The National Kidney Foundation

NKF

renal outlook

frontiers in kidney health

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contents

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frontiers in kidney health

"Frontiers in kidney health" symbolises innovative breakthroughs, where advanced research and technology (represented by the light bulb and polymers) illuminate new possibilities for kidney care, set against a vast, limitless universe, suggesting boundless opportunities for discovery and progress in kidney health.

Information correct as at time of printing

foreword

We deeply appreciate your unwavering support and collaboration as we work together to advance renal care. The theme for this edition, “Frontiers in Kidney Health”, reflects our commitment to pushing the boundaries of innovation and research to improve patient outcomes and tackle emerging challenges in kidney care.

Having joined NKF on 1 October 2024, I have been deeply impressed by the dedication of nephrologists and the broader renal community. It is an honour to build upon NKF’s strong foundation, and I look forward to working with all of you to drive research and innovation that enhances kidney care and improve patients’ lives.

This issue explores a wide range of advancements in kidney care, from cognitive challenges in dialysis patients to rethinking informed consent and optimising care models. These discussions highlight how expertise, technology and patient-centred approaches can transform outcomes. We also feature groundbreaking developments in collaborative care, automation in healthcare processes and innovative treatment strategies – bringing us closer to a future where kidney health is managed with greater precision, efficiency and empathy.

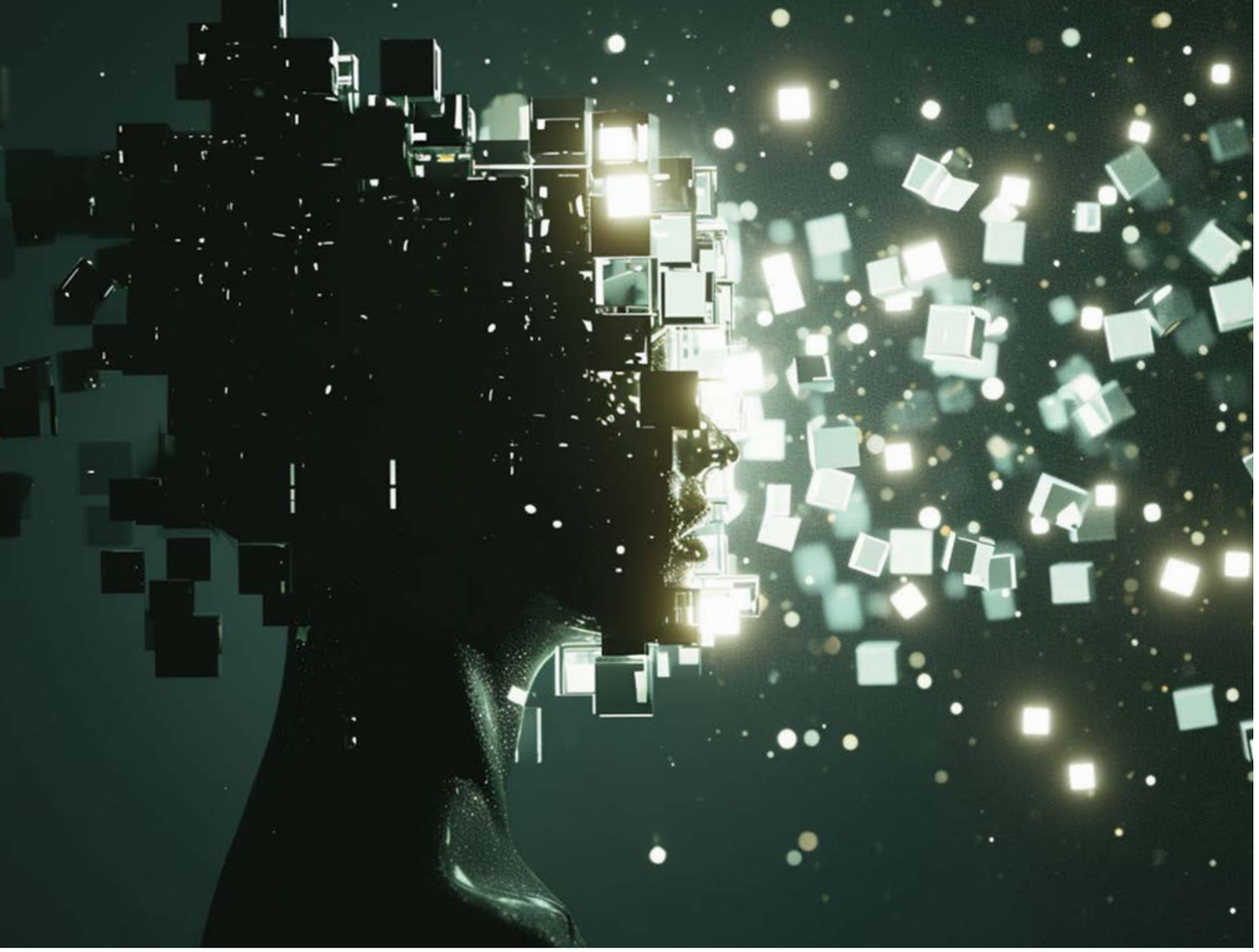
NKF has entered a pivotal phase in research and development with the establishment of the $5.5 million SGH-NKF Renal Research Fund – a strategic investment to advance early detection, develop novel renal replacement therapies, and enhance psychosocial support for patients and caregivers. This fund will also receive a dollar-for-dollar matching grant from the government, effectively doubling its impact.

