The National Kidney Foundation

NKF

2026 I Volume 5

"Evolving Kidney Care" symbolises renewal, growth and long-term sustainability in kidney care. Represented by a tree trunk cross section, each ring marks the steady evolution of knowledge, care and innovation, embodying a shared commitment to research and collaboration to ensure lasting impact for future generations.

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foreword

We are grateful for your partnership and shared commitment to advancing kidney care. Renal Outlook 2026: Evolving Kidney Care reflects Singapore's ongoing efforts to strengthen the prevention and management of chronic kidney disease through collaboration, innovation and patient-centred care.

A key priority has been the advancement of peritoneal dialysis (PD) as a home-based modality that supports both clinical outcomes and quality of life. While suitable for many patients, uptake remains below its potential. Greater awareness, early counselling and system-wide support are important to enable more patients to consider PD as an appropriate and preferred treatment option.

The National Kidney Foundation (NKF) continues to work closely with public healthcare institutions to strengthen shared-care models and support PD adoption, aligned with national efforts to expand home-based care. We are encouraged by the strong support across the public healthcare system, which has helped shape the focus of this edition.

This edition highlights practical innovations that support PD, including improved catheter insertion pathways, initiatives to reduce infection risk and enhance patient safety, and digital solutions to streamline workflows and improve care delivery. These efforts demonstrate how rethinking clinical practice, refining operations and leveraging technology can enable more effective home-based care.

Beyond PD, this publication brings together contributions across the kidney care continuum, covering service innovations, care models and patient outcomes. They reflect our shared commitment with healthcare partners to improving the quality and sustainability of kidney care.

Progress in kidney care depends on strong institutional partnerships and a sustained focus on prevention, early intervention and patient empowerment. Only through collective action can we meaningfully curb the rising burden of chronic kidney disease.

We extend our sincere appreciation to the Editorial Advisory Committee members for their guidance, as well as to our authors and reviewers for their dedication to advancing knowledge in kidney care. Our heartfelt thanks also go to our healthcare partners for their continued collaboration and support.

Together, we will continue to strengthen kidney care in Singapore and help patients live healthier, fuller lives.

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Optimising Peritoneal Dialysis Catheter Insertion

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Background

Peritoneal dialysis (PD) is an effective and safe modality of kidney replacement therapy that remains underutilised in most countries.[1] In the face of a "tsunami of chronic kidney disease"[2] and increasing strain on resources needed for in-centre haemodialysis (HD), advocating for PD has become the official ministry direction since 2022. Despite heightened awareness and several laudable initiatives, the target of "30% by 2025" remains an aspiration rather than reality.

The Catheter

One of the major determinants of PD uptake is the ability to establish dialysis access in a timely fashion. We share a unique nephrologist-driven collaboration between three departments to enhance catheter insertion capabilities. We propose that the best way to establish access is to use a combination of methods to cover a wider range of patient needs.

Percutaneous PD Catheter Insertion Under Fluoroscopic Guidance

Traditionally in many centres including ours, PD catheters are almost exclusively inserted via open surgery by vascular surgeons.

Our percutaneous PD catheter insertion service was established in 2019. The percutaneous approach offers several important advantages. Procedures are performed in the radiology suite instead of the operating theatre (OT). Hence, availability is not constrained by OT capacity, or the schedule of surgeons and anaesthetists. This reduces waiting time significantly. Shorter lead time allows greater utilisation of urgent start PD among late presenters. Also, percutaneous insertions are more feasible among patients deemed unsuitable for general anaesthesia (GA). Such frail patients often tolerate HD poorly. Percutaneous PD catheter insertion may become their only life-saving option.

PD Catheter Insertion by Advanced Laparoscopy

In 2022, an upper gastrointestinal (UGI) surgeon was engaged for the first time to perform laparoscopic PD catheter insertion in a patient with previous abdominal surgery. Intraoperatively, a small paraumbilical hernia was repaired and adhesiolysis was done. This catheter is still functioning to date.

This positive experience underscored the advantages of PD catheter insertion with advanced laparoscopy, which is deemed the gold standard based on major society guidelines.[3] This makes PD possible for patients with previous non-extensive abdominal surgery as they were historically denied this option.

Laparoscopic surgery has several advantages. Hernia repairs, adhesiolysis, omentopexy and surgical anchoring of the catheter can be performed in the same setting. Interestingly, simultaneous bariatric surgery has been performed in selected obese patients with dramatic weight loss observed. While PD was traditionally avoided in morbidly obese patients, this novel approach provides an alternative option for obese patients. Among prevalent PD patients, laparoscopic surgery allows for readjustment or replacement of malpositioned catheters. All in all, access to laparoscopic surgery is instrumental in expanding PD candidacy and reducing technique failure due to mechanical complications.

Is Open Surgery Still Relevant?

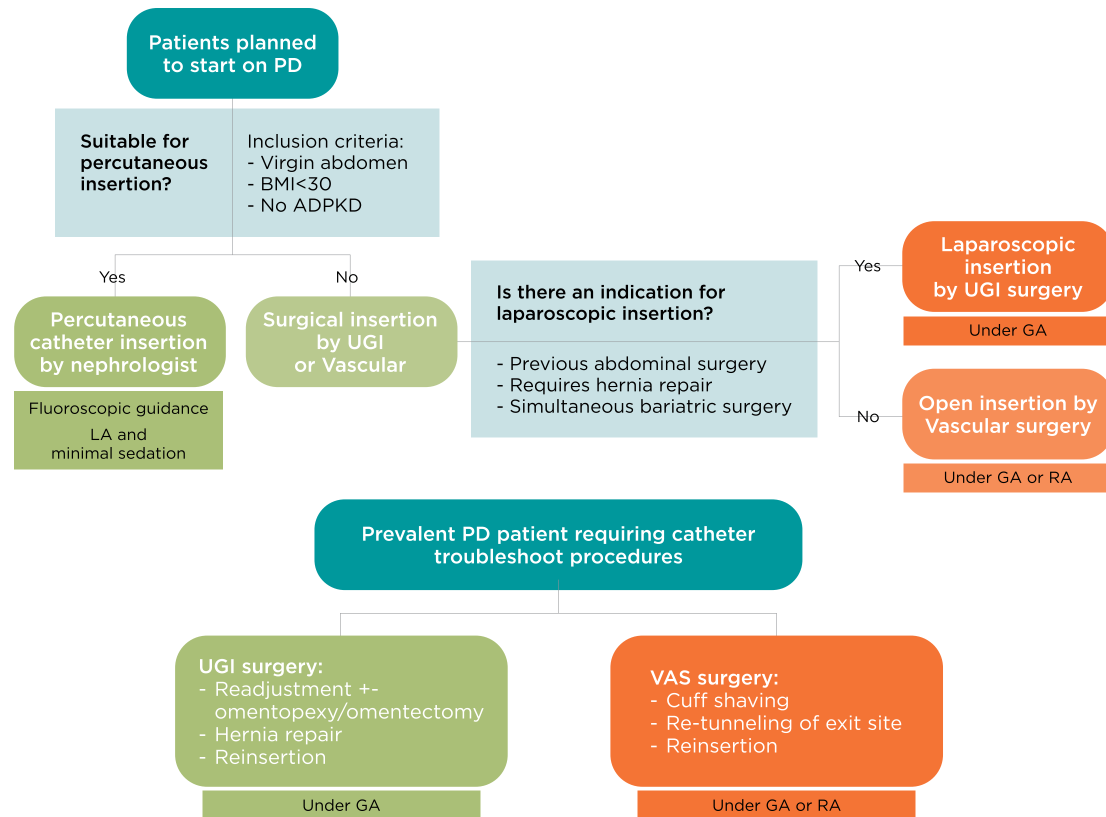
While advanced laparoscopy is the gold standard method of catheter insertion, it is costly and requires GA. Open insertion can be performed under GA or regional anaesthesia (RA). There remains a significant minority of patients who are neither suitable for percutaneous nor laparoscopic insertion and would benefit from open surgery by vascular surgeons. Vascular surgeons also perform catheter salvage procedures such as cuff shaving and re-tunnelling of exit site in cases of refractory exit site infection, reducing need to transfer to HD.

Enhanced PD Catheter Insertion Service

After several months of refinement and continuous cross-talk, our enhanced PD catheter insertion service commenced at the end of 2022, with the buy-in of both UGI and vascular surgeons.

Potential PD candidates are generally considered for percutaneous catheter insertion by default. If they do not fit the stipulated inclusion criteria, they are referred either to UGI or Vascular surgery based on their profile and needs. Among prevalent patients, surgeons perform procedures such as readjustment, reinsertion or salvage when needed. Figure 1 details the workflow of our PD catheter insertion service.

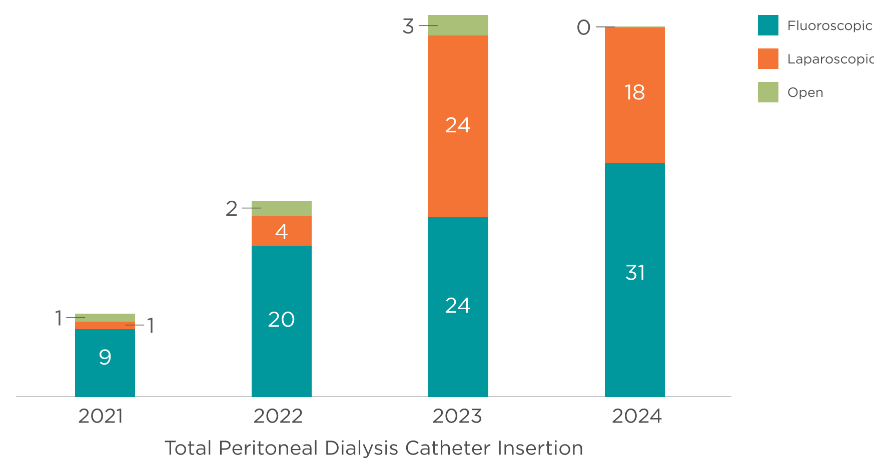
Figure 1: The Enhanced PD Catheter Insertion Service with effect from November 2022



Results

Figure 2 shows that the total number of PD catheters inserted in our unit per year has increased significantly after enhancing our catheter insertion services. The introduction and subsequent scaling up of percutaneous fluoroscopic insertions in 2019, followed by laparoscopic insertions in 2022, contributed significantly to this growth.

Figure 2: Number of Peritoneal Dialysis Catheters Inserted in CGH from 2021 – 2024



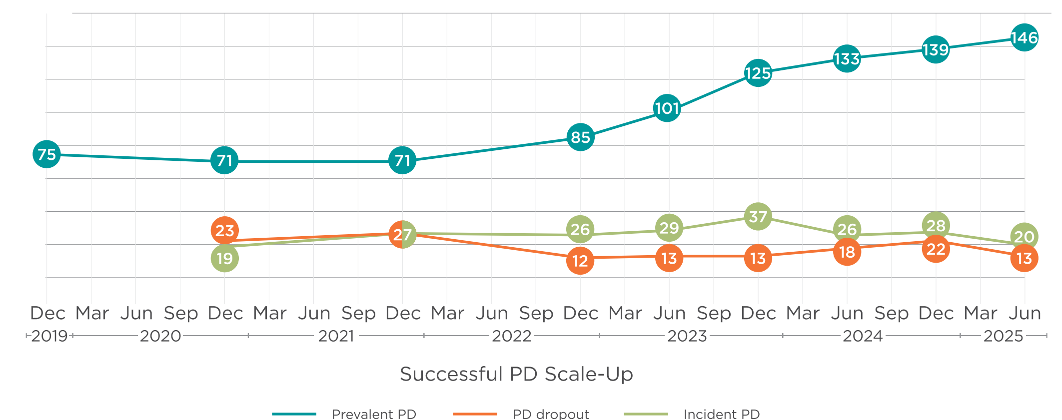
The 1-year outcomes of patients who underwent percutaneous catheter insertion by nephrologists were tracked and reported. Between 2019 – 2024, 111 catheter insertions were attempted, of which 5 (4.5%) were unsuccessful. Among the 106 successful insertions, catastrophic complications such as perforated viscus and death were absent. Overall technique survival was highly favourable. These are detailed in Figure 3.

Figure 3: Outcomes of Percutaneous PD Catheters Inserted from 2019 – 2024

Total	111
Complications	
Failure to insert	**5 (4.5%)**
Visceral perforation	**0 (0%)**
Catheter insertion related peritonitis	**0 (0%)**
Peritonitis at 12 months	**20 (18%)**
Mechanical complications requiring surgical readjustment (among those successfully inserted)	**6 (5.7%)**
Patient Outcomes	
Technique survival at 12 months	**92 (82.9%)**
Death censored technique survival at 12 months	**92 out of 100 (92%)**

Figure 4 shows that the number of prevalent PD patients in our unit increased significantly since 2022, effectively doubling over three years, after remaining stagnant in the preceding years. This was contributed to by both an increase in incidence and a reduction in dropouts. The enhancement of PD catheter insertion services is believed to have contributed significantly.

Figure 4: Number of Prevalent PD Patients from 2019 – 2025



Conclusion

Till date, it remains unclear which is the best method for PD catheter insertion, with numerous comparison studies failing to find a clear advantage of one way over another. We propose that 'the best way' is to 'have them all' and not be restricted to one particular method. The choice and mix of catheter insertion techniques in each centre should be adapted based on local expertise and resources available.

Success of PD as kidney replacement therapy depends greatly on the ability to establish access promptly, safely and durably in a wide range of patients with varying needs. This process must be nephrologist-driven, as we are most personally invested in increasing the uptake of PD. However, this cannot be achieved by nephrologists alone. Strategic collaboration with like-minded surgical partners is crucial.

