



Exploring the pharmacist's role in regional, rural, and remote kidney transplant care: Perspectives of health professionals and transplant recipients

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ABSTRACT

Background: Role clarification amongst health professionals is necessary for successful interprofessional collaboration. Despite a demonstrated need for pharmacists in the provision of care to regional, rural, and remote kidney transplant recipients, this role is not well defined.

Objectives: This study explored health professionals' and kidney transplant recipients' perceptions around the role of the pharmacist in the provision of care to kidney transplant recipients from regional, rural, and remote areas of Australia.

Methods: Semi-structured interviews and focus group discussions were conducted with Australian kidney transplant health professionals and kidney transplant recipients respectively. Transcripts were analysed thematically and deductively coded using a simplified framework of role theory constructs.

Results: Participants consisted of a multidisciplinary cross section of transplant health professionals ($n = 26$) and both deceased and living donor kidney transplant recipients ($n = 30$). Six role theory constructs were identified from the data with regards to the pharmacist's role: role identity, role ambiguity, role overload, role overqualification, role underqualification, and role insufficiency. Core role expectations centred around provision of ongoing education and support with medication management and supply (role identity), however pharmacists remain underutilised for delivery of medication education (role overqualification). A transdisciplinary model of care was suggested to overcome current shortfalls (role overload, role insufficiency). There was hesitancy around pharmacist-led immunosuppressant monitoring and titration (role ambiguity, role underqualification).

Conclusions: Kidney transplant recipients in regional, rural, and remote areas experience unique barriers and challenges associated with medication management, necessitating an increased level of involvement and support from the pharmacist.

1. Introduction

One of the earliest descriptions of pharmacist involvement in the provision of kidney transplant (KT) care was published in 1976, outlining hospital pharmacists' attendance at daily ward rounds, and provision of medication education to patients immediately post-transplant and at the point of discharge.¹ The role of the pharmacist across all solid organ transplants (SOT) has evolved significantly since this early

depiction, and evidence now exists supporting the important and specialised role of the pharmacist as part of the multidisciplinary transplant team, with clinical and research responsibilities that span across pre-, peri-, and post-transplant phases of care.² Pharmacist medication reconciliation, review and optimisation of drug therapies, and medication counselling have been demonstrated to improve outcomes in SOT recipients,³ with improvements in medication adherence and a reduction in medication errors and health care costs also reported.³

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In countries such as the United States of America, the required knowledge and expertise within the field of SOT pharmacotherapy is widely recognised, and as such specialty training for pharmacists is provided through accredited post-graduate transplant pharmacist residency training programs, plus there is the option of fellowship positions.² The American Society of Health System Pharmacists (ASHP) also have published guidelines around the provision of pharmacy services in SOT, clearly outlining the roles and responsibilities of transplant pharmacists and recommended standards for provision of care.⁴ However, transplant pharmacy is not currently recognised as a specialty practice area by Advanced Pharmacy Australia (AdPha), therefore formal training for pharmacists in Australia is limited to AdPha's Registrar Training Program Framework for the most relevant specialty areas such as nephrology or cardiology.⁵

Kidneys are the most commonly transplanted organ globally, making up more than half of the total deceased donor organs transplanted in Australia in 2023.⁶ According to registry data there continues to be a progressive growth of people with functioning KT in Australia and New Zealand,⁷ which is likely the result of continuing advances in transplant therapeutics. However, transplant pharmacist roles are generally embedded within KT units,² which in Australia are primarily based within hospitals in metropolitan centres.⁸ The delivery of KT services therefore occurs via a hub-and-spoke model, and for patients receiving a KT that reside in regional, rural, and remote areas of Australia, provision of care is a shared responsibility between the KT unit and home nephrology services.⁹ This means access to the specialty transplant service (including the pharmacist) occurs pre-transplant to determine patient eligibility for transplantation and provide care in the peri- and acute post-transplant periods, but is generally limited once they are discharged back to their home nephrology or primary care service.⁹ This is detrimental given access to primary health care providers is also limited in rural and remote areas¹⁰ resulting in an increased reliance back onto hospital based services with increasing remoteness.¹¹

There is also a distinct lack of data around the pharmacist's role in providing care to potential or actual kidney (or other solid organ) transplant recipients in regional, rural, and remote areas specifically, and how it may differ from the traditionally described role of the transplant pharmacist based within a transplanting unit.² Role clarification amongst health professionals is well documented in existing studies and frameworks as a necessary component of successful inter-professional collaboration within health care teams.^{12–14} More recently, the importance of consumer participation in the design, implementation, and evaluation of health care services has also been recognised as a vital step in developing relationship-focused services.¹⁵

The purpose of this study was to explore both health professionals' and KT recipients' perceptions around the role of the hospital pharmacist in the provision of care to KT recipients from regional, rural, and remote areas of Australia. The focus was identifying barriers to or gaps in current pharmacy service provision as well as opportunities to advance the scope of the hospital pharmacist's role and responsibilities.

2. Methods

2.1. Study design and context

This study used data from two concurrently conducted qualitative studies across two separate participant groups. The first study consisted of one-on-one semi-structured interviews conducted with kidney transplant health professionals,¹⁶ and the second consisted of focus group discussions undertaken with a cohort of recent KT recipients (unpublished results). The primary objective of both studies was to describe participants' experiences of KT processes for populations residing in regional, rural, and remote areas of Australia, with a particular focus on understanding the current barriers and identifying ways in which access to, and experiences of KT could be improved for this cohort. As part of the overall KT experience, perceptions around the hospital pharmacist's

current, potential or expanded role in care provision, as well as medication related barriers or issues experienced by KT recipients emerged both directly (in the case of the health professionals) and indirectly (in the case of the KT recipients) from the data and were therefore explored. Multisite ethical approval was granted by the Townsville Hospital and Health Service Human Research Ethics Committee (HREC/2023/QTHS/89342). This study was reported following the Standards for Reporting Qualitative Research (SRQR).¹⁷

2.2. Sampling and recruitment

Sampling was via a purposive non-probability method to ensure the research objective was answered,¹⁸ and the investigators selected participants for recruitment to ensure a representative sample from each participant population. Geographical remoteness of participants was defined according to the Modified Monash Model (MMM) 2019 using residency and principle place of practice location.¹⁹ Written consent was obtained from all participants and reconfirmed verbally with participants prior to commencement of each interview or focus group discussion.