This 4th edition of Renal Outlook also marks key milestones, including our first article contribution from Malaysia and the addition of two Guest Editors from Malaysia and the Philippines to the Editorial Advisory Committee (EAC). These developments reflect our dedication to regional collaboration, knowledge exchange and the collective advancement in renal care.

I would like to express my heartfelt gratitude to the EAC for your invaluable time, guidance and expertise in shaping Renal Outlook into a meaningful publication. My sincere appreciation also goes to the authors for your thought-provoking insights and innovative contributions, as well as to the reviewers for your meticulous evaluations that uphold the quality and relevance of this edition.

To our healthcare partners, thank you for your unwavering support and collaboration. Together, through research, knowledge-sharing and collective effort, we can continue to drive breakthroughs and shape a brighter future for kidney health.

Yen Tan
Chief Executive Officer



Exploring Cognitive Impairment in Dialysis Through Renal Nurses' Insights

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Cognitive impairment (CI) is common among dialysis patients. Previous studies showed that at least 70% of dialysis patients experience at least mild impairment in various cognitive domains. CI affects many aspects of wellbeing, including independence, self-efficacy, disease management and treatment adherence, which could lead to adverse outcomes such as hospitalisation and mortality.

Although the cognitive burden in dialysis patients has been well-established, there is a dearth of research on providers' perspectives of the implications of CI for their clinical practice. Dialysis nurses, who provide direct clinical care to dialysis patients on a regular basis, may experience an increased caregiving burden when managing patients with CI. However, currently there is little or no research investigating renal nurses' burden when caring for these patients. We therefore conducted an online survey study among renal nurses practicing in Singapore, in order to understand the impacts of CI on various stakeholders and associated needs.

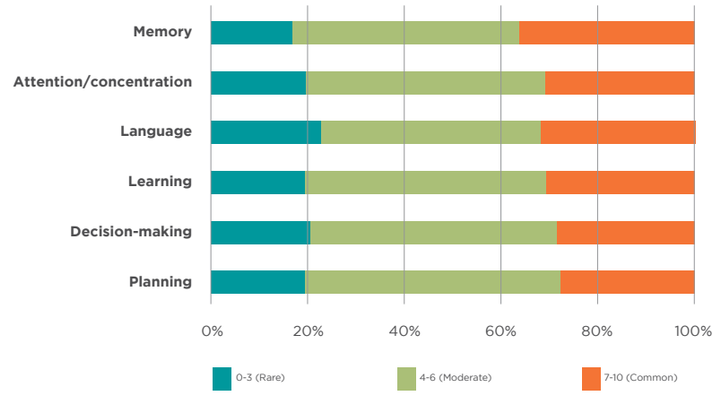
The study was approved by the institutional review board of Nanyang Technological University (IRB-2021-025). An online anonymous survey was administered among renal nurses in Singapore. Nurses were eligible if they were working in a renal care setting in Singapore at the time of the study and had at least three months of experience providing direct clinical care to dialysis patients. An invitation to the survey study was sent in a mass email to all NKF Singapore renal nurses. The survey was also advertised at the Kidney Care Conference Singapore held in May 2024. Snowball sampling was also used. Eligible nurses interested in the study signed an online consent form and completed the 10-minute survey via Qualtrics.