References

1. Jain AK, Blake P, Cordy P, Garg AX. Global trends in rates of peritoneal dialysis. Journal of the American Society of Nephrology. 2012 Mar 1;23(3):533-44.
2. Amrita K. 'Imminent kidney tsunami': Chronic renal disease on the rise in Singapore. The Straits Times. 2023 Sep 20.
3. Crabtree JH, Shrestha BM, Chow KM, Figueiredo AE, Povlsen JV, Wilkie M, Abdel-Aal A, Cullis B, Goh BL, Briggs VR, Brown EA. Creating and maintaining optimal peritoneal dialysis access in the adult patient: 2019 update. Peritoneal Dialysis International. 2019 Sep;39(5):414-36.

Enhancing Infection Prevention in Peritoneal Dialysis with CHG Dressings

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Background

Exit site infection (ESI) represents a significant challenge in peritoneal dialysis (PD) care. These infections affect the catheter-skin interface and increase the risk of developing PD-associated peritonitis. Studies indicate that 12% of ESI cases progress to peritonitis, contributing to technique failure and hospitalisation.[1]

Current prevention strategies rely on daily topical antibiotic application. However, emerging drug-resistant organisms limit this approach's effectiveness. The International Society for Peritoneal Dialysis recommends daily antibiotic cream application, yet alternative antimicrobial strategies require investigation.[2,3]

Chlorhexidine gluconate (CHG) has demonstrated antimicrobial efficacy for over fifty years.[4,5] CHG-impregnated dressings reduce catheter-related bloodstream infections by 40% in intravascular catheters.[6] These dressings provide sustained 2% CHG release and require weekly changes, potentially improving patient compliance compared to daily applications.

Study Objectives

This prospective single-centre pilot study evaluated Tegaderm™ CHG-impregnated dressing effectiveness in preventing ESI among incident PD patients. The primary outcome measured was ESI incidence rates. Secondary outcomes included PD-associated peritonitis rates and time to first infection.

Methods

This single-centre study recruited incident PD patients aged 21 – 99 years between October 2019 and August 2022. Patients with CHG or Tegaderm™ allergies were excluded. 30 patients received CHG-impregnated dressing for twelve weeks, with weekly dressing changes or when soiled. The 12-week follow-up period was selected as appropriate for this pilot feasibility study, though this timeframe may be insufficient to capture meaningful differences in PD-related infections, particularly peritonitis, which may develop later in the treatment course.

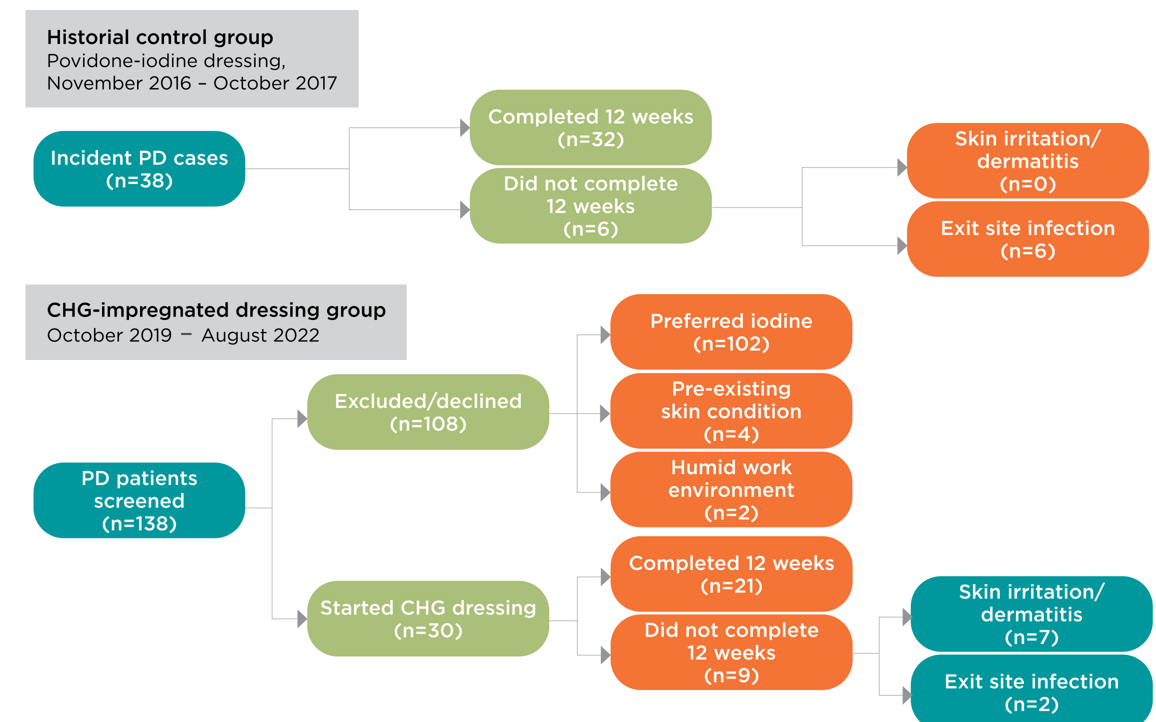
A historical cohort (November 2016 – October 2017) provided comparison data. These 38 patients received conventional care with daily 10% povidone-iodine cleaning,[7] 0.1% gentamicin cream and cloth dressing.

All patients underwent standardised PD catheter insertion with prophylactic antibiotics. CHG-impregnated dressing application began 2 – 3 weeks post-insertion following comprehensive patient training. Monthly reviews monitored exit site conditions and adverse reactions.

Historical Control Comparability: The historical cohort received a different exit site care protocol compared with the CHG group. Whilst the CHG group used weekly CHG-impregnated dressings, the historical cohort followed daily care with 10% povidone-iodine cleaning, 0.1% gentamicin cream and cloth dressing. No major changes in catheter insertion technique or prophylactic antibiotic protocols occurred between the study periods (2016 – 2017 versus 2019 – 2022). However, full comparability cannot be assumed and unmeasured confounders — including staff experience, patient education practices, environmental factors and other temporal influences — cannot be excluded.

Statistical Analysis: The study was evaluated using an intention-to-treat approach. Parametric data were presented as mean±3 standard deviation and non-parametric data as median with interquartile range. Between group comparisons for categorical variables were performed using the Chi-square test, while continuous data were analysed using the independent sample Student's t-test. Kaplan–Meier survival analysis was applied for time-dependent variables. A p-value of less than 0.05 was considered statistically significant. Data analysis was conducted using IBM® SPSS® Statistics version 28.

Figure 1: Cohort Flow Diagram for CHG Dressing Versus Control (Povidone-Podine Dressing)



Results

Patient Demographics

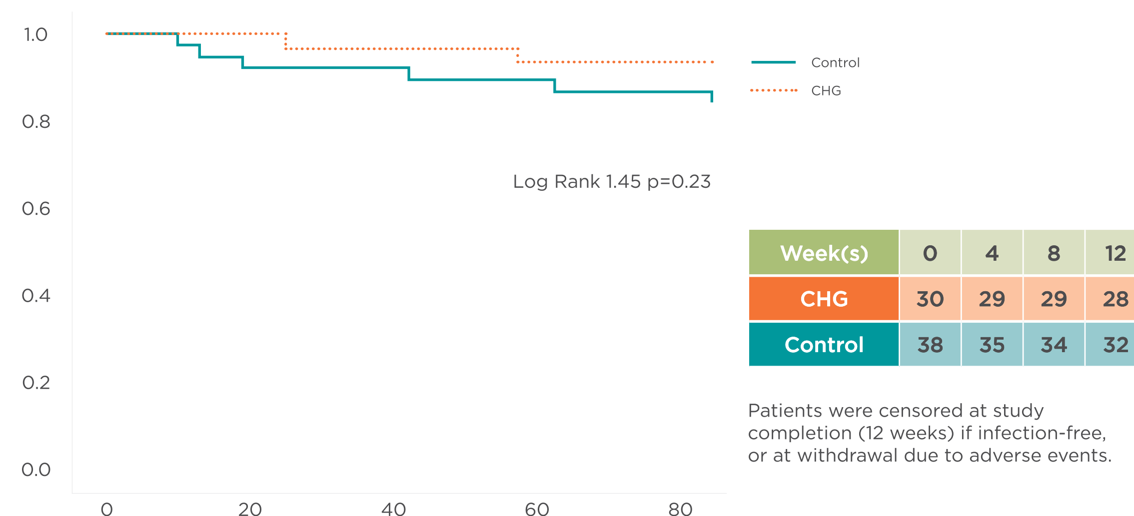
The CHG-impregnated dressing group was younger (58.6±12.6 versus 64.4±10.0 years) with fewer hypertension (80% versus 97.4%) and cardiovascular disease (10% versus 36.8%). These baseline differences may have influenced infection outcomes and represent a limitation of the historical control design. More patients in the CHG-impregnated dressing group chose automated PD (90% versus 57.9%).

Infection Outcomes

ESI occurred in two of 30 patients (6%) using CHG-impregnated dressing compared to six of 38 patients (15.8%) in the historical cohort (p=0.25). The risk of ESI was 9.1% lower in the CHG group, although this was not statistically significant. The relative risk was 0.42. Compared to the control group, the CHG-impregnated dressing group had a similar ESI rate by survival analysis on time to ESI (Figure 2; Log-rank 1.45 p=0.23). Mean time to ESI was 81.2 days (95% CI 77.2-85.2) for the CHG group versus 76.8 days (95% CI 69.9-83.7) for the control group.

One peritonitis episode occurred in each group (3.3% versus 2.6%, p=0.87). The CHG-impregnated dressing group experienced culture-negative peritonitis at 20 days, whilst the historical cohort developed Staphylococcus epidermidis peritonitis at 50 days. Both episodes resolved with appropriate antibiotic therapy.

Figure 2: Kaplan–Meier Survival Analysis for Comparison Between CHG-Impregnated Dressing and Control for the 12-Week Study Period



Week(s)	0	4	8	12
CHG	30	29	29	28
Control	38	35	34	32

Patients were censored at study completion (12 weeks) if infection-free, or at withdrawal due to adverse events.

Adverse Events

Seven patients (23.3%) developed localised skin reactions to CHG-impregnated dressing. Reactions included contact dermatitis and exacerbation of pre-existing psoriatic conditions.[8] Median time to skin reaction was eight weeks. All reactions resolved following dressing cessation. Three patients required topical hydrocortisone treatment.

Clinical Management Considerations: The 23.3% skin reaction rate represents a major finding that may limit generalisability more than the infection outcomes themselves. This tolerability issue, rather than efficacy, may be the primary limiting factor for widespread adoption. Given the substantial skin reaction rate, patient selection should consider pre-existing dermatological conditions. Patients developing reactions should discontinue CHG-impregnated dressings immediately, with topical corticosteroids considered for symptomatic relief. Regular monitoring during the first 8 weeks may help identify early reactions. It remains unclear whether reactions occurred predominantly in patients with pre-existing dermatological conditions, which should be investigated in future studies.

Clinical Implications

Usage of CHG-impregnated dressings resulted in numerically lower infection rates compared to historical controls, though statistical significance was not achieved in this pilot study. The weekly application schedule offers practical advantages including reduced care burden and potentially improved compliance. However, the 23.3% skin reaction rate requires consideration in patient selection.

The study's findings align with previous research showing CHG effectiveness in catheter care.[9-11] Unlike intravascular applications where CHG dressings significantly reduce infections, PD applications showed numerical but non-significant improvements. This difference may reflect the unique challenges of prolonged skin contact in ambulatory patients.

Limitations and Future Directions

The modest sample size limited statistical power to detect significant differences. Adjusted analyses were not feasible due to the limited sample size and therefore effect estimates should be interpreted cautiously and contextualised within the exploratory nature of the study. The historical control design introduced potential performance bias, as care practices and patient populations may have differed between study periods despite protocol similarities. The significant baseline demographic differences between cohorts, including age and comorbidity profiles, may have confounded infection risk comparisons.

Future randomised controlled trials with larger cohorts could provide definitive evidence. Skin reaction rates suggest the need for patient selection criteria or modified application protocols. Alternating CHG-impregnated dressings with conventional care periods might reduce adverse reactions whilst maintaining antimicrobial benefits.

Conclusion

Tegaderm™ CHG-impregnated dressing appears to be a feasible alternative to daily exit site care in selected PD patients. This pilot study demonstrates workable implementation and suggests possible infection prevention benefits, but the notable adverse skin reaction rate (23.3%) highlights the need for careful patient selection and close monitoring. The weekly application schedule may also support improved treatment adherence and patient convenience. While the findings provide early safety signals and practical insight into real-world use, more robust studies are required to better characterise tolerability, refine patient selection and determine optimal application protocols for this intervention.

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References

1. Szeto CC, Li PK, Johnson DW, Bernardini J, Dong J, Figueiredo AE, et al. Ispd catheter-related infection recommendations: 2017 update. Perit Dial Int. 2017; 37:141-154.
2. Chow KM, Li PK-T, Cho Y, Abu-Alfa A, Bavanandan S, Brown EA, et al. Ispd catheter-related infection recommendations: 2023 update. Peritoneal Dialysis International. 0:08968608231172740.
3. Mehrotra R, Singh H. Peritoneal dialysis-associated peritonitis with simultaneous exit-site infection. Clin J Am Soc Nephrol. 2013; 8:126-9; discussion 129-30.
4. Milstone AM, Passaretti CL, Perl TM. Chlorhexidine: Expanding the armamentarium for infection control and prevention. Clin Infect Dis. 2008; 46:274-81.
5. McDonnell G, Russell AD. Antiseptics and disinfectants: Activity, action, and resistance. Clin Microbiol Rev. 1999; 12:147-79.
6. Wei L, Li Y, Li X, Bian L, Wen Z, Li M. Chlorhexidine-impregnated dressing for the prophylaxis of central venous catheter-related complications: A systematic review and meta-analysis. BMC Infect Dis. 2019; 19:429.
7. Waite NM, Webster N, Laurel M, et al. The efficacy of exit site povidone-iodine ointment in the prevention of early peritoneal dialysis-related infections. Am J Kidney Dis. 1997; 29:763-8.
8. Weitz NA, Lauren CT, Weiser JA, LeBoeuf NR, Grossman ME, Biagas K, et al. Chlorhexidine gluconate–impregnated central access catheter dressings as a cause of erosive contact dermatitis: A report of 7 cases. JAMA Dermatol. 2013; 149:195-9.
9. Wang HH, Hung SY, Chang MY, Lee YC, Lin HF, Lin TM, et al. Bacterial colonisation patterns in daily chlorhexidine care at the exit site in peritoneal dialysis patients-a prospective, randomised controlled trial. PLoS One. 2017; 12:e0184859.
10. Htay H, Johnson DW, Wu SY, Oei EL, Foo MWY, Choo JCJ. Comparison of topical chlorhexidine and mupirocin for the prevention of exit-site infection in incident peritoneal dialysis patients. Perit Dial Int. 2017; 37:266-272.
11. Htay H, Choo JCJ, Johnson DW, Pascoe EM, Jayaballa M, Oei EL, et al. Chlorhexidine-impregnated sponge dressing for prevention of catheter exit-site infection in peritoneal dialysis patients: A pilot study. Int Urol Nephrol. 2021; 53:803-812.