Health professional (HP) participants consisted of a multidisciplinary cross section of KT health professionals such as nephrologists, transplant nurses, hospital pharmacists, and other allied health or support staff. Given the provision of KT care is shared in Australia, health professionals based in metropolitan KT units, as well as regional, rural, or remote health care facilities providing pre- and post-transplant care within Australia were included. However metropolitan based health professionals were only eligible to participate if they were directly involved in the provision of care to regional, rural, and remote KT recipients, to ensure participants were appropriately placed to address the research objective. Kidney transplant recipient (KTR) participants consisted of those who had received their transplant within the last 5 years residing in regional, rural, or remote areas within northern Queensland. Further information regarding recruitment for the two studies can be found in Supplementary File 1.

2.3. Data collection

Development of the interview guides were informed by findings of a scoping literature review.²⁰ The semi-structured interview guide (Supplementary File 2) and focus group discussion guide (Supplementary File 3) included questions around perceived current, potential or expanded roles of the pharmacist in provision of KT care (HP participants) as well as experiences with kidney transplant medications and interaction/s with the pharmacist (KTR participants), in order to identify gaps in current service provision and any new or potential expanded roles for the pharmacist. The interview and focus group discussion guides were reviewed by all investigators, with two pilot interviews conducted to confirm content clarity and value of response data in addressing the research objective. Semi-structured one-on-one interviews were conducted with HP participants by the principal investigator (TKW) using online videoconference platform Microsoft Teams (MS Teams, Version 24,231.507.3099.9636, Microsoft, Redmond United States) which also recorded and transcribed the interviews verbatim. Focus group discussions were conducted in-person with KTR participants at various regional locations as well as online via Microsoft Teams for those unable to attend in-person. All focus group discussions were moderated by the principal investigator under the guidance of a co-investigator (NSR) with extensive qualitative research experience. Discussions were audio recorded and transcribed verbatim. Interview and focus group transcription records were manually checked against the recordings by the principal investigator to ensure accuracy. A total of 26 interviews and 5 focus group discussions were conducted over a 3-month period from April to June 2024 and all participants were provided with a \$20 gift voucher to compensate them for their time.

2.4. Data analysis

Data from both qualitative studies were imported into NVivo (NVivo, Version 12, Lumivero, Denver United States) and analysed using a descriptive thematic method following the Braun and Clarke framework.^{21,22} During preliminary inductive coding of all data collected, the perceived role of the pharmacist in provision of KT care emerged as a crucial aspect of the overall KT experience for regional, rural, and remote recipients across both participant groups. The investigators therefore decided to analyse these data separately and explore participant perceptions of the pharmacist's role against the constructs of role theory.²³ As described by Hardy and Conway, role theory provides a collection of constructs that may predict how an individual will perform in a given role, taking into account both internal and external demands placed on the person occupying the role.²³ Role theory can therefore provide a useful conceptual framework for examining attitudes and perceptions around the role of pharmacists (and other health care professionals) in various health care settings.^{24–27} A simplified framework of role theory constructs relevant to the data was developed iteratively through a preliminary review of transcripts by the principal investigator, based on seminal works and more recent adaptations used in similar pharmacy and nursing studies.^{23–26} Deductive coding was then used to map the data to the role theory constructs, and develop subthemes within specific constructs of the framework. The principal investigator reviewed and coded the data initially, with co-investigators (NSR and BDG) confirming interpretation and coding by independently reviewing sections of data.^{28,29} The coding scheme based on the role theory constructs was discussed and refined with all investigators until consensus was reached.

2.5. Research team and reflexivity

The research team consisted of a PhD candidate (TKW) supported by supervisors NSR, AJM and BDG. NSR is an experienced qualitative researcher and rural consumer with lived experience of KT. AJM is an adult nephrologist clinician-researcher with subspecialist interest in kidney genetics and academic internal medicine experience in metropolitan, regional, and rural areas. BDG is an experienced pharmacist academic, having conducted extensive research into the role of pharmacists in providing health services to underserved and vulnerable populations, especially those residing in rural and remote communities in Australia. TKW is a currently registered pharmacist with extensive hospital experience as a senior renal pharmacist. Acknowledging that these characteristics could influence interpretation and analysis of the data, at least one co-investigator without a pharmacy background assisted with data analysis to confirm interpretation of the data. All members of the team reviewed the quotations and coding scheme to minimise the risk of pre-conceived ideas or bias influencing the analysis, ensuring an objective representation of participants' experiences.³⁰

3. Results

HP participants ($n = 26$) consisted largely of hospital pharmacists ($n = 5$), nursing staff ($n = 5$), nephrologists from regional, rural, or remote non-transplanting centres ($n = 5$), and nephrologists from transplanting centres ($n = 4$). All HP participants who were interviewed provided perspectives around the role of the pharmacist. Over half of HP participants ($n = 14$) were based in regional, rural, or remote areas, and a majority ($n = 19$) had >7 years of experience in their profession. Refer to Table 1 for detailed demographic characteristics of HP participants.

Most ($n = 23$) of the KTR participants ($n = 30$) attended one of the three face-to-face focus group discussions (FG1 $n = 8$; FG2 $n = 8$; FG3 $n = 7$), while the remainder chose to attend the online session (FG4 $n = 7$). Experiences around medication related barriers or issues that directly relate to the perceived role of the pharmacist were discussed by participants in all focus groups conducted. A majority of KTR participants

Table 1

Demographic characteristics of health professional participants.

Health Professional Participant Characteristics	Value ($n = 26$)
Profession	
Nephrologist (transplanting)	4
Nephrologist (non-transplanting)	5
Hospital pharmacist	5
Nursing staff	5
Social worker	2
Indigenous liaison officer	2
Psychologist	1
Transplant surgeon	1
Senior medical officer	1
Years of experience	
0–7 years	7
8–14 years	12
> 14 years	7
Rurality of principle place of practice (MMM 2019)	
Metropolitan Area	12
Regional Centre	9
Large Rural Town	1
Remote Community	1
Very Remote Community	3

($n = 27$) had received a deceased donor kidney transplant, and over half ($n = 17$) had been on dialysis for 1–3 years prior to receiving their transplant. Almost a third ($n = 7$) resided in rural and remote locations prior to receiving their transplant, and a small proportion ($n = 3$) identified as Aboriginal and/or Torres Strait Islander. Refer to Table 2 for detailed demographic characteristics of KTR participants.