The questions were designed by the research team based on existing literature and expert inputs. It began with two statements defining the key terms "cognitive function" and "cognitive difficulties". The first part of the survey collected information about sociodemographic and professional profiles. The second part consisted of 12 questions, including one on the prevalence of different types of cognitive difficulties in dialysis patients, 10 questions on the implications of these difficulties, and one on specific types of support that nurses prefer. Descriptive analysis was conducted.

A total of 846 renal nurses (76.3% female) responded to the survey, with the majority being Indian (31%), followed by Filipino (26%), Malay (17%) and Chinese (17%). The mean age of respondents was 36.2 years (ranging from 20 to 67 years). About half (48.1%) have been in clinical practice for more than five years.

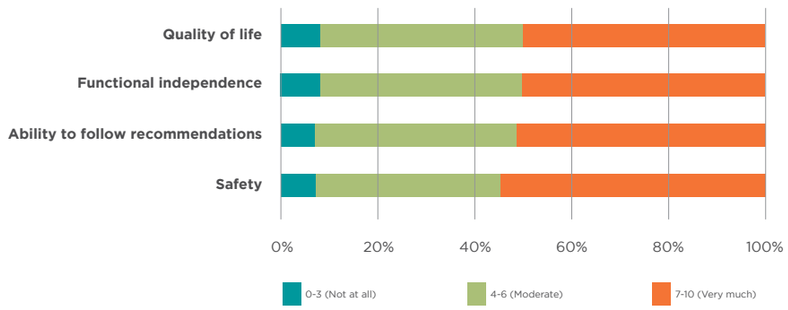
When asked how frequently different types of cognitive difficulties were observed in dialysis patients during their clinical practice, about 80% of nurses considered cognitive difficulties to be at least moderately common in all cognitive domains (see Figure 1). It is of note that this perceived prevalence of CI is subjective, based on the observation of nurses who are not formally trained to identify cognitive difficulties. However, it appears that nurses are generally aware that a significant proportion of their patients experience at least some cognitive difficulties.

Figure 1: Percentages of Nurses Rating the Prevalence of Cognitive Difficulties on a Scale from 0 (Not at All Common) to 10 (Very Common)



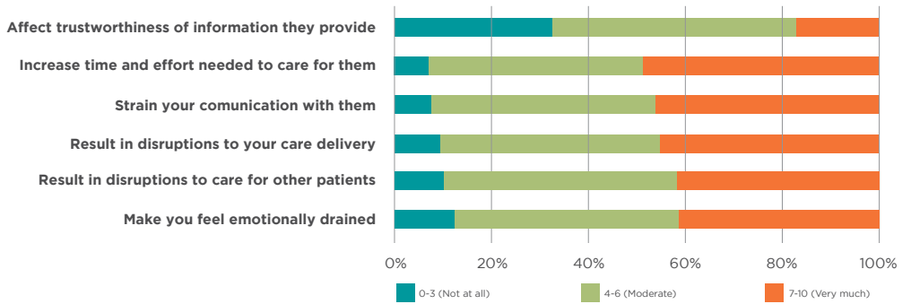
When asked about the extent to which cognitive difficulties affect patients' wellbeing, almost all nurses considered CI to have moderate to severe impacts on patients' quality of life, functional independence, ability to follow medical recommendations and safety awareness (see Figure 2).

Figure 2: Percentages of Nurses Rating the Impacts of CI on Patients on a Scale from 0 (No Impact at All) to 10 (Severe Impact)