Improving Peritoneal Dialysis Prescription Workflows through Automation

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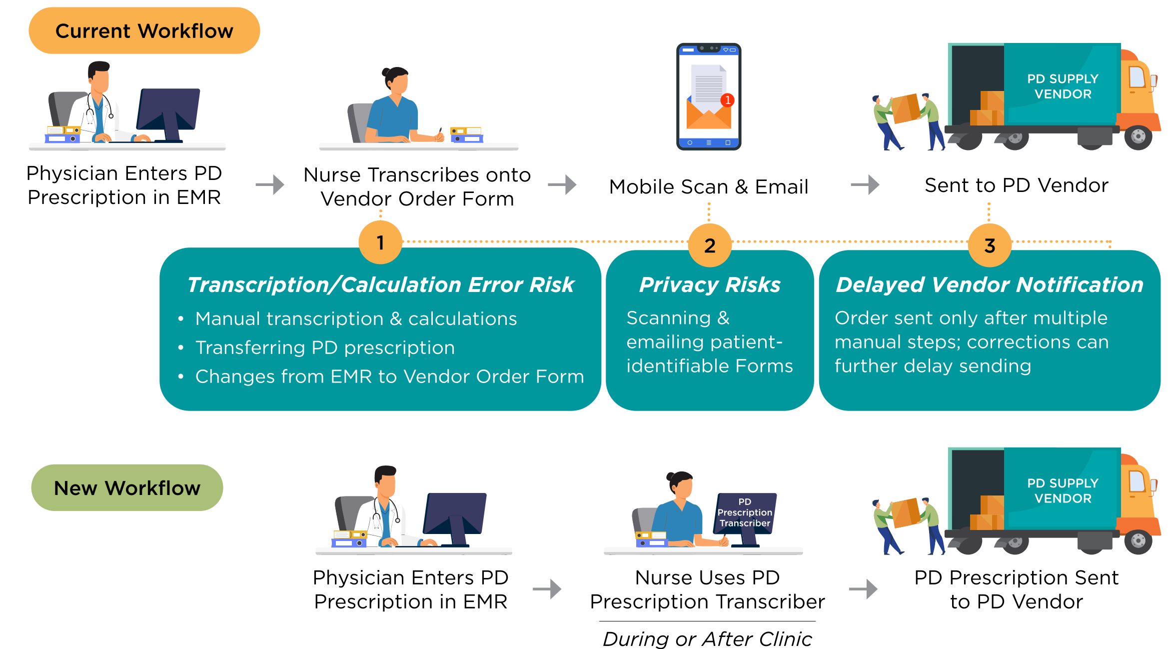
Background

Peritoneal dialysis (PD) supply management requires accurate and timely communication of physician-prescribed PD regimen changes from the hospital to PD supply vendors to ensure prompt and correct supply fulfilment. In Singapore, this process remains largely manual and involves multiple parties. Physicians document PD prescriptions as free text in electronic medical records (EMR), after which nurses manually transcribe the information onto physical order forms. These forms are subsequently scanned and emailed to PD vendors and subsidy partners. Singapore is projected to have approximately 1,569 PD patients by 2026,[1] with Singapore General Hospital (SGH) currently managing 558 PD patients. Patients attend follow-up appointments every three to four months, during which prescription adjustments are common. Each adjustment necessitates careful transcription of prescriptions, accurate volume calculations and preparation of vendor-specific PD prescription order forms. This manual workflow is time-intensive and prone to ambiguities, transcription errors associated with handwritten or free text prescriptions and manual calculations. As a result, PD vendors often initiate follow-up phone calls or email correspondence to clarify prescription details. On average, the process takes eight minutes per patient. With approximately 30 patients weekly, this corresponds to 240 minutes per week or about 208 hours annually, time that could otherwise be devoted to direct patient care. Figure 1 illustrates the current workflow for communicating PD prescription changes, highlighting the key problems associated with the existing process and the proposed new workflow.

Figure 1: Current Workflow and Proposed New Workflow for Communicating PD Prescription Changes



Problem Statement

This highlights the need for an automated system that minimises administrative workload, reduces transcription errors, protects patient data and ensures timely, accurate prescription communication – allowing nurses to focus on direct patient care.

Designing a Practical Solution

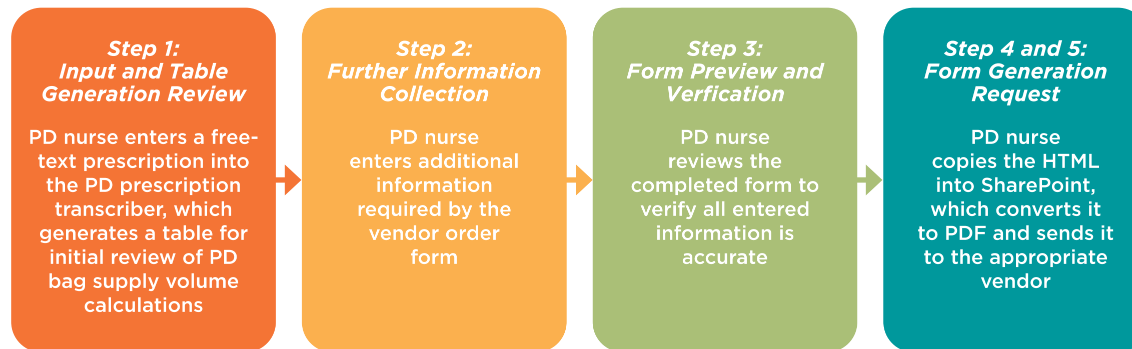
We developed a PD prescription transcriber in collaboration with the Office of Digital Empowerment (ODE), leveraging open government products and existing enterprise platforms to deliver an end-to-end digital workflow without the need for custom system development. This work is currently in the development and pre-implementation phase at SGH, focusing on workflow configuration and creation of AI prompt logic.

Using PAIR Chat powered by Claude Sonnet 4, the solution converts free-text PD prescriptions into standardised vendor order forms. At this stage, the GenAI assistant extracts, structures and validates prescription information, with a human-in-the-loop verification to ensure ongoing clinical oversight and safe testing during development. The workflow automates document generation and secure email transmission via Power Automate within the institutional Microsoft 365 environment.

This system supports consistent and standardised outputs for PD vendors and the subsidy partner. Figure 2 illustrates the current developmental workflow for transmitting new PD prescriptions to external parties. Nurses enter PD prescriptions as free text from the electronic medical record (EMR). The system then parses the content, performs the necessary calculations and generates a structured PD prescription form for preview and verification. Upon nurse approval, the finalised prescription is published to a secure SharePoint repository and automatically transmitted to vendors through a Power Automate workflow.

The Synapse team within ODE supported this project in an advisory capacity to guide solution design using existing institutional infrastructure. No bespoke development or capital investment was required as the system relies entirely on institution-approved platforms already in operational use.

Figure 2: Proposed Solution - PD Prescription Transcriber developed using PAIR Chat



Impact and Benefits

The PD Prescription Transcriber streamlines the PD prescription ordering workflow by automating transcription, calculations and vendor communication while maintaining secure document handling within institutional systems. The key operational and system-level benefits are summarised in Table 1.

Table 1: Potential Impact and Benefits of the PD Prescription Transcriber

PD Prescription Transcriber Function	Operational Impact	Stakeholder who benefits	Operational/Clinical/System Benefit
Automated parsing of free-text PD prescriptions, calculation of PD supply quantities, generation and automated sending of standardised vendor order forms	Reduces manual transcription, calculations, scanning and emailing of prescription orders	Nurses/ Patients/ Healthcare Organisation	Saves ~3 hours per week (156 hours annually), equivalent to ~0.085 full-time equivalent (FTE) of nursing time, allowing redeployment towards higher-value activities such as patient education, counselling, troubleshooting and coordinated care
Generate standardised PD vendor order forms	Ensures consistent and accurate vendor order forms	Nurses/ Healthcare Organisation/ Vendors	Mitigates potential ambiguities and errors arising from handwritten or free-text prescriptions and manual calculations, reducing the need for vendor-initiated clarification calls or emails and downstream communication delays
Secure document generation and automated sending of PD vendor order forms through SharePoint and Power Automate	Removes the need for scanning and emailing patient-identifiable forms	Patients/ Healthcare Organisation	Strengthens data security and aligns with the national Personal Data Protection Act (PDPA) while enabling timely PD supply delivery
Use of institution-approved open government platforms (PAIR Chat) and existing enterprise platforms (SharePoint, Power Automate)	Enables implementation using existing institutional infrastructure with minimal maintenance	Healthcare Organisation/ Healthcare system	No capital set-up cost; the workflow leverages existing institutional platforms and is developed with guidance from the Synapse team within the ODE. Augmented by AI and low-code automation, the PD prescription transcriber is readily extensible, enabling updates and workflow refinements through PAIR Chat prompt adjustments and low code modifications within Power Automate, while supporting scalability as PD uptake increases

Future Work

Building on the development of the PD Prescription Transcriber, the next phase will be a formal pilot evaluation at SGH. This will involve silent deployment and structured user testing to assess transcription accuracy, usability and efficiency compared with the current manual process. Transcription accuracy will be evaluated through independent review by PD nurses and domain experts, with iterative prompt refinement based on identified discrepancies. Workflow efficiency will be assessed by comparing the time required to complete PD vendor orders using the transcriber versus the current manual process. User acceptance and perceptions will be assessed using the Technology Acceptance Model (TAM). Findings will inform further optimisation and guide decisions regarding wider adoption across other healthcare institutions. Pilot testing is planned to be completed within the current year, subject to institutional approvals and operational feasibility.

Although the current implementation is limited to SGH, the solution is inherently generalisable to other public hospitals. It is built entirely on Singapore institution-approved enterprise platforms that are already deployed across the public healthcare system. Extension to another hospital would primarily involve configuration of local PD prescription templates and workflows, rather than redevelopment of the core system or AI logic.

Conclusion

The PD Prescription Transcriber presents a practical, technology-enabled solution to improve transcription accuracy, communication reliability and data security in PD supply management. By leveraging SharePoint for secure document storage and Power Automate for automated vendor communication, the system reduces administrative workload and supports timely prescription updates.

Because the solution is built on existing enterprise platforms and low-code automation, no capital set-up is required and wider adoption can be implemented using standard institutional resources. Once validated through pilot evaluation, administrative tasks related to PD prescription transcription could potentially be delegated to patient service associates, allowing PD nurses to focus on higher value clinical responsibilities. As PD uptake continues to increase, such automation offers a sustainable, scalable and patient-centred approach to supporting safe and efficient PD care delivery.

References

1. Khan BA, Singh T, Ng AL, Teo RZ. Health economics of kidney replacement therapy in Singapore: Taking stock and looking ahead. Ann Acad Med Singap. 2022;51(4):236–40. https://doi.org/10.47102/annals-acadmedsg.2021494

Transforming Rituximab Care with a Nurse-Led Day Case Model

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Background

Rituximab has seen increasing use for patients with glomerulonephritis, including lupus nephritis, ANCA-associated vasculitis and membranous glomerulonephritis.[1] Although rituximab infusions have excellent tolerability and safety profiles, infusion-related risks are highest with the first dose.[2] Traditionally, patients receiving rituximab were routinely hospitalised in acute wards under physician-led care (Appendix 1), exacerbating the strain on healthcare systems that were already facing acute bed shortages and workforce pressures. We identified substantial inefficiencies in the existing model, including prolonged bed occupancy and discharge delays caused primarily by limited physician availability to perform admission and discharge procedures.

Rituximab administration in ambulatory care settings has shown comparable clinical outcomes and safety when appropriate patient selection criteria are applied.[2] Healthcare systems now have access to growing numbers of Advanced Practice Nurses (APNs) whose clinical expertise and prescribing rights[3] could be better utilised in managing stable infusion patients. Together with growing evidence supporting nurse-led discharge protocols across various clinical settings,[4-7] these factors provide strong justification for redesigning the care model for suitable renal patients to emphasise appropriate care placement and optimal resource utilisation.

Objectives

To transition clinically stable patients receiving second and subsequent rituximab infusions from an inpatient physician-led model to a nurse-led day case model.

To improve bed utilisation, reduce unnecessary inpatient stays and enhance operational efficiency without compromising patient safety.

To optimise workforce utilisation by expanding the clinical role of APNs in pre-infusion assessment, infusion oversight and discharge processes.

Problem Analysis

The existing inpatient model, whilst designed with patient safety as the primary consideration, created operational challenges affecting resource utilisation and patient experience. Key issues included bed capacity constraints limiting acute admissions and discharge delays despite patients achieving early clinical stability.