Six role theory constructs were identified from the data to form the framework: role identity, role ambiguity, role overload, role over-qualification, role underqualification, and role insufficiency. Table 3 provides the framework of role constructs developed and associated definitions. Refer to Supplementary File 4 for the complete table of role construct themes, subthemes, and illustrative participant quotations.

Table 2

Demographic characteristics of kidney transplant recipient participants.

Kidney Transplant Recipient Participant Characteristics	FG1 ($n = 8$)	FG2 ($n = 8$)	FG3 ($n = 7$)	FG4 ($n = 7$)	Total ($n = 30$)
Type of kidney transplant received					
Deceased donor transplant	7	8	6	6	27
Living donor transplant	1	–	1	1	3
Years on dialysis prior to transplant					
0–1 year	3	–	2	1	6
1–3 years	3	5	4	5	17
3–5 years	1	3	1	1	6
> 5 years	1	–	–	–	1
Rurality of residence at time of transplant (MMM 2019)					
Regional Centre	5	8	4	4	21
Medium Rural Town	1	–	–	1	2
Small Rural Town	–	–	3	–	3
Remote Community	1	–	–	–	1
Very Remote Community	1	–	–	2	3
Aboriginal and/or Torres Strait Islander					
Torres Strait Islander	–	–	–	1	1
Aboriginal and Torres Strait Islander	2	–	–	–	2
Non-Indigenous	6	8	7	6	27

3.1. Role identity

Six subthemes relating to role identify were identified from the data, each relating to a specific fundamental role expectation of the pharmacist in providing care to regional, rural, and remote KT recipients: spearheading provision of medication education, guiding a consensus around pre-transplant medication information, clinical expertise and input into complex decision making, supporting medication management, navigating medication access and continuity, and fostering relationships with primary care providers.

3.1.1. Spearheading provision of medication education

Providing pre- and post-transplant medication education was identified by most participants as a fundamental part of pharmacists' role identity, particularly given that hospital pharmacists working within the area of renal medicine usually have an established relationship and rapport with patients through the provision of ongoing care throughout their preceding chronic kidney disease (CKD) and dialysis journey. The need for education delivery to be repeated in a staged format rather than just a one-off session was highlighted, due to concerns around the ability of patients to absorb so much information in one sitting, as well as the potential to forget important information if their time on the waitlist for transplantation was prolonged.

“It wouldn't be a one-off session that you would have with the patients, you'd have to have a couple of sessions to talk about medications pre-transplant because the first time nothing goes in, the second time it will go in.”

(Nur; Reg)

“A 12-month reminder would be good if you're waiting. . . I'm pretty sure it was three years that I met the team before I had the transplant. . . And you forget a lot.”

(KTR; FG3)

Participants identified that often KT recipients from regional, rural, and remote areas require increased and ongoing medication education and support from the pharmacist post-transplant, as the intensive support they receive while under the care of the transplanting centre is generally no longer available once they return home.

“What I found was patients who were returning from having had transplants had a lower baseline level of understanding of their medications compared to what you might have expected for someone at the same point in their journey in a more metropolitan area. . . There's definitely a really big role post-transplant for ongoing education.”

(Phar; Reg)

3.1.2. Guiding a consensus around pre-transplant medication information

Despite the clear expectation from participants for the pharmacist to

provide pre-transplant medication education, there were differing opinions amongst HP participants regarding the appropriate extent of medication information to be included. Opinions amongst medical and nursing staff were divided, with some feeling that too much information about medications would overwhelm patients, and the focus should therefore be more on practical components like medication supply and related costs. Pharmacists however felt quite strongly that more in-depth medication education was necessary pre-transplant, largely based on their experiences supporting patients with medication management and adherence issues post-transplant.

“I think it adds value before transplant. I've certainly transplant counselled someone who said to me “if I knew I had to take this many medicines, I never would have got a transplant”. . . I think they need to understand that a lifelong relationship with medications, pharmacists, doctors, nephrologists would be part of that.”

(Phar; Metro)

“I think there's a certain amount of real estate in brain space when you're getting that much information. I'm not sure that adding more detail in before, especially when their medications are going to be tinkered with in all kinds of ways, is helpful then.”

(Med; Rem)

Likewise, amongst KTR participants there were varying preferences around the complexity of medication education that should be provided by the pharmacist pre-transplant, indicating that a more patient-specific approach to education may be required.

“After transplant, when the pharmacist come in with this bag full of medications, oh my god! You're trying to absorb all this information. . . I think they probably should give more education about the drugs beforehand.”

(KTR; FG1)

“I don't think you'd want too much information. . . I was taking like 10 of them [medications] a day, so I don't need to know about another 49 a day that I'm not taking yet.”

(KTR; FG3)

3.1.3. Clinical expertise and input into complex decision making

While pharmacist participants did not always acknowledge their own clinical expertise, other HP participants recognised the clinical skills of pharmacists as another essential component of their role and professional identity. Key role expectations included optimising transplant pharmacotherapy, including the identification and management of drug interactions, required dose adjustments based on kidney and liver function, identification of prescribing or supply errors, implementation and management of drug therapy protocols, and decision making around clinically complex patients or issues.

“They [pharmacist] pick up things perhaps that the doctors don't or have missed, so things like your valganciclovir dosing needs to be increased if your creatinine clearance is improving. . . They pick up all sorts of things.”

(Nur; Metro)

“They [pharmacist] do have an important role. . . we've had a fungal infection, we're using voriconazole and that interferes with tacrolimus and it's become a huge problem for us to manage it without a pharmacist.”

(Neph; Metro)

3.1.4. Supporting medication management

One of the most important pharmacist roles identified by participants was providing ongoing support to KT recipients with medication management and adherence post-transplant, including management of adverse effects. Participants acknowledged the need for ongoing access

Table 3
Role theory constructs and definitions.

Role Construct	Definition ^{23–26}
Role identity	The individual's interpretation of role expectation, that is, position specific norms, identifying the attitudes, behaviours and cognitions required and anticipated for a role occupant
Role ambiguity	Disagreement on the role expectation associated with a lack of clarity of those expectations
Role overload	Inadequate resources relative to possibly excessive demands
Role overqualification	When the individuals' role expectations are less than their education qualifies them to accomplish
Role underqualification	When the individual requires more training to successfully perform the given role
Role insufficiency	Disparity in fulfilling role expectations, obligations or goals as perceived by self or significant others

to pharmacist support to assist patients with managing the large volume of new and unfamiliar medications and frequent medication changes and dose adjustments. Patients often struggle to keep track of changes communicated via verbal instruction from the nephrologist, and follow-up counselling and provision of an updated medication list from the pharmacist are required to assist patients in actioning the required changes.