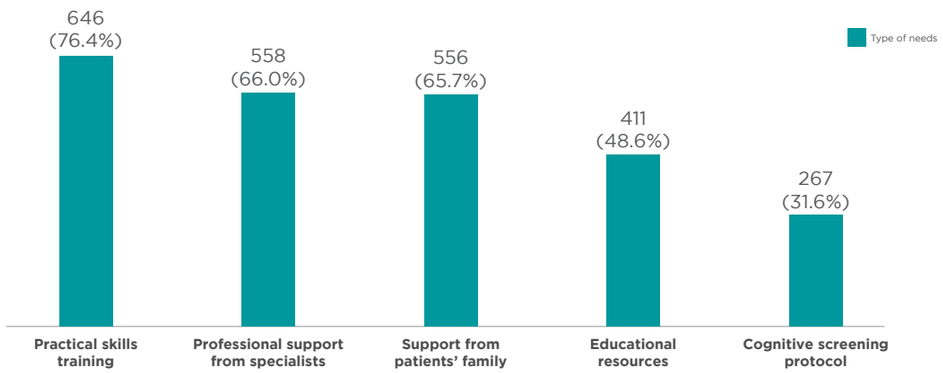
Nurses also reported how patients' CI affected their clinical care provision. Interestingly, about 70% of nurses thought that patients' CI affected the trustworthiness of information provided by them. For example, nurses may be unsure whether patients' self-reported adherence is accurate. Many nurses reported that patients' CI affected the communication and disrupted dialysis care, which increased their workload and caregiving burden. Notably, more than 80% of nurses reported that patients' cognitive issues made them feel emotionally drained. This emotional exhaustion item was taken from the Maslach Burnout Inventory (MBI), the gold standard measure of occupational burnout. These findings highlight that nurses face significant challenges in caring for patients with CI. It is of note however that there is no quantification of the degree of patients' CI that resulted in these perceived impacts. Future work is needed to advance our understanding of healthcare providers' perspectives of tailored care strategies for this specific subgroup of patients.

Figure 3: Percentages of Nurses Rating the Impacts of CI on Their Clinical Practice on a Scale from 0 (No Impact at All) to 10 (Severe Impact)

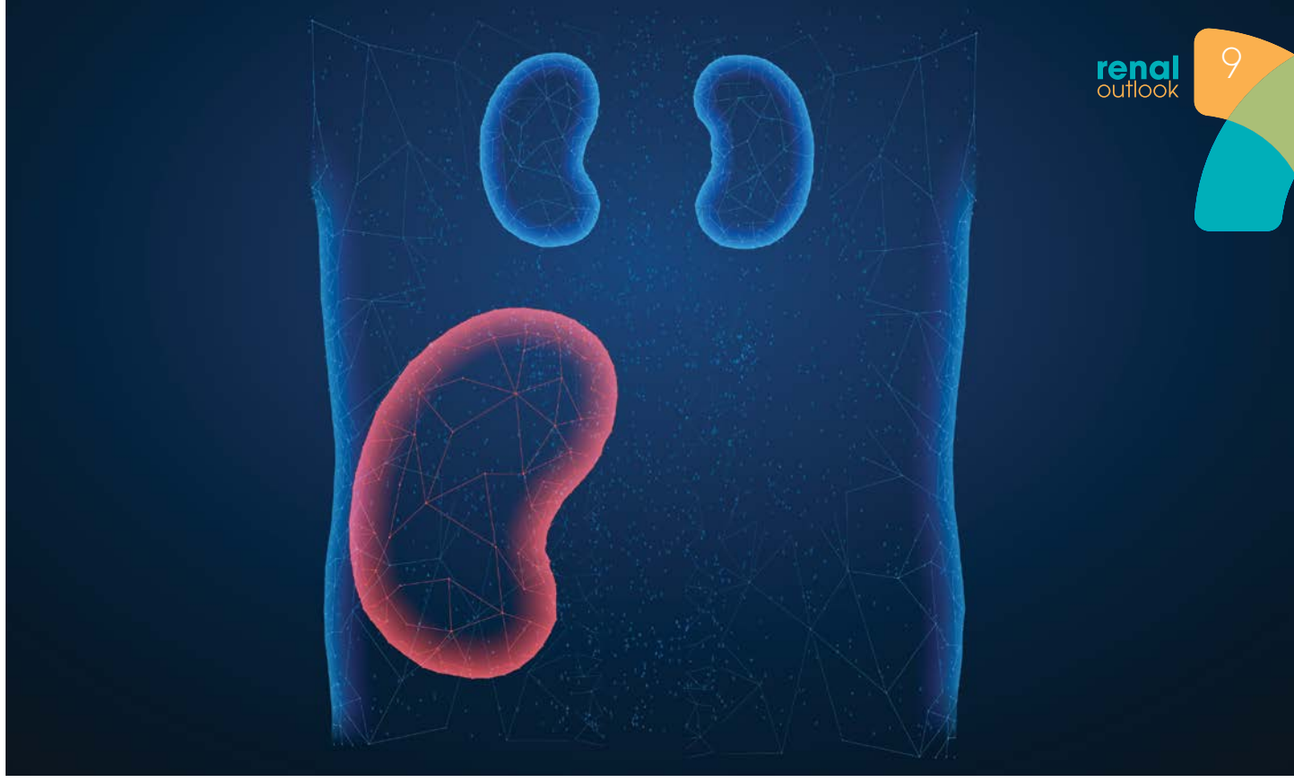


It is important to acknowledge that burden reported by nurses also offers opportunities for personal and professional fulfilment. Developing and providing adequate resources, training and emotional support can help nurses feel better equipped and valued, thereby maintaining the quality of patient care across different care needs. In the final section of our survey, nurses were asked what specific support they would like to receive regarding patients' CI. Nurses were mainly interested in practical skills training (e.g., how to communicate with patients with CI), and considered support from specialists and family members beneficial. Some also requested educational resources and wondered if a standard screening protocol could be developed.

