being knowledge managers, linkage agents and capacity
20 builders. This journey was defined by the clinician’s capability, motivation and the demands of the
21 local research project and workplace context. The way in which research fellows selected knowledge
22 brokering activities to initiate linkage and exchange functions and facilitate knowledge management
23 is presented in Table 2. Key mentoring tasks are delineated and interspersed. Throughout, research
24 fellows used capacity building functions to co-create individualised learning journeys for clinicians
25 focused on their own research project.
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35 To begin, research fellows reported clarifying clinicians’ motivation to do research: *“it’s about*
36 *connecting with who they see themselves to be”*. For some clinicians, research was not part of their
37 identity, there were few role models and uncertain longer-term career benefits. Research fellows
38 also needed to monitor and evaluate each clinician’s level of knowledge and skills to engage in
39 research: *“if someone says they’ve done [it] before, then you think they’re capable, but I must check*
40 *whether they’re doing it the way that I would expect them to do it”*. Further, understanding the
41 workplace environment was crucial to understand competing demands and local supports: *“they*
42 *have different amounts of opportunity, so it’s crafting something they want to engage in but also*
43 *what’s achievable within the environment that they are in”*.
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52 Based on this individualised analysis, research fellows described choosing knowledge brokering
53 activities carefully: *“based on the person, the project, the context and the barriers that have been*
54 *identified”*. The choice of knowledge brokering activities needed to be responsive and timely: *“some*
55 *clinicians work better when they go away and do something independently and others like to be*
56 *shown how to do it and then try it themselves”*.
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5 Early on, research fellows actively initiated networks and set up research projects while also
6 conceptualising the research process for each clinician: *“the learning curriculum is like the research*
7 *journey from the idea formation through to dissemination”*. They initiated linkage and exchange
8 functions, such as identifying and aligning stakeholders, establishing meetings and facilitating
9 clinicians to connect and collaborate with stakeholders.
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15 Following on, research fellows described aligning clinicians' readiness to engage with research
16 before setting clear learning goals: *“identify their motivations for engaging in research and then*
17 *connect that with the research project at hand”*. They identified appropriate research tasks within
18 local projects: *“if you've made an assessment of the clinician's knowledge, skills and attributes, then*
19 *you can design strategies that will ensure they achieve the next step”*.
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25 Research fellows then described facilitating knowledge management activities of sharing relevant
26 information, creating tailored knowledge products, providing specific assistance and project
27 coordination. They reported providing encouragement, feedback and positive reinforcement around
28 these knowledge management tasks: *“you have to look at the project, the person, their skillset and*
29 *what needs to happen... and how they respond, because everyone's different”*. Research fellows
30 emphasised maintaining a consistent facilitative role to build clinicians' confidence by: *“making it a*
31 *positive learning environment, so they're more likely to want to engage in research and share*
32 *positive experiences with their clinical peers”*. Ultimately, they co-created successful experiences
33 over 12 months for clinicians participating in and leading local research projects.
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42 All research fellows described the need to anticipate *“what's going to come next”*, respond *“to what*
43 *unfolds, being mindful of who they are”* and have protective measures in place *“so they will still*
44 *progress”*. They reported setting appropriate boundaries in relation to clinicians' work demands:
45 *“working out who is going to be able to do the job and who's not”*. They described monitoring micro-
46 cycles of progress for every clinician and providing just-in-time challenges to: *“meet the needs of the*
47 *clinicians at the right time within the life of the project”*. Research fellows described utilising
48 knowledge management and linkage and exchange activities to build research capacity, as they co-
49 designed, with clinicians, activities to progressively complete their local research projects.
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Table 2. Application of knowledge brokering activities within a mentoring process

Knowledge Brokering Activity	Initiation <i>Research fellows guided clinicians by...</i>	Facilitation <i>Research fellows helped clinicians to...</i>
<i>Mentoring Process:</i>	<i>Clarify motivation to do research Assess and monitor knowledge and skills to do research Understand competing demands and support in local workplace</i>	
Identify, engage and connect with stakeholders	Scoping, establishing and aligning best combination of local stakeholders	
Identify and obtain relevant information	Accessing relevant research evidence and practical local resources	
Project coordination	Setting up and coordinating the research project using local tools and relevant timelines	
Support communication and information sharing	Initiating regular meetings and guiding content and communication strategies	
<i>Mentoring Process:</i>	<i>Align clinicians' readiness to engage in research project Set expectations around learning goals Identify appropriate tasks</i>	
Create tailored knowledge products		Access purpose-designed templates, checklists, tutorials, guides
Facilitate collaboration		Establish communication systems to collaborate with stakeholders
Facilitate development of analytic and interpretive skills		Learn the skills of doing research, analysing, and interpreting data
Network development, maintenance facilitation		Develop and maintain key stakeholder and working groups
Facilitate and evaluate change		Set realistic goals, monitor and evaluate their progress in local context
Support sustainability	Co-design research project in local context through monitoring motivation, local opportunities and clinicians' changing capabilities	

Discussion

This study has utilised a reflexive thematic analysis to explore how three research fellows, working in a regional health service, utilised knowledge brokering activities to engage 21 research-interested clinicians in local research projects over 12 months. Research fellows described using all ten knowledge brokering activities in a manner that was consistent with the descriptions generated from a seminal systematic review²². Further, they summarised a broader and dynamic process of mentoring in which they initiated many linkage and exchange activities, facilitated knowledge