“Medications change so frequently, and patients aren't always able to make necessary adjustments or even just keep a track of all of the changes that are happening.”

(Phar; Reg)

KTR participants reported feeling overwhelmed by having to manage their medications independently, often relying on family members or carers to assist them, particularly if they were previously using pharmacy supplied dosage administration aids such as Webster-paks®.

“At first, it was very daunting. My daughter was helping me pack it, but then I had to get used to it.”

(KTR; FG1)

3.1.5. Navigating medication access and continuity

Assisting KT recipients to navigate prescription and medication supply issues to ensure ongoing access to transplant medications was again described as a crucial part of pharmacists' role identity. HP participants highlighted that patients sometimes struggle to manage their prescriptions and medication supply at home, and there is often confusion around which prescriptions can be dispensed by a community pharmacy and which need to come from the hospital pharmacy, resulting in a delay or inability to access the medications they require.

“People just go walk about and then they're like, “oh, I haven't organised my medications”. Then they're in the middle of nowhere needing tacrolimus, we've done a couple of those emergency supplies.”

(Phar; Metro)

Many KTR participants experienced difficulties obtaining prescriptions and accessing ongoing transplant medication supply, reporting supply through the hospital pharmacy to be inconvenient due to restrictive opening hours, long waiting times, and the need for additional travel and parking expenses. Some also expressed the desire for larger quantities of transplant medications to be supplied per dispensing, with more repeats and nil expiry date on their prescriptions.

“It has been inconvenient in that aspect, and very hard to get through to the doctors about making sure the scripts are filled out correctly so that I can get them from an outside chemist, or from any chemist rather than the hospital, because in that small town it's a waste of time – waste of time trying to get it from the hospital, and it's not convenient whatsoever.”

(KTR; FG3)

3.1.6. Fostering relationships with primary care providers

Provision of education and support to community pharmacy and primary care providers such as general physicians, rural and remote medical and nursing staff, and health workers was another pharmacist role expectation outlined by participants. The hospital pharmacist was identified as facilitating transition of care and continuity of safe and appropriate medication supply for rural and remote transplant recipients by liaising directly with these primary care practitioners to foster professional relationships.

“I think there's a lot of scope for pharmacists to play a better role in ensuring adherence and really educating health workers, health practitioners and the nurses on the ground.”

(Nur; Rem)

Particularly in more rural and remote settings, community pharmacy may be the sole supplier of medications to both individuals and health care facilities. Both HP and KTR participants described issues related to the supply and availability of transplant medications through community pharmacy, including swapping between brands of immunosuppressant medications with a narrow therapeutic window.

“Making sure they're not changing brands of medications because that's become such a challenge when they go back to community pharmacies.”

(Nur; Metro)

“I lived out towards [remote area] for a few years, five or six years or something. It was a bit harder with being out there and having the medications available, we had a mix up where they changed the brand of a medication, ended up with a hospital visit out of that one.”

(KTR; FG4)

3.2. Role ambiguity

Despite most being able to identify clear pharmacist role expectations, there was still disagreement or lack of clarity expressed by some participants around pharmacists' current role, as well as potential additional responsibilities to advance the scope of the current role.

3.2.1. Uncertainty around the pharmacist's role

Some HP participants expressed uncertainty around the pharmacist's role and variability in their level of engagement with transplant recipients. While this was more common amongst allied health staff that perhaps have less direct involvement with the pharmacist in their workplace, there were still medical and nursing staff who struggled to clearly define the pharmacist's role.

“What is the pharmacist's role? I don't know the answer to that question.”

(Neph; Metro)

“I think because it's still an evolving role because it's fairly new, and they're still working out what their role is and it's changing all the time here as well. . . Sometimes they're more involved. . . Sometimes they're less involved.”

(Nur; Metro)

Responses from some of the KTR participants also indicated a lack of understanding around pharmacists' roles and the value they add to patient care.

“I'm pretty sure I don't remember actually meeting a dietician or pharmacist down there.”

(KTR; FG3)

3.2.2. Indecision around pharmacist prescribing

There were mixed opinions regarding the potential role of the pharmacist in managing therapeutic drug monitoring of immunosuppressant medications and subsequent dose adjustment. Some HP participants, including pharmacists, felt that this was not an appropriate role for the pharmacist to take on without consultation with and support from a nephrologist. Others felt that pharmacists are ideally placed to manage this.

“I don't think I would feel comfortable doing it in complete isolation and I don't think that's really ever going to be an acceptable model.”

(Phar; Reg)

“I know pharmacists who are better prescribers than doctors, but they do it from the back seat. . . Complex care requires a team.”

(Neph; Metro)

"I think we know more of the pitfalls and what should or shouldn't be done."

(Phar; Reg)

"The pharmacists understand it more. Even immunosuppression, to be able to initiate and titrate in consultation, I think that's very important because then you're making things happen faster than relying on a nephrologist who's got a million other patients as well."

(Nur; Rem)

Some HP participants however felt that pharmacists could take on more of a prominent role in managing other transplant related conditions, such as hypertension and lipid and blood sugar control.

"There could be some scope down the track with more pharmacist prescriber type things, just getting involved in the management of hypertension. . . Maybe BSL management too."

(Phar; Reg)

3.3. Role overload

HP participants highlighted system level barriers resulting in role overload for pharmacists while trying to maintain a high standard of care for transplant recipients.

3.3.1. Facing a paucity of resources

HP participants acknowledged that it can be difficult for pharmacists to manage the workload and role expectations due to lack of resourcing and staffing shortfalls.

"We have a great pharmacist, but unfortunately he's not resourced for outpatients, which we're trying to change of course."

(Nur; Metro)

"[Pharmacist] is getting pulled from renal to go and do ward work and work in other areas to do with the pharmacy service. That's been quite a battle for her."

(Psysc; Reg)

3.4. Role overqualification

Participants identified several different areas of KT care in which pharmacists are currently underutilised, despite being well placed and adequately qualified to be making meaningful contributions to care.