Clinical observations consistently showed that patients receiving second and subsequent rituximab infusions achieved stability and met discharge criteria well before the mandated 24-hour stay under the usual standard of care. The mandatory physician review process may have created procedural bottlenecks that exceeded what was clinically necessary in many cases, indicating an opportunity to refine the balance between safety protocols and operational efficiency.

These findings indicate opportunities for care pathway redesign by right-siting patients based on clinical necessity rather than traditional protocols, addressing capacity constraints whilst maintaining safety standards.

Implementation

The initiative comprised two major phases to ensure methodical implementation with continuous monitoring and adjustment. Renal APNs served as the primary clinical point of contact for any issues arising throughout the implementation process.

Phase 1 focused on fundamental care model redesign, transitioning patients receiving their second and subsequent rituximab doses from inpatient to day-care delivery within the Short Stay Ward (SSW). This phase required extensive collaboration across multiple departments, including Finance and Admissions for case reclassification and billing process modifications, nephrologists for clinical criteria development and nursing teams for workflow design and safety protocol establishment. The intervention aimed to right-site patients whilst maintaining safe and necessary care standards through structured 8-hour observation periods.

Individuals were eligible for the nurse-led day case model if they had previously tolerated at least one rituximab infusion without adverse effects. Patients receiving their first dose of rituximab or those who had experienced previous infusion reactions continued to receive rituximab under the inpatient physician-led care model.

Phase 2 enhanced operational efficiency by redistributing clinical responsibilities from physicians to appropriately trained nursing staff. Renal APNs assumed responsibility for pre-infusion assessments, including patient evaluation, risk stratification and treatment authorisation. Discharge procedures were initially streamlined with APNs performing post-infusion reviews and making independent discharge decisions based on standardised criteria for one year. The process was then further refined through nurse-led protocols that eliminated routine post-infusion reviews for clinically stable cases. Standardised checklists and escalation criteria ensured patient safety and appropriate follow-up arrangements.

Outcomes

Between October 2023 – April 2025, 183 patients received second or subsequent rituximab infusion under the nurse-led day case model (Appendix 2). The results exceeded expectations, with 178 patients (97.3%) successfully completing treatment within the 8-hour window and achieving safe discharge. Only 5 patients (2.7%) required extended monitoring due to infusion-related complications, demonstrating the model's safety and effectiveness.

The initiative achieved substantial measurable improvements across multiple domains. The length of stay reduction from 24 hours to 8 hours represented a 66.7% decrease in bed occupancy per patient, significantly enhancing capacity for acute admissions. Cost savings totalled $9,846.96 in ward charges alone, demonstrating both clinical efficiency and economic benefits.

In addition, the transition from physician-led to nurse-led care generated substantial medical workforce efficiencies. The workflow redesign achieved a 2-hour reduction in physician time per patient, translating to 356 hours of medical time saved across 178 patients, equivalent to 44.5 standard workdays. This substantial time saving enabled physicians to redirect their attention to more complex cases whilst maintaining care standards.

Beyond measurable outcomes, the initiative generated significant qualitative improvements. Enhanced patient flow efficiency through optimised scheduling and streamlined discharge processes reduced waiting times and improved inpatient bed availability. Patients benefited from shorter hospital stays, reduced disruption to daily routines and smoother overall care experiences.

Staff satisfaction improved notably, with APNs expressing greater job satisfaction due to increased clinical autonomy and expanded scope of practice. SSW nurses also reported enhanced job satisfaction through increased ownership of care delivery. This enhanced professional fulfilment contributes to workforce retention and quality of care.

The nurse-led model's success has established it as the recommended approach for stable renal patients receiving other biologic infusions such as belimumab, provided appropriate patient selection criteria are met. This model's adaptable design presents opportunities for expanded application across other ambulatory infusion pathways and medical specialties.

We have further scaled the nurse-led day case care model to other patient populations, specifically targeting low-risk native renal biopsy cases and IV belimumab infusion. This phased expansion will allow for further validation of the model's effectiveness whilst building institutional confidence and expertise in its application across diverse clinical scenarios.

Conclusion

This initiative demonstrates strong alignment with our organisation's strategic objectives by enhancing operational productivity, optimising bed utilisation and expanding the scope of nurse-led services. The success of this model presents promising opportunities for wider implementation, potentially serving as a blueprint for other ambulatory infusion pathways and specialties. Its scalable design offers a sustainable solution for future healthcare delivery, exemplifying our commitment to innovative, efficient and patient-centred care.

Appendix 1: The Inpatient Physician-led Model

Appendix 2: The Nurse-led day case model

References

1. Zhu, W., He, H., & Pai, P. (2025). The use of rituximab in glomerulonephritis: What is the evidence? Biomedicines, 13(9), 2157. https://doi.org/10.3390/biomedicines13092157
2. Ye, J., Zhang, C., Ren, X., Huang, L., & Zhang, X. (2025). Efficacy and safety of rituximab in Chinese patients of glomerular kidney diseases: An observational study. Medicine, 104(37), e44127. https://doi.org/10.1097/MD.0000000000044127
3. Woo, B. F. Y., Cashin, A., Higgins, A., Casey, M., Buckley, T., & Zhou, W. (2025). Prescribing Practices and Behaviours of Advanced Practice Nurses and Pharmacists: A Nationwide Cross-Sectional Survey. Journal of Advanced Nursing, Advance online publication. https://doi.org/10.1111/jan.70111
4. Bowen, A., Kumar, R., Howard, J., & Camilleri, A. (2014). Nurse led discharge: Improving efficiency, safely. Clinical Governance: An International Journal, 19, 123-135. https://doi.org/10.1108/CGIJ-03-2013-0007
5. Lo, S. L., Yu, L. M. E., & Suen, S. M. (2018). Nurse-led discharge for gynaecology day surgery to reduce length of stay [Conference abstract HAC1266]. Princess Margaret Hospital.
6. Mao, H., Xie, Y., Shen, Y., Wang, M., & Luo, Y. (2022). Effectiveness of nurse-led discharge service on adult surgical inpatients: A meta-analysis of randomized controlled trials. Nursing Open, 9(5), 2250–2262. https://doi.org/10.1002/nop2.1268
7. Yang, B., Luo, X., Wang, P., Pan, P., Lin, P., & Zhao, W. (2025). Nurse-led discharge versus consulting surgeon-led discharge for patients who underwent laparoscopic surgeries: an evaluation of follow-up outcome, readmission frequencies, cost of care, and satisfaction of patients. BMC Nursing, 24(1), 218. https://doi.org/10.1186/s12912-025-02805-7

Scaling Up Supportive Care for Inpatient Renal Patients

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Introduction

Renal Supportive Care (RSC) is a growing field that addresses the complex needs of patients with advanced chronic kidney disease (CKD), particularly those who opt for conservative management or are approaching end-of-life.[1] These patients, even in early stages of renal progression, experience substantial symptom burden affecting 7 out of 10 individuals, with symptoms including fatigue, pain and psychological distress that are comparable to terminal malignant conditions and remain consistently high across all CKD stages.[2] Despite the increasing recognition of RSC's value, its integration into inpatient care remains inconsistent across institutions.

Problem Statement

In a tertiary hospital in Singapore, the inpatient RSC programme was launched in October 2021 to support hospitalised renal patients with symptom management, psychosocial support and shared decision-making. However, referral rates remained low, averaging fewer than 20 per month. This gap in service utilisation prompted a multidisciplinary team to work together with the aim of increasing the monthly uptake of inpatient RSC referrals by 50% from 20 – 30 referrals per month within six months.

Understanding the Barriers

The project began with a survey of healthcare staff in the Department of Renal Medicine, designed to explore referral behaviours, perceived barriers and attitudes toward Renal Supportive Care (RSC). This local effort aligns with findings from a national survey of nephrologists, geriatricians and palliative physicians in Singapore, which identified similar challenges including limited time during consultations, reliance on family decision-making, and inadequate palliative training.[1]

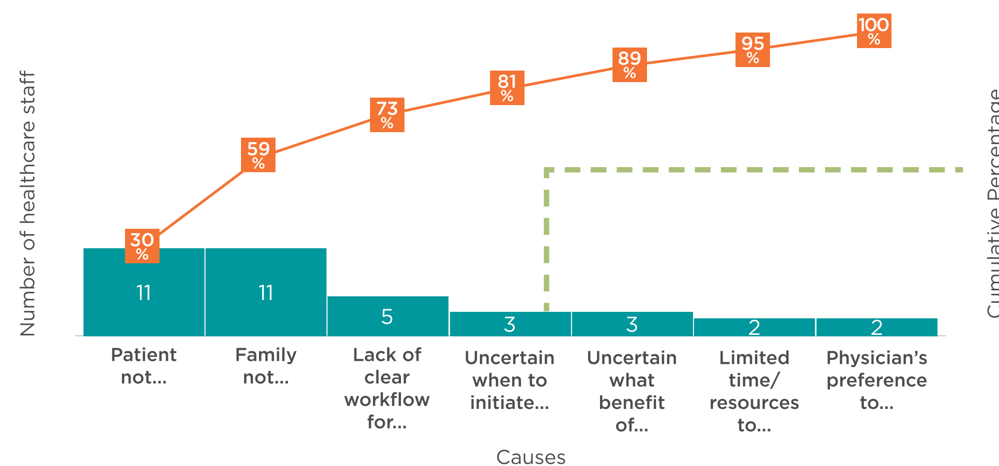
Among 28 healthcare staff surveyed, half reported making zero inpatient RSC referrals monthly and all made fewer than three. The most common clinical triggers for referral were withdrawal of dialysis (71.4%), terminal illness (64.3%) and uncontrolled symptoms (57.1%). These findings reflect the broader need to integrate supportive care earlier in the management of advanced CKD, where symptom burden, frailty and quality of life should guide clinical decisions.[3]

Intervention Design

In addition, several barriers were identified that hindered referral uptake. The top three, as revealed through Pareto analysis (Figure 1), were patient non-receptiveness (39.3%), family non-receptiveness (39.3%) and lack of a clear referral workflow (17.9%). To address these barriers, the team developed and implemented a streamlined nursing workflow for RSC referrals. This workflow was integrated into the hospital's Computerised Physician Order Entry (CPOE) system, allowing nurses to initiate referrals directly to improve accessibility. Awareness sessions were conducted via departmental meetings and digital platforms to educate staff on the new process and the scope of RSC services.

In parallel, the team created screening criteria to identify eligible patients. These criteria included indicators such as limited prognosis, inability to tolerate dialysis and poor vascular access. Over a 4.5-month period, 700 admissions were manually screened using these criteria. Although resource-intensive, this process ensured that patients who could benefit from RSC were identified early and referred appropriately.

Figure 1: Pareto Chart of Barriers Preventing Healthcare Staff from Refering Patients to RSC



Results and Impact

The results were significant. The weekly referral rate increased from 2 – 3 to 10 – 25, translating to a monthly volume of 40 – 100 referrals, well above the initial target of 30. This represented more than 100% increase in referral volume, demonstrating the effectiveness of the intervention. The nursing workflow was incorporated into departmental standard of care and the CPOE system provided a permanent, user-friendly mechanism for referral initiation, ensuring sustainability.

Beyond volume metrics, the project also improved clinical relevance and staff engagement. Survey responses indicated that the most valuable aspects of RSC were end-of-life care including home or inpatient hospice (85.7%), symptom management (64.3%) and decision-making around withdrawal of renal replacement therapy (60.7%). These findings reflect the broader role of RSC in supporting patients and families through complex medical and emotional challenges.

Team Collaboration and Reflections

The project's success was underpinned by a multidisciplinary team approach. Members included nephrologists, specialty nurses, pharmacists, medical social workers and nurse managers. Each played a role in data collection, analysis, and implementation. Reflections from team members highlighted the importance of ownership, communication and iterative learning through Plan-Do-Study-Act (PDSA) cycles. The team also recognised the need for ongoing education to address misconceptions about RSC and build confidence among staff in initiating referrals.

Challenges and Future Directions

One challenge encountered was the manual nature of the screening process. While effective, it was time-consuming and not scalable in the long term. The team explored the possibility of electronic or AI-assisted screening but found it unfeasible at the time. Future directions may include leveraging digital tools to automate patient identification and streamline referrals, aligning with broader trends in healthcare innovation.

Another key insight was the importance of patient and family engagement. Resistance to RSC often stems from emotional distress, cultural beliefs or lack of understanding. Addressing these concerns requires empathy, time and clear communication. Training staff in serious illness conversations and advanced care planning can help bridge this gap and ensure that patients receive care aligned with their values and goals.

Conclusion

This initiative successfully increased inpatient RSC referrals through workflow redesign, staff education and structured screening. It demonstrated that small, targeted changes can lead to significant improvements in service utilisation and patient care. The project also laid the foundation for sustained practice change, with the new workflow embedded into routine operations and ongoing efforts to scale up screening and referral processes.

As healthcare systems evolve to meet the needs of ageing populations and patients with complex chronic conditions, integrating supportive care into renal services is not just beneficial; it is essential. This project offers a replicable model for other institutions seeking to enhance their RSC programmes and ensure that patients receive holistic, dignified care throughout their kidney journey.

References

1. Chua, Y. T., Seetharaman, S., & Khatri, P. (2021). Barriers to renal supportive care in Singapore: A survey-based study of nephrologists, geriatricians and palliative physicians. Nephrology Dialysis Transplantation, 36(Supplement_1), gfab092.0049. https://doi.org/10.1093/ndt/gfab092.0049
2. Shedden-Mora, M., Jessen, B., & Huber, T. B. (2024). Why symptom burden in non-dialysis CKD matters [Editorial]. American Journal of Kidney Diseases, 84(6), 672-674.
3. Davison, S. N., & Jassal, S. V. (2016). Supportive care: Integration of palliative care in chronic kidney disease. Clinical Journal of the American Society of Nephrology, 11(10), 1909–1914. https://doi.org/10.2215/CJN.00400116

Fast-Tracking Care with Nurse-Led Catheter Unblocking

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Background

Patients with end-stage renal disease (ESRD) undergoing haemodialysis (HD) often rely on tunnelled dialysis catheters (TDCs) for vascular access.[1] These catheters, while essential, are prone to complications such as poor flow or complete blockage.[2] When such issues occur, patients are unable to dialyse at their community centres and must be admitted to hospital for catheter unblocking and dialysis. At the Singapore General Hospital (SGH), a tertiary hospital in Singapore, malfunctioning vascular access accounts for a significant proportion of HD patient admissions.