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3 management, and interspersed capacity building roles. They described a complex and dynamic
4 process of co-creating an individualised and contextualised learning curriculum for each clinician.
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8 These deep narrative descriptions are aligned with and extend the current literature. This study
9 supports the key focus of knowledge brokering in making research in clinical practice more
10 accessible to clinicians and researchers, while recognising that knowledge brokering does not need
11 to be a unique and focussed role ²⁵. Instead, the different underpinning theories and practical
12 knowledge brokering activities can be enacted as part of the broad research engagement activities
13 of embedded researchers ⁹. Consistent with the complexity of health systems, this study does not
14 offer a linear or singular best option for how knowledge brokering activities can be enacted ¹³.
15 Instead, it offers a nuanced description of how research fellows chose and coordinated knowledge
16 brokering activities in their mentoring relationships with 21 clinicians. The three theoretical
17 functions are expressed through the application of a selection of complementary knowledge
18 brokering activities ²².
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28 The relational functions of mentoring, initiating and facilitation interpersonal contact are core to
29 knowledge brokering ^{23 24}. This study contributes a unique explanation of how research fellows (as
30 embedded researchers) utilised knowledge brokering activities within broader mentoring
31 relationships ²⁵. Research fellows have utilised mentoring and the timely provision of research
32 education build clinicians' capacity to undertake research ^{20 35}. Their additional contextual
33 knowledge of the healthcare organisation enabled research fellows to choose appropriate
34 knowledge brokering activities ^{23 24}. They enacted a broader range of activities than the more
35 traditional capacity building activities of training, mentoring, leadership and networking ^{36 37}.
36 Research fellows described initiating, modelling and facilitating linkage and exchange activities with
37 key stakeholders ³⁶. They brokered knowledge networks and created practical just-in-time learning
38 tools to support local research projects ^{9 24}. They helped to clarify the research process in the local
39 context, making it clinically relevant and personally meaningful ⁵.
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50 This study describes an overarching learning process in which embedded research fellows selected
51 knowledge brokering activities to create individualised, practical research curriculums, to facilitate
52 clinicians' engagement in research. They aligned clinicians' willingness to learn with specific research
53 tasks ^{5 7 28}. Further, they recognised that when this learning was individualised and contextualised in
54 a local research project, it was more meaningful ³⁸. It is also consistent with other studies that have
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3 shown that when individuals view research as important to being a professional, it may facilitate
4 their involvement in local projects, which then enhances their skills and confidence ^{38 39}.
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8 As they were embedded in the healthcare organisation, research fellows were aware of the
9 organisational demands and supports for research (or lack thereof) and they were able to support
10 individuals' learning needs. ⁵. They aligned clinicians' research capabilities and motivation around
11 local research projects ^{30 37}. They actively facilitated clinicians' confidence in and sense of control of
12 their research journey ^{7 8}. Research fellows also initiated many linkage and knowledge management
13 activities when clinicians were unfamiliar or underconfident. They monitored individuals' emotional
14 responses, set clear expectations and sequenced appropriate tasks amidst their clinical work
15 pressures ⁴⁰. They utilised existing social networks to reinforce personal and practical learning ^{28 37}.
16 This reflexive process suggests that knowledge brokering activities may be important mechanisms to
17 support research learning opportunities and progressively build clinicians engagement in research ²².
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28 **Practical implications**

29 Health and academic leaders could consider structuring embedded researcher positions to include
30 knowledge brokering roles and activities, specifically for research interested clinicians who are ready
31 to participate in and lead research projects. Initial identification of clinicians' motivation and
32 capability for engaging in research, together with an understanding of local organisational barriers
33 and opportunities can set the scene. Initially, embedded researchers may need to initiate linkage
34 and exchange activities to identify, communicate and collaborate with a local network of researchers
35 around each clinician. Depending upon clinicians' skills and confidence, embedded researchers may
36 also need to create research projects using local project management tools and strategies. However,
37 as they build facilitative relationships with clinicians, embedded researchers can gradually hand over
38 specific research tasks, support just-in-time learning and provide ongoing feedback. Together,
39 embedded researchers can co-design learning activities with clinicians to complete key research
40 tasks.
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52 **Conclusions**

53 This study has extended the application of knowledge brokering activities in clinical practice beyond
54 research capacity building to include knowledge management and linkage and exchange activities.
55 Different knowledge brokering activities have been utilised together within an individualised
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3 research journey for research interested clinicians to participate in and/or lead a research project in
4 their workplace. Experienced research fellows described a dynamic mentoring relationship, where
5 they regularly evaluated clinicians' motivation and research capabilities in the context of a specific
6 research project. Research fellows initiated linkage and exchange activities to build networks and
7 establish research project while facilitating knowledge management, within capacity building roles.
8 They described co-creating a learning curriculum for each clinician, their research project and in
9 their workplace.
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Footnotes

Author Contributions

SM developed the initial research question, and led the research project in which CN, RW and KW participated as research fellows. AB conducted research fellow interviews. All authors provided critical evaluation and revision of the manuscript and have given final approval of the manuscript accepting responsibility for all aspects.

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Competing interests

The Authors declare that they have no conflicts of interest to disclose.

Data sharing statement

Copies of interview templates are available from the corresponding author.