3.4.1. Overlooked for education delivery

HP participants recognised that pharmacists are often an underused resource when it comes to the provision of medication education to potential or actual KT recipients, particularly given they have the knowledge and expertise that ideally places them to provide education around transplant medications.

"Possibly a little underutilised in that we liaise with them and then we liaise with the patient, as opposed to them liaising direct and providing that education. . . I think probably we underutilise them in patient education."

(Med; Rem)

3.4.2. Untapped knowledge of prescribing minutiae

Another area in which the pharmacist may be underutilised according to HP participants, is in the provision of ongoing prescriptions for transplant medications. It was felt this would likely improve both efficiency and accuracy of prescription provision, particularly given the complexities around prescribing regulations and reimbursement schemes, ensuring the prescription provided is appropriate for the intended dispensing pharmacy (hospital pharmacy vs community pharmacy).

"The paper trail of the dose changing can be different and it can be difficult to keep up with it, and medication errors happen across the board all over the place. A pharmacist who is writing a script for the immunosuppression who is a transplant clinical pharmacist I think would be safe and would be probably a smart option."

(Neph; Reg)

3.4.3. Potential to champion pharmacogenomic testing

Pharmacists leading pharmacogenomic testing to identify patients with potentially altered drug metabolism pre-transplant and enable personalised immunosuppressant regimens at the time of transplant was also discussed by HP participants. Their expert pharmacokinetic knowledge could be used to further optimise transplant pharmacotherapy to improve graft survival and patient outcomes. One pharmacist participant described their experience developing this as a routine service within their local transplanting service and described promising preliminary outcomes.

"We've actually found about 40% of our patients have a 3A4 or 3A5 phenotype that will alter their tacrolimus metabolism. We've had the first two transplants on the ward in the last two weeks that have had personalised tacrolimus dosing at time of transplant. . . I think that we would never have escalated or had the confidence to escalate doses that quickly if we weren't aware of their phenotype."

(Phar; Metro)

3.5. Role underqualification

When considering options for advancing the scope of pharmacists' role from the current role expectations, it was suggested that they may not possess the required training and skill set to take on certain responsibilities.

3.5.1. Inadequate skills and experience to titrate immunosuppression

There were concerns raised by some HP participants, including pharmacists themselves, that pharmacists may not possess the adequate skills and experience required to interpret serum drug levels and adjust immunosuppression levels accordingly. It was highlighted that there are many patient-specific factors that need to be considered, including immunological matching and infection risk.

"The targets for immunosuppressants, it depends on a large number of patient factors. . . I think that needs some greater oversight by a nephrologist involved as well."

(Phar; Reg)

"Those are pretty complex pharmacokinetics and interactions. I think even advanced trainees or junior doctors are not aware of that, so I'd be cautious in terms of having pharmacists prescribing."

(Neph; Reg)

3.6. Role insufficiency

Participants set high expectations with regards to the roles and responsibilities of the pharmacist providing care to transplant recipients, and it was suggested that the associated goals and obligations are not always being adequately fulfilled by them.

3.6.1. Straining to meet expectations

Some HP participants felt that pharmacists may be underperforming with regards to specific role expectations, resulting in gaps in service provision and failure to meet standards set by colleagues and patients. Pharmacists themselves identified areas of KT care in which they felt they could be performing better in their current role, including more frequent post-transplant medication reviews for patients.

"I didn't know the patients well and I found that tricky. When they were admitted to hospital that was the first time I met them, every time was trying to do a medication history when they're admitted and unwell. . . There was definitely a gap in the service."

(Phar; Rem)

"Right now, I feel like the pharmacist's role is diluted to checking an interaction checker which I think is devolved."

(Neph; Metro)

Some KTR participants also felt that pharmacists are not providing enough ongoing medication support and education post-transplant in their current role.

"They [pharmacist] should be coming to you and going through everything specifically. . . They sort of give you a little bit and then let you fly and then years later you're learning stuff about the medication you've been on for years, by accident."

(KTR; FG3)

4. Discussion

The objective of this research was to explore perceptions around the role of the hospital pharmacist in the provision of care to KT recipients from regional, rural, and remote areas of Australia. Participants identified the unique complexities and barriers to medication management for this patient cohort and the correlating increased level of involvement and support required from the pharmacist, which has not been explored previously. Given that KT recipients in regional, rural, and remote areas face many additional barriers throughout their KT journey compared to their metropolitan counterparts,^{16,20} and in the context of the new regional KT service that is currently in development for North Queensland,³¹ this study provides valuable insight into what underpins HP and KT recipients' perspectives of the pharmacist's role in providing KT care to this specific population.

Overall, the role expectations identified in this study are consistent with existing literature around the roles and responsibilities of SOT pharmacists.^{2,3,32} The provision of transplant medication education pre- and post-transplant was a clear role expectation identified by participants, along with role overqualification due to the perception that the pharmacist is often underutilised in this area of patient care. The role of pharmacists educating KT recipients post-transplant is well supported, demonstrating improved medication knowledge,³³ and reduction in average length of hospital stay yielding significant cost saving benefits.³⁴ Pharmacists' role in providing pre-transplant medication education is not as well defined,³⁵ however the dissatisfaction with medication education received pre-transplant expressed in this study was similarly reported by Jones et al.³⁶ Targeted pre-transplant medication education improves patients' understanding of why transplant medications are necessary,³⁷ and participants in this study felt that increased pre-transplant medication education is critical to adequately inform and prepare patients for the long term commitment required to maintain their transplant. Participants felt this would translate to improved adherence and reduced medication management difficulties experienced by patients post-transplant, which aligns with the findings of Crawford et al.³⁸ However, the indecision around the appropriate depth of medication information to be provided pre-transplant apparent in this study is also reported elsewhere, with some perceiving in-depth information to be irrelevant and overwhelming at this point in the transplant journey.³⁹

The provision of clinical expertise around transplant medications and contributions to complex decision making was another role expectation identified in this study. This is a long-recognised core role of the pharmacist within the transplant team, with various studies demonstrating the benefits of pharmacist-led interventions in KT care.^{40,41}

Assisting patients to manage their medications and navigate access

and supply issues were significant role expectations identified in this study. This finding is supported in other studies, particularly given the significant medication burden and complex treatment regimens KT recipients face,^{42,43} and the limited support available from nephrologists.⁴⁴ These pharmacist role expectations are particularly important in the context of regional, rural, and remote KT recipients, given access to transplant medications in these areas has been highlighted as a significant issue in this study. Self-reported medication adherence amongst SOT recipients residing outside of metropolitan areas is also lower compared to their metropolitan counterparts,⁴⁵ highlighting the need for increased pharmacist support. However, access to primary care services such as general practitioners and community pharmacies is reduced in rural and remote areas,¹⁰ resulting in very limited locally available support for these patients with ongoing medication management.