From January 2022 – December 2023, 292 patients presented to the SGH Emergency Department (ED) with malfunctioning TDCs. Prior to intervention, these patients were typically admitted for inpatient unblocking, resulting in an average length of stay (ALOS) of 4.3 days. This contributed to increased bed occupancy, delayed dialysis and higher healthcare costs. The team identified this as an opportunity for process redesign and aimed to reduce the ALOS for patients admitted via the ED for malfunctioning TDCs by 20%, from 4.3 days to 3.4 days within 12 months.[3]

Method

A root cause analysis revealed inefficiencies in the existing workflow, particularly delays caused by multiple handoffs between nurses and physicians. The process required nurses to wait for a physician to order and administer thrombolytic agents (TA), followed by a separate step for assessing catheter patency. This prolonged the overall process and increased patient length of stay. The team redesigned the workflow to empower trained ED nurses to instil TA and assess catheter patency directly. Following TA prescription, nurses were empowered to instil the thrombolytic agent and evaluate catheter function after a one-hour dwell period. Upon successful restoration, patients could undergo haemodialysis and be discharged home, preventing extended hospitalisation.[4]

Design: This was a single-centre, quality improvement (QI) project conducted in the SGH ED. Patients presented to the SGH ED with malfunctioning TDCs between January – December 2021 were used as the pre-intervention baseline cohort. The intervention lasted from January 2022 – December 2023 and sustainability was tracked from January 2024 – June 2025.

Training & Competency: Seven ED nursing champions (Advanced Practice Nurses and resident nurses) completed structured training comprising lectures, videos, simulation and ≥10 supervised procedures prior to independent practice.

Definition: The pre-intervention success rate refers to inpatient, physician-led unblocking procedures performed prior to the nurse-led ED workflow.

Inclusion criteria: Adults on maintenance HD with suspected TDC malfunction (poor flow/ occlusion) presenting to the ED.

Exclusion criteria: Haemodynamic instability, suspected catheter-related bloodstream infection, active bleeding/INR above the protocol threshold, known thrombolytic allergy or urgent need for non-catheter dialysis access.

Intervention: Nurses instilled the thrombolytic agent into each lumen with a 60-minute dwell and reassessed patency. The agent and dose used in this programme were 2mg alteplase per lumen. If patency was restored, patients proceeded to dialysis the same day; if not, a second dwell or escalation to interventional radiology for catheter exchange was pursued as per protocol.

Outcomes:

Primary will be ALOS (days).

Secondary will be technical success of unblocking, proportion managed as ED unblocking and cost avoidance (Class C bed-day cost x patient-days saved).

Statistical analysis was performed using Microsoft Excel. Difference in ALOS were analysed using Student's t-test.

To support this change, seven ED nursing champions – mainly Advanced Practice Nurses (APNs) and resident nurses – were first identified and underwent structured training. The training programme included lectures, instructional videos, hands-on practice using models and supervised procedures. Each nurse completed a minimum of ten supervised procedures to ensure competency. This nurse-led intervention was implemented in January 2022 and monitored over a two-year period.

Results

During January 2022 – December 2023, 292 patients presented to the ED with malfunctioning TDCs. Of these, 49 (16.8%) underwent ED unblocking. The ALOS decreased from 4.3 – 3.2 days (p=0.003), an absolute reduction of 1.1 days (-25.6%). The success rate of catheter unblocking increased from 62.1% pre-intervention to 72.6% post-intervention.

Discussion

Nurse-led interventions in vascular access care have demonstrated safety and efficiency when supported by training, protocols and governance. This project adds real-world evidence from a tertiary ED setting, showing reductions in ALOS alongside improved technical success.

ALOS demonstrated a clear statistical signal of improvement (SSOI) after the intervention, indicating that the observed gains were unlikely to be due to random variation.

Empowering ED nurses to instil thrombolytics streamlined care by reducing avoidable handoffs and enabling earlier catheter restoration, which in turn supported same-day dialysis. The improvement over physician-led, inpatient unblocking likely reflects faster time to therapy and increased workflow standardisation.

Sustainability was demonstrated, with ALOS maintained at 3.3 days from January 2024 – June 2025, reflecting >95% retention of improvement. The broader system context likely influenced patient flow: the community thrombolysis programme reduced the number of patients presenting to the ED, with only those dialysing at centres without community thrombolysis or those with failed community attempts needing ED-based intervention.

Low uptake (16.8%) of ED unblocking among 292 eligible patients may be explained by strict inclusion criteria, clinical comorbidities (e.g. suspected infection), after hours resource constraints and upstream diversion to community thrombolysis. Potential strategies include expanding nurse credentialing to full day coverage, refining inclusion criteria, implementing electronic medical record-based eligibility prompts and improving shared visibility between ED and dialysis centres.

As a QI project without randomisation, results may be influenced by case-mix differences, ED crowding, downstream dialysis slot availability and hospital discharge processes. Nonetheless, the consistency of improvement, presence of an SSOI and sustained ALOS performance strengthen the validity of the findings.

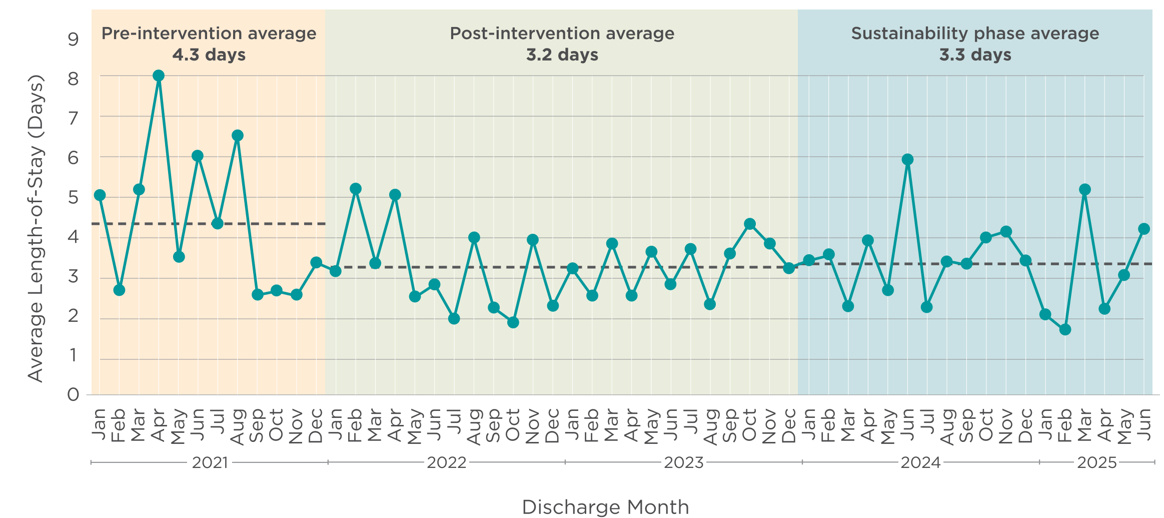
Conclusion

In conclusion, empowering ED nurses to perform early unblocking of TDCs significantly reduced patient length of stay and improved clinical outcomes. This nurse-led intervention demonstrates the value of process redesign and interdepartmental collaboration in enhancing patient care and resource efficiency. The initiative not only met its clinical targets but also delivered measurable cost savings and sustained improvements. The protocol is now embedded in nursing guidelines and onboarding. Broader adoption, in tandem with community thrombolysis may further reduce avoidable admissions and optimise dialysis access care. With the groundwork laid for broader implementation, this model holds promise for transforming renal emergency care across institutions.

Summary of Outcomes Before and After Implementation

Metric	Pre-intervention (n=120)	Post-intervention (n=292)
Average length-of-stay (days)	4.3	3.2
Technical success of unblocking (%)	62.1	72.6
Patients managed by ED unblocking (n, % of 292)	–	49 (16.8%)

Run Chart Showing the Average Length of Stay from January 2021 – June 2025



References

1. Lazarus B, Lok CE, Moist L, Polkinghorne KR. Strategies to prevent hemodialysis catheter dysfunction. J Am Soc Nephrol. 2025; doi:10.1681/ASN.0000000666.
2. Beathard GA, Dillavou ED, Berns JS, Schwab SJ, Collins KA. Malfunction of chronic hemodialysis catheters [Internet]. UpToDate; 2025 [cited 2025 Nov 11]. Available from: https://www.uptodate.com/contents/malfunction-of-chronic-hemodialysis-catheters
3. Ministry of Health Singapore. Hospital bills and fee benchmarks [Internet]. Singapore: Ministry of Health; 2025 Aug 15 [cited 2025 Nov 11]. Available from: https://www.moh.gov.sg/managing-expenses/bills-and-fee-benchmarks/hospital-bills-and-fee-benchmarks/
4. National Improvement Unit. Change package: Optimising blood flow, locking solution, anticoagulant & standardising technique (BLAST) and catheter flow restoration with lytic dwell at community dialysis centre (CLEAR). Singapore: Ministry of Health; 2024.

Moving Towards Precision Medicine in Kidney Transplantation

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Optimising outcomes for kidney transplant recipients involves finely balancing the scales of immunosuppression. On the one hand, it requires minimising morbidity and premature death associated with cardiovascular disease, infection and cancer related to over-immunosuppression. On the other hand, it aims to avoid alloimmune-mediated injury, the most common cause of allograft failure, associated with under-immunosuppression.

Immunologic compatibility has long been recognised as a key determinant of successful kidney transplantation outcomes, with early studies indicating an association between the number of human leukocyte antigen (HLA) mismatches and allograft survival. Traditionally, HLA compatibility between donor and recipient has been determined at the HLA-A, -B and -DR antigen levels. However, over the past two decades, it has been increasingly recognised that de novo donor-specific antibodies (dnDSA) directed against HLA-DQ are particularly frequent following solid organ transplantation and are strongly associated with allograft injury.

Assessment of HLA mismatch at the antigen level is imprecise, with each antigen mismatch conferring a unique and highly variable degree of alloimmune risk based on the number, type and position of the mismatched amino acids between the two HLA molecules. Molecular mismatch, which assesses donor-recipient differences at the amino acid level, has evolved since Rene Duquesnoy first described epitopes represented by amino acid triplets on the exposed surface of an HLA molecule. Currently, there are various approaches for molecular mismatch analysis, including eplet mismatch (HLA-Matchmaker), Electrostatic Mismatch Score (EMS-3D), amino acid mismatch (including the Cambridge algorithm), Epitope MisMatch Algorithm (HLA-EMMA and Snowflake) and Predicted Indirectly ReCognizable HLA Epitopes (PIRCHE-II).

Molecular Mismatch as a Pre-Transplant Biomarker for Primary Alloimmunity

The goal of personalised immunosuppression is to achieve the lowest level of immunosuppression possible to avoid cardiovascular and metabolic adverse effects, risk for infection and cancer while ensuring adequacy to prevent alloreactivity resulting in acute and chronic rejection. Molecular mismatch has the potential to facilitate precision medicine in transplantation by serving as a prognostic and predictive biomarker for primary alloimmunity.

Eplets are patches of polymorphic surface-exposed amino acids within a 3-Å radius that may constitute the binding sites for complementarity-determining regions of anti-HLA antibody paratopes (Figure 1A). HLA-Matchmaker is the most commonly used software for determining the eplet mismatch load between donor and recipient, which has been associated with dnDSAs, T-cell-mediated rejection (TCMR), antibody-mediated rejection (ABMR) and allograft survival.

HLA-DR/DQ single-molecule eplet mismatch was first introduced as a prognostic biomarker for dnDSA, ABMR and TCMR in 2019 by Wiebe et al.[1] In this approach, the eplet mismatch of individual HLA-DR$\beta_{1/3/4/5}$ and HLA-DQ$\alpha_1\beta_1$ molecules was correlated with dnDSA development (Figure 1B) to generate thresholds to categorise recipients into Low, Intermediate, or High-risk groups for primary alloimmunity. Subsequent studies in racially diverse cohorts (Caucasian, African-American, Hispanic, Indigenous) using HLA-DR/DQ single-molecule eplet mismatch and alloimmune risk categories validated its role as a prognostic biomarker.

We also validated this approach in a Southeast Asian cohort of 234 kidney transplant recipients without pre-transplant DSA in the National University Centre for Organ Transplantation (NUCOT).[2] This cohort was unique in that 71% of recipients were on cyclosporine (as opposed to tacrolimus) maintenance calcineurin-inhibitor (CNI) immunosuppression. We found that low-risk recipients, even those prescribed a less potent CNI for maintenance immunosuppression, had a low absolute rate of dnDSA regardless of the immunosuppression choice.

Molecular mismatch can also serve as a predictive biomarker for immunosuppression adequacy. Studies have shown that class II eplet mismatch at the time of transplant can identify recipients who are less likely to tolerate (A) CNI withdrawal or minimisation, (B) conversion to alternative immunosuppressive agents (e.g. mTOR inhibitors or belatacept) and (C) benefit from heightened immunologic monitoring. The use of molecular mismatch can also be expanded to inform a personalised approach to post-transplant alloimmune monitoring and dnDSA surveillance.

The Role of Imputation for Alloimmune Risk Assessment

One recognised barrier to implementing molecular mismatch is the recommendation for high-resolution HLA typing, which may prove challenging and costly in resource-constrained contexts, or laborious and not cost-effective in centres with a large pre-transplant census. Eplet analysis requires high-resolution genotype data, which may often be unavailable, especially in older cohorts or under-resourced centres.