Figure 4: Numbers and Percentages of Nurses Who Thought the Types of Support Would be Helpful for Them to Better Care for Dialysis Patients



CI is a major issue in renal care that affects both the wellbeing and care of dialysis patients. We call for future studies to explore, in more depth, healthcare providers' needs regarding dialysis patients' CI, and to develop resources and guidelines that align providers in different settings and improve the quality of patient care.



Achieving Excellent Outcomes

Living-related Kidney Transplantation in Children Weighing Under 15kg

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Kidney transplantation is the therapy of choice for children with kidney failure. Even though the first successful adult kidney transplant was performed in 1954, the first reported results of kidney transplantation in children did not occur until 1966[1]. Paediatric kidney transplantation (pKT) poses unique challenges which require a highly specialised and tailored approach by an experienced and coordinated team of paediatric surgeons, paediatric nephrologists and paediatric anaesthetists to ensure that the most successful outcomes are achieved[2]. The National University Centre for Organ Transplantation (NUCOT) at the National University Hospital (NUH) is Singapore's leading and only paediatric kidney transplant centre, with outcomes comparable to international benchmarks (Table 1).

Table 1: Paediatric Kidney Transplantation at the National University Centre for Organ Transplantation, National University Hospital

	1-year graft survival (%)	3-year graft survival (%)
Paediatric Kidney Transplantation in NUH (1989-2023)*		
(a) Living donor (b) Deceased donor (c) Living donor - children < 15kg (n=10)	98.1 90.3 100	93.9 76.7 90
NAPRTCS#		
(a) Living donor (b) Deceased donor	94.0 88.0	88.0 78.0

** National University Hospital*
 # North American Paediatric Renal Trials and Collaborative Studies

Despite significantly improved outcomes in pKT, there remain challenges for children weighing less than 15kg; with consequently higher risks of delayed graft function and graft loss[3,4].

Of the 12 pKT performed on children under 15kg in NUH from 1989 until 2023, 10 were from living-related adult donors (LDKT). Overall, the median age and weight at transplant were 62 months (IQR 43 – 68) and 13.8kg (IQR 10 – 14.2) respectively. All children received pre-transplant dialysis over a median duration of 26 months (IQR 10 – 62). The surgical approach was either transperitoneal (early era until 2008) (n=6) or retroperitoneal (n=6) with the arterial anastomoses being to the aorta (n=8), common iliac artery (n=3) or splenic artery (n=1) and venous anastomoses to either inferior vena cava (n=7), common iliac vein (n=4) or splenic vein (n=1). One child with kidney failure due to Denys Drash syndrome received a deceased donor graft in the transperitoneal location. She developed thromboses of graft vessels requiring graft nephrectomy (day 4). Of the 10 LDKT, one graft was lost due to progressive failure secondary to BK virus nephropathy requiring graft nephrectomy and resumption of dialysis at 16 months post-transplant. He underwent living-related kidney re-transplantation at age/weight of 79 months and 19.5kg respectively. None of the remaining children developed any slow or delayed graft function. One child developed a ureteric stricture (n=1, requiring revision and ureteroureterostomy at 5 years post-transplant). Nine recipients of LDKT have functioning kidney grafts to date; over a median follow-up period of 8 years (IQR 1 – 33) (Table 1). The mean creatinine level is 82.1 3 34.23 umol/L at last follow-up.

Our important considerations towards successful outcomes in pKT, especially for smaller paediatric recipients, include the use of adult kidneys (larger nephron mass and vessels) from a living donor (minimising delayed graft function) and optimisation of kidney perfusion (with careful attention to the technique for vascular anastomoses with anastomoses on larger recipient vessels) together with maximal volume support in the living-donor preoperatively and in the recipient at the time of reperfusion (because the adult kidney graft may sequester a significant proportion of the child's circulating volume at and soon after graft reperfusion).