Fostering relationships with primary care providers to assist with transitions of care and continuity of medication supply was another important role expectation identified in this study. This is supported by studies demonstrating that a pharmacist reconciliation in the outpatient clinic setting or as part of the transition of care for SOT recipients significantly reduces the number of medication errors.^{46,47}

Role ambiguity and underqualification were identified with regards to participants' perceptions of the pharmacist's role in monitoring immunosuppression levels and titrating medication doses accordingly. There were differing opinions from HP participants regarding whether pharmacists possess the required skills and if it really falls within the scope of their role. However, there is evidence that SOT pharmacists in other countries are already routinely managing a wider range of clinical responsibilities, including pharmacist-led therapeutic drug monitoring and prescribing for transplant-related conditions through formal collaborative practice agreements (CPAs) with transplant physicians.^{2,48–50} In addition to workload and cost saving benefits, these models have demonstrated significantly higher rates of therapeutic tacrolimus trough levels.^{51,52}

Role overload due to lack of resources and staffing issues was identified by HP participants, as well as role insufficiency in the context of pharmacists not always being able to fulfill the expectations of colleagues and patients. One recommendation from HP participants as a potential solution to both issues, was adopting a transdisciplinary model for provision of KT care. Participants described the potential role of the pharmacist as the "coordinating clinician" in this proposed model, enabling collaborative care whilst reducing the appointment burden for the patient. This would replace the traditional multidisciplinary model of care where the KT recipient is required to have routine separate consultations with each health professional. Although there are no previous studies supporting this model in KT care specifically, it has been described in other hospital settings such as emergency departments and acute stroke and rehabilitation wards.⁵³ The use of allied health transdisciplinary team models (pharmacist excluded) as a way to streamline work processes and make better use of their expert clinical skills has been demonstrated,⁵³ however very few studies have explored the pharmacist's role in the transdisciplinary care model.⁵⁴

4.1. Strengths and limitations

The strength of this research is that it provides a comprehensive insight into perspectives from both HP and KTR participants on the role of the pharmacist in provision of KT care in regional, rural, and remote areas within Australia. Although the proportion of rural and remote based HP participants was small, this is likely a result of the hub-and-spoke model of KT care provision, and a similar geographical spread within HP participant groups has been seen in similar Australian studies.⁵⁵ Given the original objective of these studies was not specifically focused around exploring the pharmacist's role, the investigators cannot be certain that data saturation was achieved, which is a limitation of the study. The application of the role theory framework to the

data collected in this study may also have limited the analysis by restricting the identification of other themes that did not fit within the constructs of the framework. The inclusion of participants within Australia only may limit the transferability of the findings internationally, particularly for countries with significant differences in health system structures or low- to middle-income countries.

5. Conclusions

This study demonstrates that KT recipients in regional, rural, and remote areas of Australia experience unique barriers and challenges related to medication management requiring increased pharmacist involvement, highlighting their role in KT care. Pharmacist role expectations as described by both HP and KT recipients centered around identified areas of need, including supporting patients to manage their medications, navigating medication access and supply issues, and fostering relationships with primary care providers. However, pharmacists remain underutilised for delivery of KT medication education. A transdisciplinary model of care was suggested to address concerns around pharmacists' workload and inability to meet role expectations. Further research is recommended to investigate transferability of these findings across regional, rural, and remote KT recipients globally. The findings of this study may support translation to clinical practice and redesign of pharmacy services to address the specific medication-related needs of KT recipients in regional, rural, and remote areas of Australia.

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CRediT authorship contribution statement

Tara K. Watters: Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Nicole J. Scholes-Robertson:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis, Conceptualization. **Andrew J. Mallett:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Beverley D. Glass:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Tara K Watters reports financial support was provided by Tropical Australian Academic Health Centre. Tara K Watters reports financial support was provided by Far North Queensland Hospital Foundation. Andrew J Mallett reports financial support was provided by Queensland Health. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.rcsop.2025.100587>.

Data availability

Transcripts from participants are not publicly available however datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