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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	6
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	1
Occupation	3	What was their occupation at the time of the study?	1
Gender	4	Was the researcher male or female?	1
Experience and training	5	What experience or training did the researcher have?	6
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	6
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	5
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	1
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	15
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	5
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	5
Sample size	12	How many participants were in the study?	5
Non-participation	13	How many people refused to participate or dropped out? Reasons?	5
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	6
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	6
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	5
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	6
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	6
Field notes	20	Were field notes made during and/or after the interview or focus group?	6
Duration	21	What was the duration of the interviews or focus group?	6
Data saturation	22	Was data saturation discussed?	NA
Transcripts returned	23	Were transcripts returned to participants for comment and/or	6

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	6,7
Description of the coding tree	25	Did authors provide a description of the coding tree?	no
Derivation of themes	26	Were themes identified in advance or derived from the data?	6, 7
Software	27	What software, if applicable, was used to manage the data?	NA
Participant checking	28	Did participants provide feedback on the findings?	6
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	7
Data and findings consistent	30	Was there consistency between the data presented and the findings?	7
Clarity of major themes	31	Were major themes clearly presented in the findings?	7-12
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	11-12

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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BMJ Open

Using knowledge brokering activities to promote allied health clinicians' engagement in research: A qualitative exploration

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7 **Using knowledge brokering activities to promote allied health clinicians' engagement in research:**
8 **A qualitative exploration**
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49 Key words: Knowledge brokering, research capacity building, mentoring, facilitation
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ABSTRACT (295 words)**Introduction**

Engaging clinicians in research can improve healthcare organisational performance, patient and staff satisfaction. Emerging evidence suggests that knowledge brokering activities potentially support clinicians' research engagement, but it is unclear how best they should be used

Objectives

This study explores how embedded researchers utilised knowledge brokering activities to engage research interested clinicians in research.

Design

A longitudinal qualitative interview based study was co-designed to investigate how experienced research fellows utilise knowledge brokering activities to facilitate allied health clinicians' engagement in research.

Setting

In one large tertiary level, regional Australian health service, research fellows were matched with research interested clinicians.

Methods

Qualitative analysis of three longitudinal semi-structured interviews for each research fellow was undertaken. Initial descriptions of their utilisation of knowledge brokering activities were deductively coded. Reflexive thematic analysis was utilised to generate a shared explanation of clinicians' engagement in research.

Results

Three research fellows facilitated 21 clinicians' participation in and leadership of clinical research projects over 12 months. They utilised all ten key knowledge brokering activities with each clinician, with differing patterns and examples. Research fellows described using linkage and exchange activities of communicating and collaborating with key stakeholders, and they tailored knowledge management products for individual's engagement. Further, they described a broader learning journey where they clarified and monitored individuals' capabilities, motivation and their contextual support for research engagement.

Conclusion

When research fellows chose and tailored knowledge brokering activities to align and extend clinicians' research capabilities and motivation, they created individualised learning curriculums to support clinicians' participation in and leadership of local research projects. Health and academic leaders should consider structuring embedded researcher positions to include knowledge brokering roles and activities, specifically for research interested clinicians who are ready to participate in and lead research projects.

Article Summary: Strengths and limitations of this study

- Embedded researchers were reflexively engaged in co-designing the study and interpreting the results
- A small sample of embedded researchers described how they used knowledge brokering strategies, using longitudinal in-depth exploration of multiple narratives
- Focussed only on allied health clinicians within one health service at a point in time when there was management support for professorial and senior research fellow positions

- Focussed on relationships between embedded researchers and clinicians, without full investigation of organisational context

For peer review only

INTRODUCTION

Engaging healthcare clinicians and organisations in research can improve healthcare organisational performance, patient outcomes, and staff satisfaction and retention [1-3]. To date, most research has linked organisational research engagement, through collaborative partnerships, with improved healthcare performance. However, there is a growing interest in supporting clinicians' ability and willingness to use and participate in research [3-5]. Clinicians often have multiple competing priorities which may limit their engagement in research. Lack of time, organisational and managerial support are commonly reported barriers, while clinically relevant and personally meaningful research are noted facilitators. Further, clinicians' research knowledge and confidence can also influence their engagement [5-9]. Consequently, an increasing array of theoretical and practical activities have emerged to enhance the ability and willingness of health professionals to use, participate in and lead research [10, 11]. The concept of a linear pipeline between the creation and application of research has been superseded by systems and complexity thinking [12, 13].

Within this complexity, embedded research positions show promise as a strategy to build the research capacity of clinical staff to produce relevant research and generate sustainable practice improvements [11, 14-20]. Specifically, when experienced researchers are employed in stable and accessible positions with leadership support and access to appropriate resources, they can enhance the workplace culture, support clinicians' professional development and generate clinical service improvements [14]. While the potentials and challenges of bringing researchers and clinicians together are being documented, it is still unclear how embedded researchers can best support clinicians to engage in research [4, 5, 9, 11].