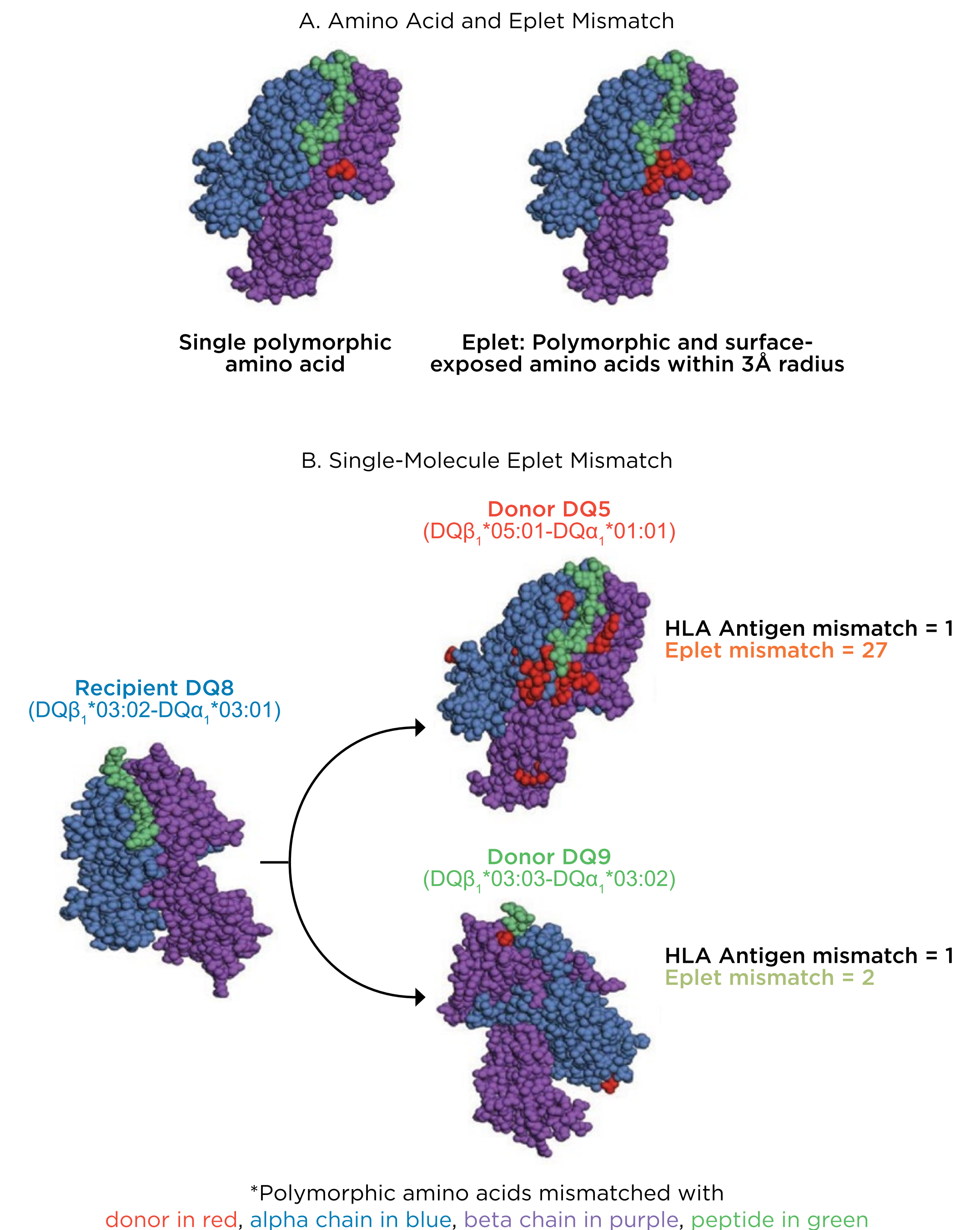
We examined the accuracy of imputed 2-field alleles, eplet mismatches and molecular mismatch categories in a cohort of 51 donor-recipient pairs whose HLA genotypes were obtained by Next-Generation Sequencing (NGS).[3] NGS HLA genotyping data were transformed to low resolution by removing the second field. Low-resolution genotyping was imputed using HaploStats, a web application provided by the United States National Marrow Donor Program Bioinformatics group, to generate high-resolution genotypes, guided by each individual's self-identified race. We found that although the concordance between imputed and NGS alleles ranged 60 – 92% depending on the HLA loci, 90% of recipients remained in the same molecular mismatch categories. This provides preliminary data indicating that imputation preserves molecular risk assessment in most cases in a Southeast Asian cohort.

Future Directions

Standardisation in eplet evaluation is a key need in this field. Currently, there are several versions of eplet mismatch evaluation software being used by researchers and clinicians. However, to reproduce published risk-categorisation outcomes, the same software and methodology should be used. Efforts are underway to confirm or revise existing thresholds with the online eplet registry to provide a single accessible source for donor-recipient eplet mismatch evaluation. There are also ongoing debate and active investigation on the relative immunogenicity of different eplet mismatches. Ongoing multi-centre prospective trials will significantly add to the evidence, which is currently dominated by retrospective studies. HLA databases should be enriched with data from Southeast Asian populations to improve the precision of immunological assessment.

As challenges in standardisation and HLA typing are addressed, physicians and recipients alike will benefit from personalised immunosuppression and monitoring strategies enabled by more accurate alloimmune risk assessment.

Figure 1: Amino Acid, Eplet and Single-Molecule Eplet Mismatch



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References

1. Wiebe C, Kosmoliaptsis V, Pochinco D, et al. HLA-DR/DQ molecular mismatch: A prognostic biomarker for primary alloimmunity. Am J Transplant. 2019;19(6):1708-1719. doi:10.1111/ajt.15177
2. Wong ETY, Pochinco D, Vathsala A, et al. HLA-DR/DQ eplet mismatch predicts de novo donor-specific antibody development in multi-ethnic Southeast Asian kidney transplant recipients on different immunosuppression regimens. Front Genet. 2024;15:1447141. doi:10.3389/fgene.2024.1447141
3. Wong E, Sran H, D'Costa M, et al. The impact of HLA genotype imputation on allele determination, eplet mismatch and alloimmune risk categories in a southeast Asian cohort of kidney transplant recipients. Hum Immunol. 2025;86:111437. doi:10.1016/j.humimm.2025.111437

Understanding Decisions in Conservative Kidney Management

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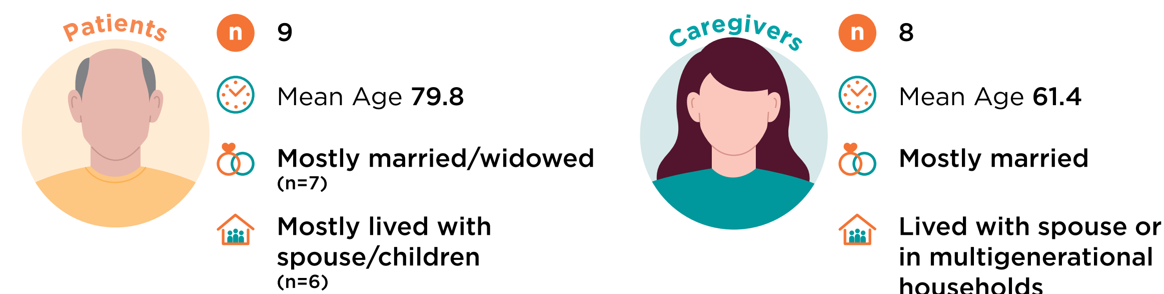
Introduction

Kidney failure represents a growing global health challenge, with affected individuals experiencing substantial symptom burden, diminished quality of life and increased healthcare utilisation. Kidney Supportive Care (KSC) offers a palliative-aligned alternative to dialysis, emphasising comfort, dignity and holistic support for both patients and their families. Despite its importance, limited research has explored how patients and caregivers experience and make decisions regarding conservative kidney management and kidney supportive care. This study therefore sought to understand the lived experiences of individuals choosing Conservative Kidney Management (CKM) and the decision-making processes that accompany this choice.

Methodology

This interpretative phenomenological study involved purposively sampled patient–caregiver dyads. Participants included adults aged 21 and above with chronic kidney disease stage G5 (eGFR ≤ 15 ml/min) who chose KSC and their primary caregivers. Semi-structured interviews with nine patients and eight caregivers were recorded, transcribed verbatim and coded for descriptive and emotional meaning. One caregiver could not complete the interview. Convergent and divergent findings were identified and group experiential statements were formed to summarise participants' lived experiences.

Participants' demographics are as follows:



Findings

The analysis revealed four overarching themes that reflected the lived experience and decision-making journey surrounding CKM.

Theme	Subtheme
Lived reality of end-stage renal disease	• Perceptions of own kidney function • Impact of kidney disease on daily life
Navigating treatment decision-making	• Viewing dialysis as a burdensome treatment choice • Value and preference-driven decision-making
Role of family and healthcare providers in treatment decision-making	• Collaborative decision making • Complexities in family involvement • Physician-directed treatment
Facing the future – perceived needs in kidney supportive care	• Care continuity in the community • Need for enhanced patient-provider communication

Lived Reality of End-Stage Renal Disease

Patients' experiences of kidney disease were characterised by their perceptions of kidney function and the substantial impact of kidney disease on their everyday lives.

P10 **"I was unable to walk far because of breathlessness."**

Navigating Treatment Decision-Making

Patients regarded dialysis as a burdensome treatment that would cause disequilibrium to their current lifestyle, with decisions driven primarily by personal values, past experiences, comorbidities, age and fear of suffering.

P2 **"100% cure? Dialysis takes all the money, our money… must sell the house to pay for dialysis."**

C6 **"To her, it just affects her quality of life further… my mum loves to travel; dialysis will stop her from being independent and going out on her own."**

Role of Family and Healthcare Providers in Treatment Decision-Making

Decisions regarding conservative kidney management were often collaborative, shaped by family dynamics and influenced by healthcare professionals' recommendations. Complexities in family involvement, including possible incongruence between decisions made by patients and their children and instances of physician-directed treatment approaches were also highlighted.

C5 **"We talked to the doctor, then we kind of vote in our chat group… The doctors are good, they give us a lot of information and give us options… They give us the best advice considering her age."**

C12 **"It is his body and he needs to decide… I can be blamed for it if I convince him to do dialysis and it is not good for him."**

Facing the Future – Perceived Needs in Kidney Supportive Care

Participants expressed a strong desire for continuity of care beyond the hospital setting as a fundamental component of kidney supportive care and the need for improved communication between patients and healthcare providers.

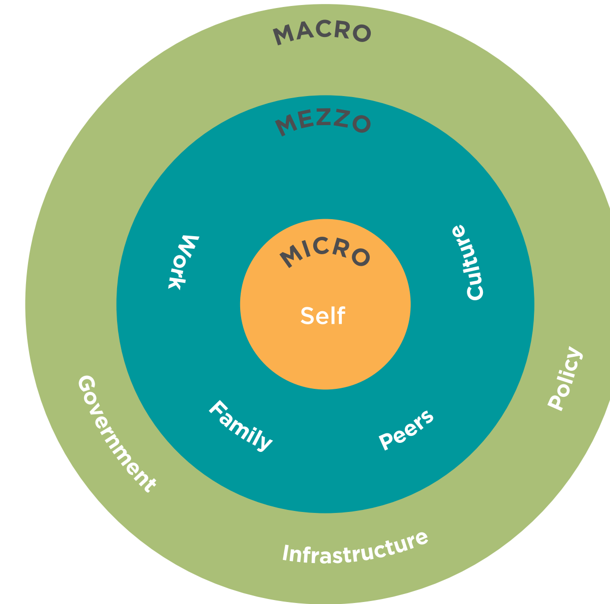
C5 **"At least check in, just make sure her well-being is still okay."**

C12 **"What if the kidney fails. Fully fails one day? We don't know what to do and don't know what to expect."**

Discussion

The study findings were further interpreted using the person-in-environment framework (Figure 1), which conceptualises decision-making as occurring across three levels: micro, mezzo and macro.

Figure 1: Person-In-Environment Framework



At the micro level, patients' awareness of their kidney condition was intertwined with their symptom burden and treatment decisions were shaped by lifestyle considerations, religious beliefs and perceptions that dialysis offered limited benefit. These findings align with earlier literature describing dialysis as often associated with loss of independence and diminished quality of life.[1,2]

At the mezzo level, decision-making occurred within the context of family and social networks. This finding is particularly salient in the Asian context, where relational autonomy, collectivism and family-centred decision-making remain cultural norms. The collaborative nature of most decisions, with patients and caregivers demonstrating alignment, reflects these cultural values. Caregivers expressed relief when they were not solely responsible for making treatment decisions and valued the opportunity for open communication within the family.

At the macro level, broader factors such as the availability of formal kidney supportive care services, healthcare financing and infrastructure significantly influenced decisions for conservative kidney management. Participants highlighted the importance of continued care beyond the hospital setting, with access to community healthcare services playing a vital role in fostering confidence and reassurance.

These findings echo Davison's[3] recommended components of comprehensive CKM, which include symptom management, shared decision-making, advance care planning, psychological support, social support and spiritual care.

Integrating upstream palliative care within kidney supportive care using an interdisciplinary, person-centred approach can facilitate better management of emotional symptoms and practical issues among patients with advanced diseases.

Implications for Practice and Research

The study findings have significant implications for kidney supportive care practice and research. They highlight that treatment decisions should not be based solely on clinical indicators such as disease progression or kidney function. Instead, conversations around treatment decision-making must also consider the needs, value and available resources of patients and caregivers in managing chronic kidney disease.