References

- Mitchell JF. Pharmacist involvement as a member of a renal transplant team. *Am J Hosp Pharm.* 1976;33(1):55–58.
- Lichvar AB, Chandran MM, Cohen EA, et al. The expanded role of the transplant pharmacist: a 10-year follow-up. *Am J Transplant.* 2023;23(9):1375–1387. <https://doi.org/10.1016/j.ajt.2023.04.032>.
- Sam S, Guérin A, Rieutord A, Belaiche S, Bussi eres J-F. Roles and impacts of the transplant pharmacist: a systematic review. *Can J Hosp Pharm.* 2018;71(5):324–337. <https://doi.org/10.4212/cjhp.v71i5.2843>.
- Maldonado AQ, Hall RC, Pilch NA, et al. ASHP guidelines on pharmacy Services in Solid Organ Transplantation. *Am J Health-Syst Pharm.* 2020;77(3):222–232. <https://doi.org/10.1093/ajhp/zxz291>.
- Advanced Pharmacy Australia. Registrar Training Program Pathways. Advanced Pharmacy Australia. Accessed 23rd February 2025 <https://www.adpha.au/workfor-research/training-programs/registrar/registrartrainingprogram-pathways>; 2025.
- Australian Organ and Tissue Donation and Transplantation Authority. Australian Donation and Transplantation Activity Report 2023. <https://www.donatelife.gov.au/sites/default/files/2024-02/2023%20Donation%20and%20Transplantation%20Activity%20Report.pdf>; 2024.
- Mulley W, Davies C, Au E, et al. 46th Report, Chapter 7: Kidney Transplantation. https://www.anzdata.org.au/wp-content/uploads/2023/09/ANZDATA_AR-2022-23_Chapter-7_F5.pdf; 2023.
- Rogers NM, Shtangay V, Lawton PD, Jose MD. Northern Australian kidney transplant unit: a viable option? Comparative study. *Nephrology.* Jun 2007;12(3):308–313.
- Wyld MLR, Wyburn KR, Chadban SJ. Global perspective on kidney transplantation: Australia. *Kidney360.* 2021;2(10):1641–1644. <https://doi.org/10.34067/KID.0003692021>.
- Pharmaceutical Society of Australia. Medicine Safety: Rural and Remote Care. Accessed 23rd February 2025 <https://www.psa.org.au/advocacy/working-for-our-profession/medicine-safety/medicine-safety-rural-and-remote-care/>; 2021.
- National Rural Health Alliance. Evidence base for additional investment in rural health in Australia. Accessed 23rd February 2025 <https://www.ruralhealth.org.au/sites/default/files/publications/evidence-base-additional-investment-rural-health-australia-june-2023.pdf>; 2023.
- McLaney E, Morassaei S, Hughes L, Davies R, Campbell M, Di Prospero L. A framework for interprofessional team collaboration in a hospital setting: advancing team competencies and behaviours. *Healthc Manage Forum.* 2022;35(2):112–117. <https://doi.org/10.1177/08404704211063584>.
- Orchard CA, Curran V, Kabene S. Creating a culture for interdisciplinary collaborative professional practice. *Med Educ Online.* 2005;10(1):4387. <https://doi.org/10.3402/meo.v10i.4387>.
- Makowsky MJ, Schindel TJ, Rosenthal M, Campbell K, Tsuyuki RT, Madill HM. Collaboration between pharmacists, physicians and nurse practitioners: a qualitative investigation of working relationships in the inpatient medical setting. *J Interprof Care.* 2009;23(2):169–184. <https://doi.org/10.1080/13561820802602552>.
- Canadian Interprofessional Health Collaborative. CIHC Competency Framework for Advancing Collaboration 2024. Accessed 23rd February 2025 <https://cihc-cpis.com/wp-content/uploads/2024/06/CIHC-Competency-Framework.pdf>; 2024.
- Watters TK, Glass BD, Scholes-Robertson NJ, Mallett AJ. Health professional experiences of kidney transplantation in regional, rural, and remote Australia. *BMC Nephrol.* 2025;26(1):88. <https://doi.org/10.1186/s12882-025-04015-4>.
- O'Brien BC, Harris IB, Beckman TJ, Reed DA, Cook DA. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med.* 2014;89(9):1245–1251. <https://doi.org/10.1097/acm.0000000000000388>.
- Liamputtong P. *Research Methods and Evidence-Based Practice.* 4th ed. Oxford University Press; 2022.
- Department of Health and Aged Care. Modified Monash Model. Commonwealth of Australia. Updated 14th December. Accessed 23rd February 2025 <https://www.health.gov.au/topics/rural-health-workforce/classifications/mmm>; 2021.
- Watters TK, Glass BD, Mallett AJ. Identifying the barriers to kidney transplantation for patients in rural and remote areas: a scoping review. *J Nephrol.* 2023. <https://doi.org/10.1007/s40620-023-01755-0>.
- Doyle L, McCabe C, Keogh B, Brady A, McCann M. An overview of the qualitative descriptive design within nursing research. *J Res Nurs.* Aug 2020;25(5):443–455. <https://doi.org/10.1177/1744987119880234>.
- Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Hardy M, Conway M. *Role Theory: Perspectives for Health Professionals.* 2nd ed. Appleton and Lange; 1988.