Knowledge brokering has been described as an iterative process of translation and tailoring of information, that can inform the work of embedded researchers [9, 21]. Knowledge brokering tasks include a range of capacity building, facilitation, engagement and support activities that emphasise the human component of engaging with research [22-24]. Three theoretical models inform the core functions of knowledge brokering [22, 23, 25, 26]. First, knowledge management theory emphasises the systematic creation and diffusion of knowledge, where information is organised and packaged so it is relevant for clinicians [22, 25]. Second, the linkage and exchange model highlights the dynamic interface between creators and users of knowledge. These tasks focus on interpersonal networks and highly developed communication and facilitation skills which facilitate collaboration between clinical and academic settings [23, 25]. Last, the social change framework informs capacity building, where activities are designed to develop users' knowledge and skills, and their ability to access and apply knowledge for evidence-informed decision making [22, 25]. These three theoretical functions underpin ten key knowledge brokering activities [22, 23] (see Table 1). Different combinations of knowledge brokering activities have been reported to be utilised together to achieve positive changes in organisations and clinicians' knowledge, skills and practice [22, 24, 27-29].

Table 1: Key knowledge brokering activities mapped to theoretical domains [22]

Knowledge brokering activities	Theoretical functions		
	Knowledge management	Linkage & Exchange	Capacity Building
Identify, engage and connect with stakeholders		x	
Facilitate collaboration		x	
Identify and obtain relevant information	x	x	x
Facilitate development of analytic and interpretive skills	x	x	x
Create tailored knowledge products	x	x	
Project coordination	x	x	
Support communication and information sharing	x	x	x
Network development, maintenance and facilitation		x	
Facilitate and evaluate change	x	x	x
Support sustainability			x

While most research has investigated the organisational impact of knowledge brokering, this study will investigate how embedded researchers use knowledge brokering activities, in addition to traditional mentoring and facilitation activities, to engage individual clinicians in research [24]. Most research to date has focussed on encouraging clinicians to engage with and to use research [3]. Therefore, this study was designed to explore how research fellows used knowledge brokering activities to support clinicians' engagement in, that is participating in and leading research [3, 9, 22]. This study investigates how the ten key knowledge brokering activities were enacted by embedded researchers and aims to explain how knowledge brokering activities support individual clinicians' engagement in local research.

METHODS AND ANALYSIS

Study design

This study was part of a larger mixed methods research project, that was designed to explore strategies for research engagement of clinicians in allied health [30]. A longitudinal, qualitative study used semi-structured interviews to explore embedded researchers' personal reflections about using knowledge brokering activities. We sought novel insights about supporting research interested clinicians' engagement with clinically important research. This study has ethical approval (HREC16/QGC/96).

Setting

In one large tertiary level, regional Australian health service, experienced embedded allied health researchers (referred to as research fellows) were matched with research interested allied health clinicians (referred to as clinicians). These clinicians volunteered to participate in and/or lead a local clinically relevant research project and had their managers' support to participate [14, 30]. The matching process incorporated complimentary content expertise, methodological skills, time and availability. The first four activities described in the published protocol were adhered to and outputs documented [30]. Individual case studies have yet to be published and this study represents the

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3 process evaluation from the research fellows' perspective, which may contribute to a future
4 programme theory.
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6 7 **Participants**

8 All three research fellows working in the health service at the beginning of 2016, were invited to co-
9 design and consented to participate in this study. They formed a unique purposive sample of
10 clinically experienced allied health clinicians who had completed PhD studies within the last 3-7
11 years. They were all employed full time in the health service and spent 50% of their time on research
12 capacity building activities. Over a period of 12 months, research fellows chose appropriate and
13 complementary activities from the ten key knowledge brokering activities (Table 1), to facilitate
14 clinicians' engagement in a local research project [22].
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18 To counter a small sample size, this study adopted a specific aim to explore the application of
19 knowledge brokering theory and practice at a specific time and place. Strong dialogue and
20 longitudinal in-depth exploration of multiple narratives were included to maximise its informational
21 power [31].
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25 **Data Collection**

26 As active contributors to this study, all research fellows wrote reflective field notes for each
27 interaction with their matched clinicians, including documenting their choice of knowledge
28 brokering activities, and describing key decisions and behaviours observed [22]. They participated in
29 three longitudinal interviews of approximately 60 minutes duration each, over a 12-month period
30 (once every four months).
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34 Face-to face semi-structured interviews were conducted by an independent researcher who was an
35 experienced, trained interviewer, at a convenient workplace location chosen by each research
36 fellow, during 2016 -2017. The interview guide consisted of key prompts about how research fellows
37 utilised all ten knowledge brokering activities, together with open ended questions about how the
38 research fellows supported clinicians' engagement with research. The interview guides were
39 provided to the research fellows before each interview, as a preparatory guide for reflection on their
40 field notes. This semi-structured interview guide was pilot tested in the initial interviews and
41 validated, without change, through the remaining second and third interviews.
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45 In the second and third interviews, research fellows were also asked to discuss changes in patterns
46 of their use of knowledge brokering activities over time and in response to clinicians' progress in
47 their local research projects. Additional open ended follow-up questions were used to gain deeper
48 insights as the interviewer took the stance of a naïve inquirer [32].
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52 **Data Analysis**