We conclude that living-related kidney transplantation in children weighing less than 15kg may be safely performed in experienced paediatric centres with excellent short-term and long-term outcomes. Increasing experience may allow for pKT in even younger and smaller children and infants, ideally with pre-emptive scheduling to eliminate the time on and the detrimental effects of dialysis.

References

1. Starzl TE, Marchioro TL, Porter KA, et al. The role of the organ transplantation in pediatrics. Pediatr Clin North Am 1966; 13:381-422.
2. Millan MT, Sarwal MM, Lemley KV, Yorgin P, Orlandi P, So S, Alexander S, Salvatierra O Jr. A 100% 2-year graft survival can be attained in high-risk 15-kg or smaller infant recipients of kidney allografts. Arch Surg. 2000; 135:1063-9.
3. Mickelson JJ, MacNeily AE, Leblanc J, White C, Gourlay WA. Renal transplantation in children 15 Kg or less: the British Columbia Children's Hospital experience. J Urol. 2006; 176:1797-800.
4. Vitola SP, Gnatta D, Garcia VD, Garcia CD, Bittencourt VB, Keitel E, Pires FS, D'Avila AR, Silva JG, Amaral RL, Santos LN, Kruel CD. Kidney transplantation in children weighing less than 15 kg: extraperitoneal surgical access-experience with 62 cases. Pediatr Transplant. 2013; 17:445-53.

A Paradigm Shift in Managing CKD-associated Pruritis

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Abstract

Chronic kidney disease–associated pruritus (CKD-aP) significantly impacts the quality of life of patients on dialysis. This article reviews the pathogenesis, challenges in management and recent advances in treatment, including difelikefalin, a novel kappa-opioid receptor agonist. The article outlines evidence-based strategies for monitoring and treating CKD-aP, emphasising the importance of a goal-directed, interdisciplinary approach. Difelikefalin's potential to improve symptoms and quality of life marks a paradigm shift in CKD-aP management, with implications for routine clinical practice.

Background

Chronic kidney disease–associated pruritus (CKD-aP), formerly referred to as uremic pruritus (UP), is defined as unexplained itching related to kidney disease[1]. It is a common issue, with prevalence up to 20% amongst CKD patients and 40% in patients on dialysis[2], despite potential under-reporting of cases[3]. A general lack of standardised guidelines and limited effective and safe treatment options are the main reasons CKD-aP is underrecognised and undertreated. This has gained more attention in recent decades as we adopt a more holistic approach, emphasising more on reducing symptom burden. Pruritus arising from CKD profoundly impacts on quality of life, affecting patients' sleep and mood, resulting in insomnia, fatigue, anxiety, depression and social isolation. It has been linked to increased hospitalisations due to infection, cardiovascular complications and mortality, as seen in the Dialysis Outcomes and Practice Patterns Study (DOPPS) population[4].

The pathogenesis of CKD-aP is not fully understood, but it is likely to be multifactorial. The four hypotheses proposed were[5]:

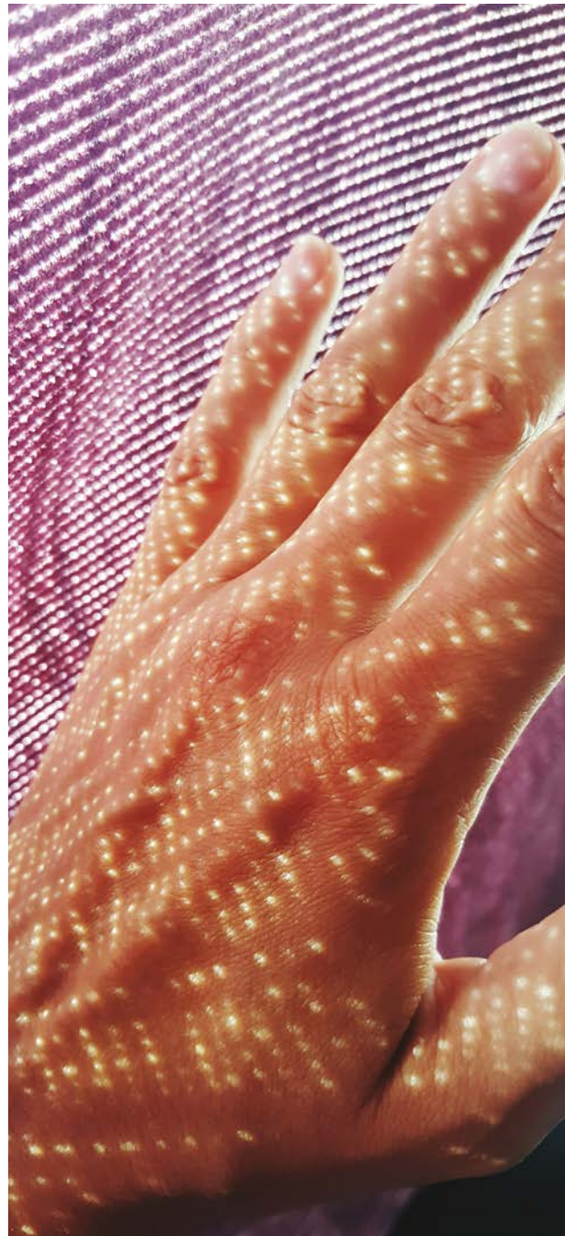
i) Uremic toxins' (such as vitamin A, aluminium, calcium, phosphorus, and magnesium) deposition in the subcutaneous tissue