24. Brookes K, Davidson PM, Daly J, Halcomb EJ. Role theory: a framework to investigate the community nurse role in contemporary health care systems. *Contemp Nurse J Austral Nurs Profes*. 2007;25(1–2):146–155. <https://doi.org/10.5172/conu.2007.25.1-2.146>.
25. Taylor S, Cairns A, Glass B. Role theory: a framework to explore health professional perceptions of expanding rural community pharmacists' role. *Pharmacy*. 2020;8(3):161. <https://doi.org/10.3390/pharmacy8030161>.
26. Gonçalves J, Santos JF, Bergarno MA, Sleath BL, Cavaco A. Long-term care professionals views on pharmacists: a qualitative study using role theory. *Int J Clin Pharmacol*. 2023;45(1):97–107. <https://doi.org/10.1007/s11096-022-01482-9>.
27. Yong FR, Garcia-Cardenas V, Williams KA, Benrimoj SI. Factors affecting community pharmacist work: a scoping review and thematic synthesis using role theory. *Res Social Adm Pharm*. 2020;16(2):123–141. <https://doi.org/10.1016/j.sapharm.2019.05.001>.
28. Archibald MM. Investigator triangulation: a collaborative strategy with potential for mixed methods research. *J Mixed Methods Res*. 2016;10(3):228–250. <https://doi.org/10.1177/1558689815570092>.
29. Patton MQ. Enhancing the quality and credibility of qualitative analysis. *Health Serv Res*. Dec 1999;34(5 Pt 2):1189–1208.
30. Olmos-Vega FM, Stalmeijer RE, Varpio L, Kahlke R. A practical guide to reflexivity in qualitative research: AMEE Guide No. 149. *Med Teach*. 2023;45(3):241–251. <https://doi.org/10.1080/0142159X.2022.2057287>.
31. North Queensland Kidney Transplant Service. Townsville Hospital and Health Service. Accessed 23rd February 2025 <https://www.townsville.health.qld.gov.au/services/renal-services/north-queensland-kidney-transplant-service/>; 2025.
32. Wiegel J, Olyaei A. The role of the pharmacist in the management of kidney transplant recipients. *Indian J Urol*. 2016;32(3):192–198. <https://doi.org/10.4103/0970-1591.185108>.
33. Chambord J, Couzi L, Merville P, Moreau K, Xuereb F, Djabarouti S. Benefit of a pharmacist-led intervention for medication management of renal transplant patients: a controlled before-and-after study. *Therap Adv Chronic Disease*. 2021;12. <https://doi.org/10.1177/20406223211005275>, 20406223211005275.
34. Maldonado AQ, Weeks DL, Bitterman AN, et al. Changing transplant recipient education and inpatient transplant pharmacy practices: a single-center perspective. *Am J Health-Syst Pharm*. May 15 2013;70(10):900–904. <https://doi.org/10.2146/ajhp120254>.
35. Hamid M, Rogers E, Chawla G, Gill J, Macanovic S, Mucsi I. Pretransplant patient education in solid-organ transplant: a narrative review. *Transplantation*. 2022;106(4). <https://doi.org/10.1097/TP.0000000000003893>.
36. Jones J, Rosaasen N, Taylor J, et al. Health literacy, knowledge, and patient satisfaction before kidney transplantation. *Transplant Proc*. 2016;48(8):2608–2614. <https://doi.org/10.1016/j.transproceed.2016.07.018>.
37. Mansell H, Rosaasen N, Wichart J, et al. A randomized controlled trial of a Pretransplant educational intervention in kidney patients. *Transplant Direct*. Oct 2021;7(10), e753. <https://doi.org/10.1097/txd.0000000000001202>.
38. Crawford K, Low JK, Manias E, Williams A. Healthcare professionals can assist patients with managing post-kidney transplant expectations. *Res Social Adm Pharm*. Nov 2017;13(6):1204–1207. <https://doi.org/10.1016/j.sapharm.2016.11.013>.
39. Williams A, Crawford K, Manias E, et al. Examining the preparation and ongoing support of adults to take their medications as prescribed in kidney transplantation. Research support, non-U.S. Gov't. *J Eval Clin Pract*. Apr 2015;21(2):180–186. <https://doi.org/10.1111/jep.12270>.
40. Yang H, Li L, Hu X, et al. Impact of pharmacist-led post-transplant medication management for kidney transplant recipients: a retrospective pre- and post-intervention study. *J Clin Pharm Ther*. 2019;44(4):603–610. <https://doi.org/10.1111/jcpt.12826>.
41. Gnatta D, Keitel E, Heineck I. Interventions performed by clinical pharmacist in the renal transplant ambulatory care. *Revista Brasileira de Farmácia Hospitalar e Serviços de Saúde*. 2019;10(3):355. <https://doi.org/10.30968/rbfhss.2019.103.0355>.
42. Low JK, Crawford K, Manias E, Williams A. Quantifying the medication burden of kidney transplant recipients in the first year post-transplantation. Multicenter study. *Int J Clin Pharmacol*. Oct 2018;40(5):1242–1249. <https://doi.org/10.1007/s11096-018-0678-9>.
43. Low JK, Crawford K, Manias E, Williams A. Stressors and coping resources of Australian kidney transplant recipients related to medication taking: a qualitative study. *J Clin Nurs (John Wiley & Sons, Inc)*. 2017;26(11–12):1495–1507. <https://doi.org/10.1111/jocn.13435>.
44. Crawford K, Low JK, Manias E, et al. Nephrologists' management of patient medications in kidney transplantation: results of an online survey. Research support, non-U.S. Gov't. *J Eval Clin Pract*. Oct 2015;21(5):879–885. <https://doi.org/10.1111/jep.12394>.
45. Sankaranarayanan J, Collier D, Furasek A, et al. Rurality and other factors associated with adherence to immunosuppressant medications in community-dwelling solid-organ transplant recipients. *Res Social Adm Pharm*. 2012;8(3):228–239. <https://doi.org/10.1016/j.sapharm.2011.04.001>.
46. Musgrave CR, Pilch NA, Taber DJ, et al. Improving transplant patient safety through pharmacist discharge medication reconciliation. *Am J Transplant*. Mar 2013;13(3):796–801. <https://doi.org/10.1111/ajt.12070>.
47. Cohen EA, McKimmy D, Cerilli A, Kulkarni S. A pharmacist-driven intervention designed to improve medication accuracy in the outpatient kidney transplant setting. *Drug Healthcare Patient Safety*. 2020;12:229–235. <https://doi.org/10.2147/DHPS.S264022>.
48. Ravichandran BR, Gillespie MW, Sparkes TM, et al. Collaborative practice agreement in solid organ transplantation. *Int J Clin Pharmacol*. Apr 2018;40(2):474–479. <https://doi.org/10.1007/s11096-018-0604-1>.
49. Rodriguez KE, Chelewski RJ, Peter ME, et al. Integrating pharmacists into a kidney transplant clinic: developing and implementing a collaborative pharmacy practice agreement. *J Am Pharm Assoc*. 2022;62(1):349–356. <https://doi.org/10.1016/j.japh.2021.07.004>.
50. Chelewski R, Rodriguez K, Peter M, Zuckerman A. Assessing pharmacist interventions at an outpatient renal transplant clinic under a collaborative pharmacy practice agreement. *J Pharm Pract*. 2023. <https://doi.org/10.1177/08971900221149544>, 8971900221149544–8971900221149544.
51. Massoglia G, Ramnarine M, Schuh MJ. Tacrolimus therapeutic drug monitoring in kidney transplant patients before and after pharmacist post-transplant consults. *Innov Pharm*. 2021;12(3). <https://doi.org/10.24926/iip.v12i3.4212>.
52. Fleming JN, Gebregziabher M, Posadas A, Su Z, McGillicuddy JW, Taber DJ. Impact of a pharmacist-led, mHealth-based intervention on tacrolimus trough variability in kidney transplant recipients: a report from the TRANSafe Rx randomized controlled trial. *Am J Health-Syst Pharm*. 2021;78(14):1287–1293. <https://doi.org/10.1093/ajhp/zxab157>.
53. Martin AK, Green TL, McCarthy AL, Sowa PM, Laakso EL. Allied health transdisciplinary models of care in hospital settings: a scoping review. *J Interprof Care*. 2023;37(1):118–130. <https://doi.org/10.1080/13561820.2022.2038552>.
54. Cheong TS, Zhu B, Chong E. The geriatric clinical pharmacist at the emergency department: a novel front-door transdisciplinary care model. *Eur J Hosp Pharm*. Jul 19 2022;30(5), e29. <https://doi.org/10.1136/ejpharm-2022-003458>.
55. Devitt J, Cass A, Cunningham J, Preece C, Anderson K, Snelling P. Study Protocol—Improving Access to Kidney Transplants (IMPAKT): a detailed account of a qualitative study investigating barriers to transplant for Australian Indigenous people with end-stage kidney disease. Comparative Study Research Support, Non-U.S. Gov't. *BMC Health Serv Res*. Feb 04 2008;8:31. <https://doi.org/10.1186/1472-6963-8-31>.

Glossary

AdPha: Advanced Pharmacy Australia
 ASHP: American Society of Health System Pharmacists
 CPA: Collaborative Practice Agreement
 CKD: Chronic kidney disease
 HP: Health professional
 KT: Kidney transplant
 KTR: Kidney transplant recipient
 MMM: Modified Monash Model
 SOT: Solid organ transplant
 SRQR: Standards for Reporting Qualitative Research