53 Interviews were transcribed and coded by the independent researcher, AB, and first author, SM.
54 After each round of interviews, research fellows were sent their transcripts for verification. They also
55 discussed as a group, their comparisons within and between their work with different clinicians.
56 Reflexive thematic analysis was utilised across two phases, to generate a thorough description and
57 explanation of how research fellows engaged clinicians in local research projects over 12 months
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4 First, the individual patterns of use of knowledge brokering activities were coded deductively against
5 the published knowledge brokering theory and practice [22]. The way in which each research fellow
6 utilised knowledge brokering activities with each matched clinician was documented. The strength
7 of this dialogue was enhanced as research fellows were encouraged to make comparisons about
8 working with different clinicians, and they included both similarities and differences in their
9 narrative descriptions. This cross- case analysis was initially described for each research fellow and
10 then further developed through comparison across all research fellows. The aim was to generate
11 realistic and pragmatic descriptions of how research fellows utilised the knowledge brokering
12 activities [31].
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17 Second, a shared explanation was developed through deliberate and reflexive engagement between
18 researchers and research fellows after each series of interviews [33]. Discussion of the progressive
19 stories of clinicians' engagement in their research projects prompted inductive analysis of the use of
20 specific theoretical functions of knowledge management, linkage and capacity building [34].
21 Comparisons were made within and between research fellows of their own explanations, informed
22 by their own internal comparisons between clinicians and their progress in their research projects.
23 This in-depth exploration across a range of different matched pairs of clinicians and research fellows
24 enabled deep narrative explanations with high informational power [31]. Based on this discussion, a
25 conceptual explanation of how research fellows utilised knowledge brokering functions to engage
26 clinicians in local research projects was co-constructed.
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31 RESULTS

32 Three research fellows facilitated 21 allied health clinicians to participate in and lead clinical
33 research projects over 12 months. Clinicians represented the disciplines of dietetics, occupational
34 therapy, physiotherapy, social work and speech pathology. Research projects included systematic
35 reviews, audit projects and pilot clinical studies. Research fellows described using all ten knowledge
36 brokering activities with each clinician, with differing patterns and examples.
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40 First, descriptive summaries of the ten knowledge brokering activities are provided, as a
41 comprehensive summary. Second, a shared explanation of the way in which the theoretical
42 knowledge brokering functions facilitated clinicians' engagement in research has been developed.
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45 **Utilisation of knowledge brokering activities**

46 Detailed summaries follow of how research fellows used the ten knowledge brokering activities over
47 12 months with different clinicians/projects [22]. Quotes from interviews with research fellows are
48 included in italicized text to substantiate this description but have not been attributed to individuals
49 to maintain their confidentiality.
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52 ***Identify, engage and connect with stakeholders***

53 Research fellows described being like an internal stakeholder, in scoping and establishing the best
54 research team possible, based on the clinical project and the clinicians' expertise. At the outset, they
55 initiated meetings to recognise and align stakeholders. During the projects, they facilitated critical
56 discussion and often identified additional and strategic stakeholders. They also described guiding
57 clinicians to engage with stakeholders, through preparatory and de-briefing meetings, and made
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3 explicit the value of connecting. One participant commented: *“you don't always have the perfect*
4 *research team to begin with [but]...identifying key stakeholders early would be more effective.”*

6 **Facilitating collaboration**

7 Research fellows described setting up and facilitating regular research team meetings, to inform and
8 engage stakeholders, build consensus and make decisions. They ensured that all members knew
9 what was happening, had clear roles and expectations: *“my role is to encourage them to think about*
10 *when they should be engaging with this person”*. Over time, clinicians took ownership of these team
11 meetings and began to set agendas.
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15 **Identify and obtain relevant information**

16 Initially, research fellows described providing access to relevant and practical information and
17 resources: *“gently giving people readings to do along the way...explaining these are the reasons why*
18 *this is important”*. Research fellows reminded clinicians about evidence-based practice and
19 encouraged clinicians to use critical appraisal skills. As clinicians engaged in the research process,
20 research fellows continued to connect them with relevant information and described facilitating
21 clinicians to use and interact with appropriate and timely resources: *“it's trying to shortcut things for*
22 *them, because we've got such short timeframes [and] you want to make sure they get a good*
23 *outcome so that they're not disenchanted.”*
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28 **Facilitate development of analytic and interpretive skills**

29 Research fellows described making assessments of clinician's knowledge and skills, and then
30 tailoring specific guidance at the appropriate level and time, for each clinician, to meet the needs of
31 their project: *“they're time poor and when they want to do something, they just want to make it*
32 *specific to their project.”* They helped clinicians to address their own knowledge and skill gaps by:
33 *“identifying what they need to know, then developing strategies to help them to meet those learning*
34 *needs.”* Research fellows described facilitating analytical and interpretive skills throughout the
35 lifetime of each project, with more time focused on data analyses and writing up phases.
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39 **Create tailored knowledge products**

40 Research fellows created an individualised learning curriculum of research knowledge and skills for
41 each clinician. They shared templates, checklists, online tutorials, guides and examples of previous
42 work (e.g., ethics applications), and aligned these to the clinician's knowledge and skills set in a
43 timely manner: *“you have to go back to your original experiences and your own journey and [suggest*
44 *the] tools and strategies that worked for you.”* When using existing resources, research fellows
45 described providing specific assistance: *“even though there were steps, we tailored those to make it*
46 *even more user-friendly”*. They also described a need to design their own resources: *“I need a suite*
47 *of handouts around critical analysis tools and some worksheets that I could use all the time.”*
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52 **Project Coordination**