Recent studies on renal treatment decision-making conversations among clinicians and patients have reported that the risks of dialysis are often minimised and CKM options are framed as a subordinate option.[4] This underscores the need for enhanced competency in communication through training and conversational aids. Additionally, expanding CKM services into the community and strengthening the transition between hospital-based and community-based care are crucial for maintaining continuity and support throughout the disease trajectory. An example at Sengkang General Hospital (SKH) includes referring patients on CKM to either the SKH community nursing team or the Home Nursing Foundation for ongoing community support before transition to home hospice during end-of-life care.

Limitations

We acknowledge the following study limitations. Firstly, recruiting patient-caregiver dyads was challenging due to patient health condition and time constraints. Secondly, patients recruited were mostly independent in their activities of daily living and caregivers were not involved in providing direct physical care. Thus, we were unable to explore experiences of individuals with advanced symptoms or caregivers who are physically caring for these patients. Thirdly, interviews were only conducted once and we are unable to find out if there are any other factors affecting decisions as illness progresses or track changes in decision. Lastly, researchers were part of the renal care team and this may have influenced the analysis of the results.

Conclusion

As kidney supportive care continues to advance, greater emphasis must be placed on integrating multidisciplinary supportive models of care into community settings, ensuring access to timely informational and emotional support.

Effective communication between healthcare providers, patients and caregivers is essential in informing shared decision-making, particularly during transitions approaching the end of life.

References
1. Saeed F, Adams H, Epstein RM. Matters of life and death: why do older patients choose conservative management? American journal of nephrology. 2020;51(1):35-42.
2. Han E, Haldane V, Koh JJK, Quek RYC, Ozdemir S, Finkelstein EA, et al. Perspectives on decision making amongst older people with end-stage renal disease and caregivers in Singapore: A qualitative study. Health Expectations. 2019;22(5):1100-10.
3. Davison SN, Pommer W, Brown MA, Douglas CA, Gelfand SL, Gueco IP, et al. Conservative kidney management and kidney supportive care: core components of integrated care for people with kidney failure. Kidney international. 2024;105(1):35-45.
4. Shaw CB, Sowden R, Murtagh FEM, Tulsky JA, Caskey FJ, Parry R, et al. Risk communication during treatment decision-making conversations with older people with advanced kidney disease. Patient Education and Counseling. 2025;140:109282.

Strengthening CKD Care through Nurse-Pharmacist Collaboration

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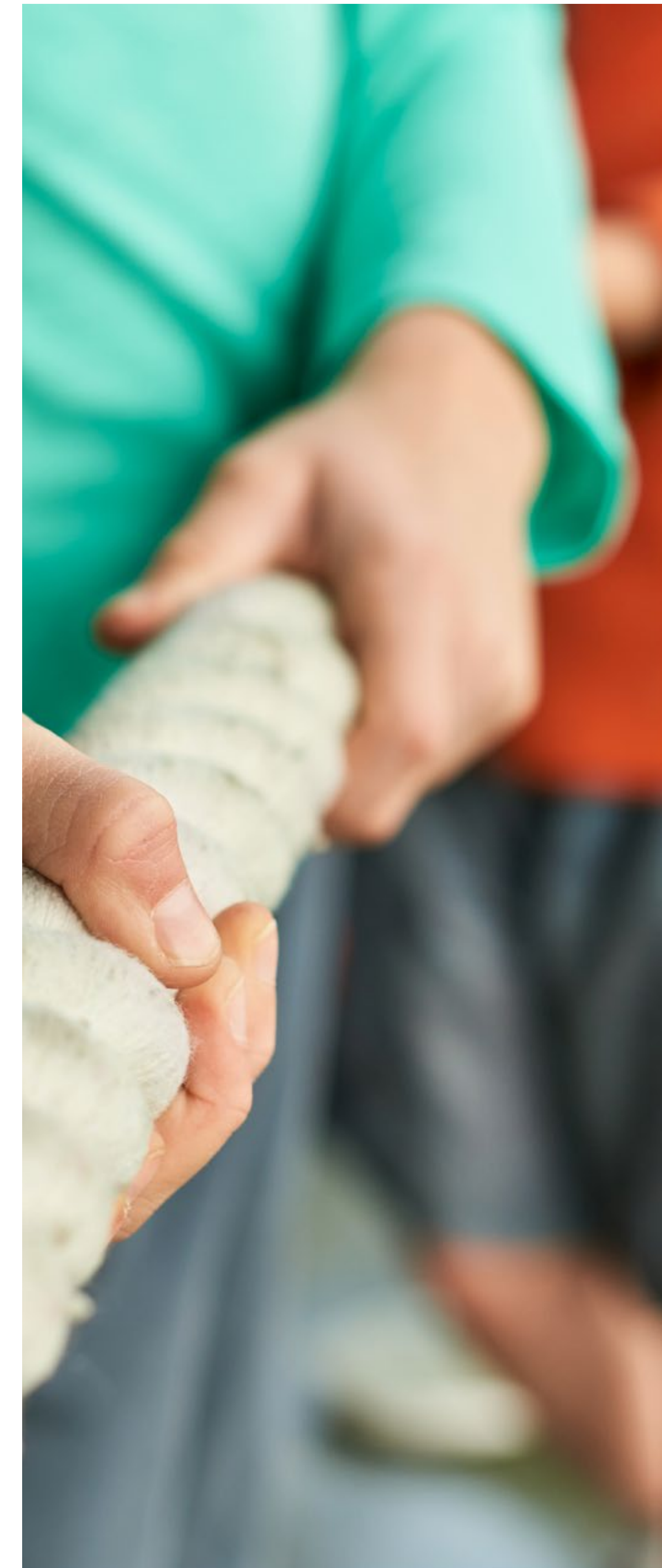


Introduction

The Advanced Practice Nurse (APN)-Pharmacist led Clinic at Sengkang General Hospital (SKH) represents an important advancement in the delivery of care for patients with chronic kidney disease (CKD). Designed to complement traditional nephrologist led services, this collaborative model addresses growing number of CKD patients, prolonged clinic waiting times and increasing need for closer monitoring of patients with complex medication regimens.

Jointly led by an APN and renal pharmacists in collaboration with nephrologists, the clinic aims to improve accessibility to care, facilitate timely intervention and optimise treatment outcomes while maintaining patient safety and high-quality care standards.

This model enhances service capacity by allowing nephrologists to focus on patients with more complex clinical needs, while clinically stable but high-risk CKD patients receive structured follow-up from the APN-Pharmacist team. This approach contributes to improved resource utilisation and overall service efficiency.

Operational Characteristics

The clinic became operational in May 2025 following the completion of collaborative prescribing training by both the APN and pharmacist, as well as subsequent approval by the Medical Board. It operates on a weekly basis and is jointly staffed by one APN and one pharmacist, with each provider attending to four patients per session.

Patients are allocated to either the APN or the pharmacist and each patient is reviewed by only one provider during the visit. Prior to the launch of the service, an institutional guideline outlining the clinic's operational framework and clinical governance was developed and formally endorsed by the Medical Board.

Patients are referred to the clinic by nephrologists. The primary focus of the clinic is to optimise guideline-directed medical therapy (GDMT), with particular emphasis on controlling modifiable risk factors to slow CKD progression.

Typically, patients newly initiated on GDMT or those who have undergone medication dose adjustments by nephrologists are referred to this clinic for monitoring, medication optimisation and early detection of potential complications. During consultations, patients also receive reinforced education on blood pressure control, dietary management, sick-day medication adjustments and self-monitoring strategies. Once treatment has been optimised, patients are discharged back to their primary nephrologist for continued follow-up.

In addition, the extended scope of practice includes titration of diuretics and erythropoietin where appropriate.

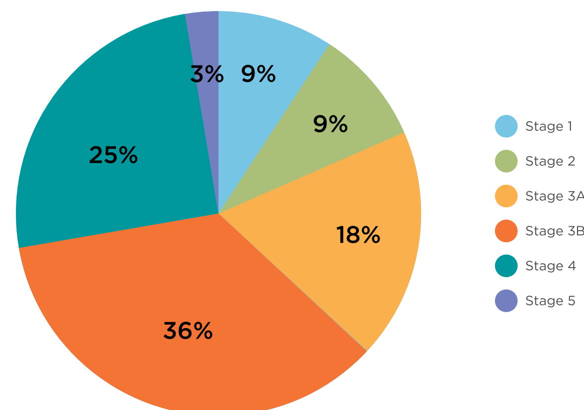
Major adverse drug reactions are defined as events requiring medication discontinuation, hospital admission or urgent review by a nephrologist. These events are monitored through scheduled laboratory investigations and symptom assessments at each clinic visit, supported by clearly defined escalation pathways. Patients demonstrating rapid decline in renal function or significant metabolic complications are promptly escalated back to nephrologist-led care. Data on the exact number of patients experiencing major adverse drug reactions were not available at the time of this evaluation.

Overall, this collaborative model enables closer follow-up, timely medication adjustments and early identification of potential complications. As nephrologists frequently face prolonged follow-up waiting times in their respective clinics, this service enhances the overall efficiency of renal care delivery for CKD patients.

Patient Profile and Attendance Trends

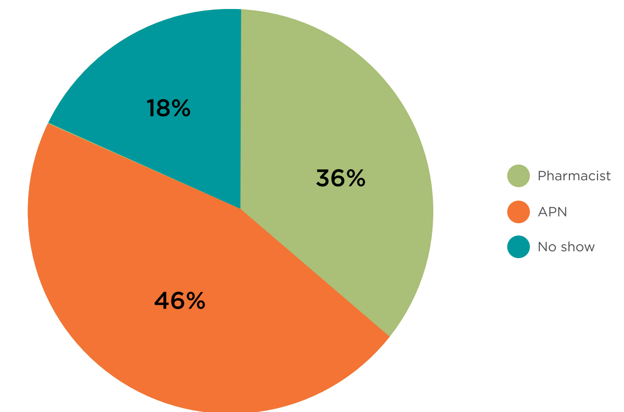
Between May and September 2025, a total of 86 patients were reviewed in the clinic. Most patients managed in the clinic were in CKD stages 3B and 4, accounting for a combined proportion of 61% of the patient cohort. These stages represent a critical window during which proactive management can significantly slow disease progression and reduce the risk of complications.

Distribution of Patients by CKD Stage (n=86)



The patient profile of this clinic aligns closely with the national HALT-CKD programme, in which earlier-stage CKD is typically managed in primary care, while referrals to specialist services commonly occur from stage 3B onwards.

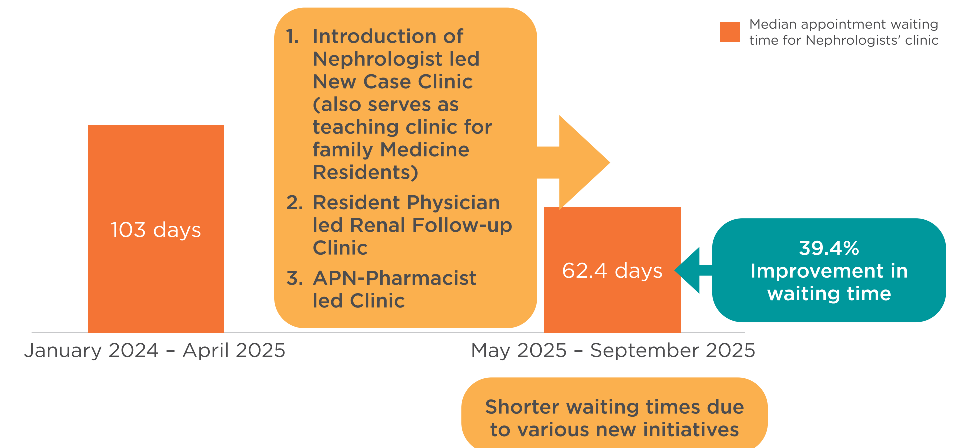
Clinic Visits by Provider Type



The clinic also demonstrated good patient attendance, with an acceptable no-show rate of 18%. The longer consultation duration of more than 30 mins allowed providers to reinforce patient education and promote greater patient engagement in disease self-management.

Impact on Waiting Time and Access to Care

Improvement in Waiting Time (Nephrologist)



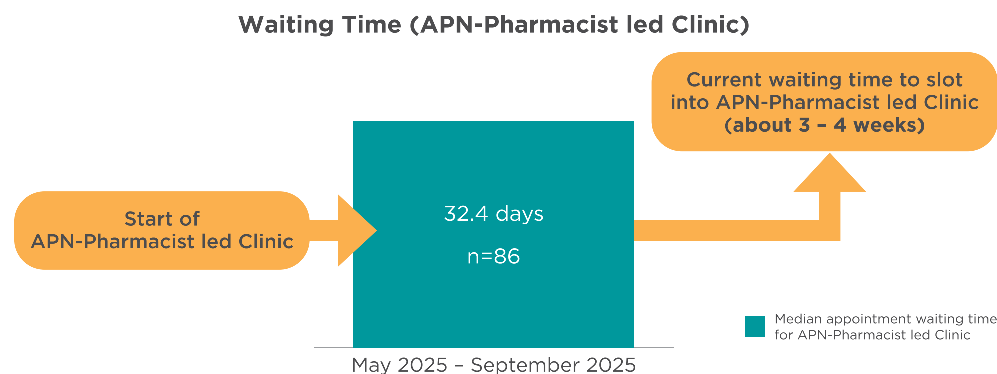
In early 2025, three service initiatives were introduced at SKH to improve the efficiency of care delivery for CKD patients:

- A Nephrologist led New Case Clinic (which also serves as a teaching clinic for Family Medicine residents)
- A Resident Physician led Renal Follow-up Clinic
- The APN-Pharmacist led Clinic

Following the implementation of these initiatives, the median waiting time for new patient appointments with nephrologists decreased by 39.4%, from 103 days – 62.4 days. While all three initiatives likely contributed to this improvement, the specific contribution of each service was not individually quantified.