ii) Peripheral neuropathy secondary to dysautonomia and central neuropathy

iii) Immune system dysregulation

iv) Mu-opioid receptor (MOR) to kappa-opioid receptor (KOR) activation imbalance

Difelikefalin is a new drug in the armamentarium of the nephrologist in the management of this debilitating condition. This drug acts via nociceptive sensory pathway alterations and opioid receptor dysfunction[5].



Approach to CKD-aP

The paradigm shift is in the improved awareness of this condition among healthcare professionals, resulting in increased identification of patients having CKD-aP patients. Case identification is centred on identifying symptom burdens, such as itching and decreased quality of life in the patients on dialysis. This is best achieved by routine screening by dialysis nurses, who has the most contact time with patients. For example, a dialysis nurse could incorporate the screening question easily into their routine of taking vital signs by asking "Have you experienced itching recently?" This straightforward question is practical and a simple screening tool for both the physician and patient. It encourages patients to report symptoms of pruritus they may have previously neglected or dismissed as unimportant. It is then followed by a detailed history taking and examination to exclude differential diagnoses, such as primary dermatological conditions (e.g. atopic dermatitis, psoriasis) or other systemic diseases (e.g. HIV infection).

Once an accurate diagnosis of CKD-aP is made, it is necessary to assess pruritus severity, which can be achieved with several standardised scales like the Visual Analog Scale (VAS), Numeric Rating Scale (NRS), Verbal Rating Scale (VRS) or the Kidney Disease Quality of Life-Short Form (KDQOL-SF). The Worst Itching Numeric Rating Scale (WI-NRS) is recommended as it is easy to implement and has been validated in major clinical trials, especially in CKD-aP. It is a single-question, patient-reported questionnaire with 11-point rating scale (with 0 representing "no itch" and 10 "worst itching imaginable"). Regular incorporation of pruritus severity in clinical practice enables more nuanced adjustments to treatment. For future research purpose, it is also encouraged to track the progress of patient's QOL by assessing the impact of CKD-aP on their sleep, work, social life and mood using scales like Self-Assess Disease Severity (SADS), Skindex-10 and 5D-itch scale[2,7].

Common non-pharmacological approaches will be adopted as an initial step in the management of CKD-aP, which include optimisation of dialysis clearance, CKD-MBD management and application of topical emollients (oil and water emulsion solution containing glycerol (15%) and paraffin). If pruritus persists, trial of pharmacological treatment, which is targeted specifically at itch relief such as antihistamine or gabapentinoid, will be attempted. In the real world, antihistamine is frequently prescribed even though its efficacy is not proven in CKD-aP. It is likely due to the familiarity of the medication as anti-pruritus. In addition to an increase in pill burden, it is often associated with significant adverse effects such as drowsiness. Gabapentinoid has proven to be superior in treating CKD-aP but its wide usage has been limited by its side effects. Hence, early consideration of difelikefalin in suitable patients is recommended and referral to a dermatologist is advised to consider UV phototherapy for resistant cases[6,8].