53 Research fellows noted that most clinicians had not led a research project before. Therefore, they
54 initially adopted a coordinator role, overseeing the whole project and guiding clinicians to use
55 project and time management tools. They helped clinicians manage tasks that operate concurrently
56 and sequentially: *“if you give them [project management] tools and say, we're going to go one step*
57 *at a time, then they can actively work on different areas and come back to you [as they complete*
58 *each step]”*. Research fellows emphasised their role in helping clinicians manage their time: *“I assist*
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3 clinicians by making them aware of the next stages that they need to plan for, and how long it might
4 take". They recognised that timely guidance ensured success at each stage and increased clinicians'
5 confidence, so they could understand: "where we are on our timeline and what's got to happen
6 next".
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9 **Support communication and information sharing**

10 Research fellows described initiating regular meetings and gradually sharing with clinicians the
11 importance and purpose of regular communication. Specific and timely guidance was noted as
12 important to prevent new researchers from becoming overwhelmed: "I think research is something
13 that has to be engaged with at a micro level to achieve macro stuff.... otherwise, it's too
14 overwhelming." They recommended clinicians share information about progress with key
15 stakeholders, and over time, revisited their priorities to maintain engagement. Research fellows
16 reminded clinicians to provide positive feedback to key stakeholder groups throughout the project:
17 "I'm mindful of highlighting positive things that are happening and acknowledging everyone's
18 contribution, to keep the motivation".
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23 **Network development, maintenance and facilitation**

24 Research fellows often introduced clinicians to researchers from their own networks: "I tailored their
25 network to achieve their goal of doing this research project within their everyday practice". They
26 encouraged clinicians to develop new networks through working and learning together: "so by
27 working on something together you're learning from and with each other". Research fellows
28 emphasised the value of networks for sharing and building resources: "helping people understand
29 that if we don't share this, someone else is going to do exactly the same... and waste resources doing
30 what we already know". Further, research fellows facilitated clinicians to balance competing
31 demands, motivation and responsibilities within their networks: "everyone's got different
32 motivations, goals, responsibilities; you have to be mindful of that...someone might have a lot of
33 other responsibilities". They encouraged clinicians to present locally, to create awareness of their
34 work and to recognise that these discussions can lead to future collaborative opportunities.
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40 **Facilitate and evaluate change**

41 Research fellows described needing to know clinicians well to align opportunities to facilitate
42 individual change: "if you're introducing them to something new, you have to monitor where they're
43 at and how ready they are". They described their crucial role in helping clinicians set realistic
44 research goals for their projects and using these goals to monitor and evaluate change: "by relooking
45 at those goals with clinicians and seeing which goals we are making good progress with ... that's
46 been helpful with ongoing evaluation of learning". Bringing clinical practice improvements to the
47 attention of peers and their managers made it real and motivating to clinicians: "making sure we're
48 acknowledging to the clinician or to people around them, that they have had a change in skill set,
49 and ... we've effected a change [in practice] because of the work that they've done". Later in the
50 research projects, research fellows also helped clinicians to assess readiness to change within their
51 local context, before implementing research findings in practice.
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56 **Support sustainability**

57 Research fellows described supporting individual sustainability through encouraging critical thinking,
58 and reflective practice: "it's easy when people ask you a question, to just give them the answer
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3 *straight away... but that doesn't help with their learning...instead, hold back a little and encourage*
4 *them to reflect and think".* They described multiple challenges to sustaining a clinician's
5 engagement in their research project over time as an: *"interplay between having the motivation,*
6 *opportunities and capability"*. It was acknowledged that sometimes both research fellows and
7 clinicians were unsure of the organisational support for specific research projects and that some
8 clinicians lacked the intrinsic motivation compared to those completing a research higher degree.
9 Research fellows emphasised that sustainability is more likely if clinicians have a successful research
10 experience: *"positive outcomes motivate you and enhance sustainability"*. Therefore, they felt
11 responsible for co-designing the research project for success in the local context: *"you've got to*
12 *work out in this clinical setting, what is reasonable in the time frame that we have... you've got to*
13 *make sure that we get [the clinician] through to the end, as a good experience"*. Further, clinicians
14 needed to understand the progression of research within a clinical area: *"a good example of the*
15 *progression from systematic review to survey of practice, to a clinical trial"*.
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21 **Shared explanation of how research fellows supported clinicians' engagement in research**

22 In addition to utilising all ten knowledge brokering activities, research fellows described facilitating
23 an overarching and unique learning journey for each clinician. This journey was defined by the
24 clinician's capability and motivation to do research. Research fellows also had to match the demands
25 of each clinicians' local workplace context with those of their research project. This influenced the
26 way in which research fellows selected knowledge brokering activities for each clinician. A
27 corresponding pattern emerged in the way research fellows initiated linkage and exchange functions
28 early and then facilitated knowledge management and capacity building functions to co-create
29 individualised learning journeys for clinicians around their own research project
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34 **Clarify clinicians' capability and motivation to do research**