Appropriate patient allocation to the APN-Pharmacist led Clinic and the Resident Physician led Renal Follow-up Clinic is likely to have freed up follow-up appointment slots within nephrologist clinics. Such free follow-up slots are converted to new patient slots in a 2:1 ratio. This redistribution of clinic capacity may partly explain the observed improvement in overall service efficiency.

For the APN-Pharmacist led Clinic specifically, the median waiting time from referral to appointment was 32.4 days, which is close to the institution's operational targets. This shorter waiting period allows for earlier medication optimisation, closer monitoring and timely intervention, key factors in effective GDMT optimisation and prevention of disease progression.



Clinical and Service Outcomes

Early service evaluation demonstrates consistent clinic utilisation and the safe implementation of protocol-driven GDMT optimisation. The structured review process facilitates early identification of medication intolerance and enables timely clinical intervention.

Longer consultation times allows for more comprehensive counselling and personalised care planning, which are essential for effective chronic disease self-management.

Importantly, this model supports evidence-based practice while enabling nephrologists to focus on patients with higher clinical complexity. In doing so, it achieves a balance between improved accessibility and the provision of specialised expertise.

The clinic also highlights the expanding role of advanced practice nurses and pharmacists in leading care transformation and optimising resource utilisation in CKD management.

Future Direction

Future developments will focus on expanding clinic capacity, introducing virtual follow-up consultations for suitable patients and establishing clearly defined outcome metrics to evaluate clinical effectiveness, patient safety and patient experience.

Further refinement of referral criteria and the development of clear discharge pathways across primary and specialist care will also strengthen integration within the renal care continuum.

Conclusion

The APN-Pharmacist led Clinic improves access to specialist care through a structured right-siting strategy, supports safe and timely optimisation of GDMT and enhances continuity of care for clinically stable patients.

As part of a coordinated set of service initiatives, this model contributes to reduced waiting times for new referrals while maintaining patient safety. The collaborative approach provides a scalable and sustainable strategy for CKD management and highlights the important role of advanced practice nurses and pharmacists in delivering high-value healthcare.

Shifting Post-Living Kidney Donation Care to Primary Healthcare

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[4] Primary Care and Clinical Networks

Background

Singapore General Hospital's (SGH) Kidney Transplant Programme manages lifelong care for over 300 living kidney donors (LKDs), creating operational challenges for clinic management as the number continues to grow. The programme reviews LKDs three times within the first-year post-donation – at six weeks, six months and 12 months followed by annual reviews subsequently. Engaging primary care providers while ensuring adequate access to transplant centres can improve long-term follow-up care of donors.[1] However, donors may face geographical and logistical barriers to maintain follow-up care with living donor transplant centres.[2] To ensure LKDs continue to receive quality follow-up care while optimising clinic resources, the programme right-sites LKDs at General Practitioners (GPs) through the Delivering-on-Target (DOT) GPs initiative. Since March 2024, LKDs have been right-sited based on three criteria: (1) being at least three years post-donation; (2) having no chronic medical conditions; or (3) having stable chronic conditions already managed by the donor programme or primary care. Donors who are under the NKF Kidney Live Donor Support Fund or receiving MediFund will be excluded from the right-siting initiative. This right-siting initiative is a continuous process in which LKDs who fulfil the criteria are right-sited and their outcomes are monitored on an ongoing basis.

Method

Study Design

This initiative conducts a retrospective review of outcomes following right-siting of care for LKDs to DOT GPs in the first year of this initiative.

Collaborative Framework

We collaborated with Right-Siting Officers (RSOs) of the SingHealth DOT programme to right-site approximately 15% of our LKDs.

Current Clinic Capacity Analysis
SGH's Donor Follow-Up Clinic (DFUC) allocates one patient per 10-minute consultation slot. However, in clinical practice, slots are routinely overbooked with two to three additional patients. With approximately 300 LKDs, each DFUC session is postulated to schedule 25 patients through overbooking. This results in 4 additional patients per DFUC resource, totalling 48 extra patients over 12 months.

Projected Impact Calculations
With the aim of reducing consultation waiting times, each DFUC session should accommodate no more than 21 patients. 48 patients (~16%) channelled to DOT GPs will optimise DFUC capacity, reducing waiting times caused by overbooking and saving 2.28 clinic days.

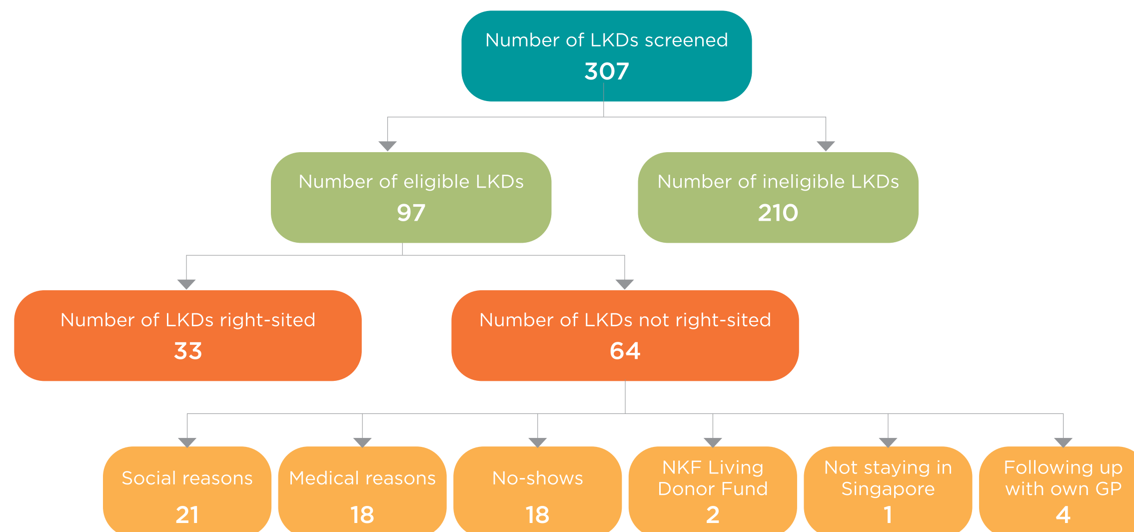
Right-Siting Process
Each month, the Advanced Practice Nurse (APN) conducts document reviews and selects patients based on the inclusion criteria. The APN then notifies the RSOs of potential LKDs for right-siting. During specialist consultations, LKDs with abnormal laboratory results or examination findings are excluded. Medically fit LKDs who consent to right-siting will receive RSO counselling. The right-sited LKDs alternate annual reviews between their chosen GP and SGH Kidney Transplant Programme. Results from GP consultations are reported back to the SGH Kidney Transplant Programme.

Data Collection
Baseline data including waiting times and patient booking numbers per clinic session were collected. Data was collected across implementation (March 2024 – March 2025) and post-implementation (April – May 2025).

Results

Between March 2024 and March 2025, 33 LKDs were right-sited to DOT GPs. This was projected to save 330 minutes (5.5 hours) of consultation time, equivalent to 1.5 clinic days. However, clinics remained overbooked with 25 patients in both April and May 2025.

Diagram 1: LKD Screening Outcomes



Of the ineligible LKDs (n=210), majority were planned for protocol abdominal imaging which could only be performed at SGH with the SGH Kidney Transplant Programme at the following visit (n=69, 33%). Of the 64 LKDs initially eligible for right-siting, 21 (32%) donors declined right-siting due to social reasons: (1) ease of concurrent visits with their recipients for their reviews (n=6) and (2) familiarity with the SGH Transplant Programme (n=15). Additionally, 18 (28%) LKDs who were initially eligible were no longer suitable for right-siting due to new medical conditions identified during consultation; 18 (28%) did not turn up for the appointment; 2 (3%) received support from the NKF Kidney Live Donor Support Fund; 1 (1%) stayed overseas (only local GPs participate in the DOT GP programme); and 4 (6%) were seeing their own GPs and hence not keen to be followed by another GP under DOT GP programme.

Discussion

The OPTN and UNOS mandates follow-ups for all LKDs at 6, 12 and 24 months post-donation, including the collection of clinical and laboratory data to ensure compliance.[2] At SGH, LKDs receive lifelong follow-up care to manage modifiable risk factors, as kidney failure typically develops over decades. LKDs are at increased risk of hypertension, proteinuria and gestational complications,[3,4] though individual risk profiles vary. Given the potential for chronic kidney disease (CKD) and kidney failure, sustained monitoring and early intervention are critical.

Standard follow-up monitoring should include: (1) comprehensive history and physical examination (blood pressure, weight, body mass index) and (2) laboratory investigations (renal function with eGFR, HbA1c, urinalysis and urinary microalbumin-to-creatinine ratio). Additionally, SGH incorporates abdominal ultrasonography as an adjunct malignancy screening tool for renal cell carcinoma (RCC) in the remaining kidney. Although not recommended by guidelines, it was implemented following the development of RCC among older donors with longer follow-up durations.

The SGH Kidney Transplant Programme had adopted telemedicine previously to support the management of DFU patient numbers. However, this did not increase the efficiency of donor care. Patients required the same amount of time to be seen in the clinic and they were still required to visit the hospital physically for laboratory investigations. Cost savings were marginal compared to those of conventional face-to-face DFU visits.

This initiative evaluated the impact of right-siting LKDs to DOT GPs to optimise specialist clinic resources, strengthen primary care partnerships and provide convenient alternatives for donors with work or family commitments. As part of the national HealthierSG initiative, the DOT GP programme is also positioned to be cheaper for consultation and investigations than in tertiary centres like SGH. Other outcomes measured, such as cost effectiveness, will be further studied when the 12-month implementation period is completed.

Over one year, 33 LKDs were right-sited, saving the equivalent of 1.5 clinic days. While efficiency gains were observed, overall impact was modest due to high medical ineligibility (n=210) and additional new LKDs during the study period (n=45). APNs are pivotal in screening, coordinating transitions and liaising with DOT GPs to ensure continuity and safety. Acting as a bridge between SGH and community providers, APNs promote collaborative care models that enhance resource efficiency while maintaining high standards of patient care.

Conclusion

The right-siting initiative successfully right-sited 33 LKDs to DOT GPs, theoretically saving 5.5 consultation hours. However, clinic overbooking persisted with 25 patients per session due to high ineligibility rates (n=210), addition of new LKDs and patient preferences for SGH-based care. While the alternating GP-specialist review model is operationally feasible through established APN screening and RSO collaboration, expansion of eligibility criteria can further achieve meaningful clinic capacity relief.

References

1. Waterman, A.D., Morgievich, M., Cohen, J.D., Butt, Z., Chakkera, H.A., Lindowner, C., Hays, R.E., Miller, J.M., Lentine, K.L., Matas, A.J., Poggio, E.D., Rees, M.A., Rodrigue, J.R., & Rudow, D.L. (2015). Living kidney donor transplantation: Improving education outside of transplant centers about live donor transplantation – recommendations from a consensus conference. Clinical Journal of the American Society of Nephrology 10(9): 1659-1669.
2. Achkar, K.A., Abdelnour, L.M., Abu Jawdeh, B.G., Tantisattamoa, E., & Ammary, F.A. (2024). Evaluation and long-term follow-up of living kidney donors. Advances In Kidney Disease and Health 31(5): 400-407
3. Lentine, K.L., Schnitzler, M.A., Xiao, H., Saab, G., Savalaggio, P.R., Axelrod, D., Davis, C.L., Abbott, K.C., & Brennan D.C. (2010). Racial variation in medical outcomes among living kidney donors. The New England Journal of Medicine 363(8): 724-732
4. Garg, A.X., Nevis, I.F., McArthur, E., Sontrop, J.M., Koval, J.J., Lam, N.N., Hildebrand, A.M., Reese, P.P., Storsley, L., Gill, J.S., Segev, D.L., Habbous, S., Bugeja, A., Knoll, G.A., Dipchand, C., Monroy-Cuadros, M., & Lentine, K.L. (2014). Gestational hypertension and pre-eclampsia in living kidney donors. The New England Journal of Medicine 372: 124-133.

"A transformative era of renal care is unfolding through the collaboration between The National Kidney Foundation and National University Hospital Nephrology Division. By aligning their expertise, they are redefining sustainability in peritoneal dialysis (PD), pivoting from clinical obligation to empowered living. This partnership dismantles barriers to PD through structured support and intuitive technology, intentionally designed to lift the cognitive burden from selfless caregivers. This includes strengthening early PD education and developing seamless care pathways to enable more suitable patients to confidently transition to home-based dialysis."

Adj A/Prof Chua Horng Ruey
Head of Division & Senior Consultant, Division of Nephrology, Department of Medicine
National University Hospital

"Singapore is progressively expanding home-based peritoneal dialysis to support more patients in managing kidney failure in the community. Through close collaboration between NKF and public healthcare institutions, including Singapore General Hospital, we are scaling up shared-care models and patient support to improve confidence and uptake of peritoneal dialysis (PD). These efforts will help more suitable patients benefit from greater flexibility, enabling them to continue work and family life while receiving effective treatment, in line with the priorities highlighted in Renal Outlook 2026: Evolving Kidney Care."

Assoc Prof Tan Chieh Suai
Head & Senior Consultant, Department of Renal Medicine
Singapore General Hospital

"The National Kidney Foundation and Khoo Teck Puat Hospital have forged a collaborative partnership to advance renal care delivery in Singapore. Key initiatives include a comprehensive peritoneal dialysis (PD) home support programme and the adoption of ultrasound-guided arteriovenous fistula cannulation techniques to enhance vascular access safety and outcomes. This strategic alliance reflects a shared commitment to improving patient outcomes through innovative and evidence-based renal care models. It strengthens clinical confidence for patients and caregivers, while supporting safer and more sustainable home-based PD through structured training and support."

Dr Tan Feng Ling Grace
Senior Consultant Nephrologist & Head, Section of Nephrology, Department of General Medicine
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