35 To begin, research fellows reported clarifying clinicians' motivation to do research: *"it's about*
36 *connecting with who they see themselves to be"*. For some clinicians, research was not part of their
37 identity, there were few role models and uncertain longer-term career benefits. Research fellows
38 also needed to monitor and evaluate each clinician's level of knowledge and skills to engage in
39 research: *"if someone says they've done [it] before, then you think they're capable, but I must check*
40 *whether they're doing it the way that I would expect them to do it"*.
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45 Early on, research fellows actively initiated networks and set up research projects while also
46 conceptualising the research process for each clinician: *"the learning curriculum is like the research*
47 *journey from the idea formation through to dissemination"*. They initiated linkage and exchange
48 functions, such as identifying and aligning stakeholders, establishing meetings and facilitating
49 clinicians to connect and collaborate with stakeholders.
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52 Following on, research fellows described aligning clinicians' readiness to engage with research
53 before setting clear learning goals: *"identify their motivations for engaging in research and then*
54 *connect that with the research project at hand"*. They identified appropriate research tasks within
55 local projects: *"if you've made an assessment of the clinician's knowledge, skills and attributes, then*
56 *you can design strategies that will ensure they achieve the next step"*.
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60 **Match demands of the workplace context with clinicians' research project.**

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3 Further, research fellows reported needing to understand the workplace environment, with respect
4 to competing demands and local supports: *“they have different amounts of opportunity, so it’s*
5 *crafting something they want to engage in but also what’s achievable within the environment that*
6 *they are in”*. They described facilitating knowledge management activities of sharing relevant
7 information, creating tailored knowledge products, providing specific assistance and project
8 coordination. They reported providing encouragement, feedback and positive reinforcement around
9 these knowledge management tasks: *“you have to look at the project, the person, their skillset and*
10 *what needs to happen... and how they respond, because everyone’s different”*. Research fellows
11 emphasised maintaining a consistent facilitative role to build clinicians’ confidence by: *“making it a*
12 *positive learning environment, so they’re more likely to want to engage in research and share*
13 *positive experiences with their clinical peers”*.
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19 **Building individualised learning curriculums**

20 Based on this individualised analysis, research fellows described choosing knowledge brokering
21 activities carefully: *“based on the person, the project, the context and the barriers that have been*
22 *identified”*. The choice of knowledge brokering activities needed to be responsive and timely: *“some*
23 *clinicians work better when they go away and do something independently and others like to be*
24 *shown how to do it and then try it themselves”*.
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28 All research fellows described the need to anticipate *“what’s going to come next”*, respond *“to what*
29 *unfolds, being mindful of who they are”* and have protective measures in place *“so they will still*
30 *progress”*. They reported setting appropriate boundaries in relation to clinicians’ work demands:
31 *“working out who is going to be able to do the job and who’s not”*. They described monitoring micro-
32 cycles of progress for every clinician and providing just-in-time challenges to: *“meet the needs of the*
33 *clinicians at the right time within the life of the project”*. Research fellows described utilising
34 knowledge management and linkage and exchange activities to build research capacity, as they co-
35 designed, with clinicians, activities to progressively complete their local research projects.
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39 **Discussion**

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41 This study has utilised a reflexive thematic analysis to explore how three research fellows, working in
42 a regional health service, utilised knowledge brokering activities to engage 21 research-interested
43 clinicians in local research projects over 12 months. Research fellows described using all ten
44 knowledge brokering activities in a manner that was consistent with the descriptions generated
45 from a seminal systematic review [22]. Further, they summarised facilitating individualised learning
46 journeys for each clinician in which they initiated many linkage and exchange activities, facilitated
47 knowledge management, and interspersed capacity building roles. They described a complex and
48 dynamic process of clarifying clinicians’ capability and motivation to do research, and then matching
49 demands of the workplace context with clinicians’ research project. Ultimately research fellows
50 chose knowledge brokering activities and roles to co-creating an individualised and contextualised
51 learning curriculum for each clinician.
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57 These deep narrative descriptions are aligned with and extend the current literature. This study
58 supports the key focus of knowledge brokering in making research in clinical practice more
59 accessible to clinicians and researchers, while recognising that knowledge brokering does not need
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3 to be a unique and focussed role [23, 25]. Instead, the different underpinning theories and practical
4 knowledge brokering activities can be enacted as part of the broad research engagement activities
5 of embedded researchers [9]. Consistent with the complexity of health systems, this study does not
6 offer a linear or singular best option for how knowledge brokering activities can be enacted [13].
7 Instead, it offers a nuanced description of how research fellows chose and coordinated knowledge
8 brokering activities in their facilitative year long relationships with 21 clinicians. The three
9 theoretical functions are expressed through the application of a selection of complementary
10 knowledge brokering activities [22]. In addition, the facilitative and evaluation functions of
11 knowledge brokers were also evidence in this study. Research fellows described evaluating
12 clinicians' capability and motivation to do research, and their workplace demands, in order to
13 facilitate their learning about and engagement with research [23].
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19 The relational functions of initiating, facilitating and evaluating interpersonal contact are core to
20 knowledge brokering [23, 24]. This study contributes a unique explanation of how research fellows
21 (as embedded researchers) utilised knowledge brokering activities to create individualised learning-
22 focussed relationships [25]. Research fellows have utilised facilitation and the timely provision of
23 research education build clinicians' capacity to undertake research [20, 35]. Their additional
24 contextual knowledge of the healthcare organisation enabled research fellows to choose
25 appropriate knowledge brokering activities [23, 24]. They enacted a broader range of activities than
26 the more traditional capacity building activities of training, mentoring, leadership and networking
27 [36, 37]. Research fellows described initiating, modelling and facilitating linkage and exchange
28 activities with key stakeholders [36]. They brokered knowledge networks and created practical just-
29 in-time learning tools to support local research projects [9, 24]. They helped to clarify the research
30 process in the local context, making it clinically relevant and personally meaningful [5].
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36 This study describes an overarching learning process in which embedded research fellows selected
37 knowledge brokering activities to create individualised, practical research curriculums, to facilitate
38 clinicians' engagement in research. They aligned clinicians' willingness to learn with specific research
39 tasks [5, 7, 28]. Further, they recognised that when this learning was individualised and
40 contextualised in a local research project, it was more meaningful [38]. It is also consistent with
41 other studies that have shown that when individuals view research as important to being a
42 professional, it may facilitate their involvement in local projects, which then enhances their skills and
43 confidence [38, 39].
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47 As they were embedded in the healthcare organisation, research fellows were aware of the
48 organisational demands and supports for research (or lack thereof) and they were able to support
49 individuals' learning needs. [5]. They aligned clinicians' research capabilities and motivation around
50 local research projects [30, 37]. They actively facilitated clinicians' confidence in and sense of
51 control of their research journey [7, 8]. Research fellows also initiated many linkage and knowledge
52 management activities when clinicians were unfamiliar or underconfident. They monitored
53 individuals' emotional responses, set clear expectations and sequenced appropriate tasks amidst
54 their clinical work pressures [40]. They utilised existing social networks to reinforce personal and
55 practical learning [28, 37]. This reflexive process suggests that knowledge brokering activities may be
56 important mechanisms to support research learning opportunities and progressively build clinicians
57 engagement in research [22].
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Practical implications

Health and academic leaders could consider structuring embedded researcher positions to include knowledge brokering roles and activities, specifically for research interested clinicians who are ready to participate in and lead research projects.

Initial identification of clinicians' motivation and capability for engaging in research, together with matching the demands of the work environment with the tasks of local research project can set the scene. Embedded researchers may need to initiate linkage and exchange activities to identify, communicate and collaborate with a local network of researchers around each clinician. They may also need to create research projects using local project management tools and strategies. With facilitative relationships that support clinicians' learning about research, embedded researchers can gradually hand over specific research tasks, support just-in-time learning and provide ongoing feedback.

Limitations and strengths.

A strength of this study is that research fellows were reflexively and creatively engaged in making sense of their own use of knowledge brokering activities when working with clinicians.

A key limitation of this study is the focus on allied health clinicians within one health service at a point in time when there was management support for professorial and senior research fellow positions. This study focused on the individual relationships between embedded researchers and clinicians without detailed consideration of organisational strategies that can also facilitate clinicians' motivation and maximise social influences [7].

Future research is required to monitor the continuation and scale up of these interventions, and to monitor patient outcomes as clinicians improve their research engagement.

Conclusions

This study has extended the application of knowledge brokering activities in clinical practice beyond research capacity building to include knowledge management and linkage and exchange activities. Different knowledge brokering activities have been utilised together within an individualised research journey for research interested clinicians to participate in and/or lead a research project in their workplace. Experienced research fellows described evaluating clinicians' motivation and research capabilities and matching tasks in their local work context to complete a specific research project. Research fellows initiated linkage and exchange activities to build networks and establish research projects while facilitating knowledge management, within capacity building roles. They described co-creating a learning journey for each clinician, their research project and in their workplace.

Footnotes

Contributors

SM developed the initial research question, and led the research project in which CN, RW and KW participated as research fellows. AB conducted research fellow interviews. All authors provided critical evaluation and revision of the manuscript and have given final approval of the manuscript accepting responsibility for all aspects.

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Competing interests

The Authors declare that they have no conflicts of interest to disclose.

Data sharing statement

Copies of interview templates are available from the corresponding author.

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COREQ (CONsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
<i>Personal characteristics</i>			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	6
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	1
Occupation	3	What was their occupation at the time of the study?	1
Gender	4	Was the researcher male or female?	1
Experience and training	5	What experience or training did the researcher have?	6
<i>Relationship with participants</i>			
Relationship established	6	Was a relationship established prior to study commencement?	6
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	5
Interviewer characteristics	8	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	1
Domain 2: Study design			
<i>Theoretical framework</i>			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	15
<i>Participant selection</i>			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	5
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	5
Sample size	12	How many participants were in the study?	5
Non-participation	13	How many people refused to participate or dropped out? Reasons?	5
<i>Setting</i>			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	6
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	6
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	5
<i>Data collection</i>			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	6
Repeat interviews	18	Were repeat interviews carried out? If yes, how many?	6
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	6
Field notes	20	Were field notes made during and/or after the interview or focus group?	6
Duration	21	What was the duration of the interviews or focus group?	6
Data saturation	22	Was data saturation discussed?	NA
Transcripts returned	23	Were transcripts returned to participants for comment and/or	6

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
<i>Data analysis</i>			
Number of data coders	24	How many data coders coded the data?	6,7
Description of the coding tree	25	Did authors provide a description of the coding tree?	no
Derivation of themes	26	Were themes identified in advance or derived from the data?	6, 7
Software	27	What software, if applicable, was used to manage the data?	NA
Participant checking	28	Did participants provide feedback on the findings?	6
<i>Reporting</i>			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	7
Data and findings consistent	30	Was there consistency between the data presented and the findings?	7
Clarity of major themes	31	Were major themes clearly presented in the findings?	7-12
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	11-12

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.