Table 1: Summary of the Common Therapeutic Agents for Management of CKD-aP With Its Pros and Cons

Treatment	Effectiveness	Adverse reactions
Optimisation of dialysis clearance and CKD-MBD	No direct relationship and no established "target" Mandatory for well-being of dialysis patient	Time-consuming to achieve the target which may delay the prescription of the proper treatment
Topical products such as emollients, tacrolimus etc	Efficacy is limited to case series Effective as most of the CKD-aP overlaps with primary xerosis	Extensive use of topical medication containing tacrolimus may increase risk of dermatologic malignancies
Antihistamines	Limited evidence. Additionally, histamines are not a major pruritogen in CKD-aP	Giddiness/drowsiness that potentially leads to fall
Gabapentinoids	Effectiveness demonstrated in randomised controlled trials (RCT) for reduction of itch intensity	Need to watch out for side effects such as altered mental status, falls and fractures (especially when used in high doses on elderly patients)
Difelikafalin	Effectiveness demonstrated in RCT and the only approved drug for CKD-aP in Singapore (HSA), Japan (PMDA), U.S.A (FDA) and Europe (EMA) for haemodialysis patient	Diarrhoea, dizziness, nausea and somnolence Expensive in local setting (Singapore) as it is not subsidised
UV Phototherapy	Limited evidence Usually reserved for resistant cases	Time-consuming, limited availability, increased risk of dermatologic malignancies, particularly in immunosuppressed patients

Difelikefalin needs to be considered for moderate-to-severe CKD-aP. Its recommended dose is 0.5mcg/kg for each dose and administered three times a week across haemodialysis. It does not cross the brain-blood barrier and hence less association with severe central nervous system adverse effects linked to opioids. Randomised controlled trials involving haemodialysis patients with moderate-to-severe pruritus, difelikefalin was shown to improve itch and sleep disturbance scores when compared to the placebo[9]. This drug is removed by the dialyser membrane and must be administered after dialysis making administration during or after rinsing most appropriate. The patient needs to be monitored for an hour after administration for adverse effects which include diarrhoea (9%), dizziness (6.8%), nausea (6.6%) and somnolence (4.2%). Difelikefalin can be prescribed by nephrologists or dermatologists in Singapore. As it is a non-formulary drug, doctors need to raise their named-physician-named-patient (NPNP) order to their pharmacist who can then purchase the drug from the drug company.

Continuity of care with on-going optimisation is important. Monitoring of response to treatment can be achieved by using a standardised itch scale or QOL scale every 1 to 3 months. A strong working relationship with the dermatologist will be useful to exclude other dermatological causes of itch and in selecting the most appropriate patients for this expensive treatment.

Discussion

Difelikefalin is a novel agent which shows great promise in the effective management of CKD-aP and has the potential to significantly improve the QOL of these patients. However, its uptake still remains low in the local context mainly due to the physicians' lack of familiarity with the drug and the practical barriers of cost which is up to S$360/month. Patients would tend to forgo the medication and choose to live with the itchiness after learning about the costs. Hence, we believe that national healthcare funding will definitely play a major role in improving access to difelikefalin.

Conclusion

CKD-associated pruritus is a frequent and debilitating symptom that significantly impacts the quality of life (QOL) of patients on dialysis. Addressing CKD-aP requires a goal-directed and patient-centred approach to therapy, emphasising routine screening, symptom burden assessment and integration of effective treatments. Difelikefalin, as a novel kappa-opioid receptor agonist, has demonstrated great promise in managing moderate-to-severe CKD-aP, offering significant improvements in itch relief and overall QOL.

Looking ahead, ongoing research is critical to deepen our understanding of the pathogenesis of CKD-aP and optimising therapeutic strategies. Collaborative care models, involving nephrologists, dialysis nurses, dermatologists and healthcare policymakers, will play a crucial role in ensuring comprehensive and accessible management options. Future studies should explore the long-term safety, cost-effectiveness and real-world application of difelikefalin and other emerging therapies. By fostering interdisciplinary collaboration and advancing research, we can continue to enhance the management of CKD-aP, ultimately improving patient outcomes and quality of life.

References

1. Yosipovitch G, Bernhard JD. Chronic pruritus. N Engl J Med.2013;368:1625–34.
2. Sukul N, Karaboyas A, Csomor PA, et al. Self-reported pruritus and clinical, dialysis-related, and patient-reported outcomes in hemodialysis patients. Kidney Med.2021;3(1):42–53.
3. Rayner HC, Larkina M, Wang M, et al. International comparisons of prevalence, awareness, and treatment of pruritus in people on hemodialysis. Clin J Am Soc Nephrol. 2017;12(12):2000–2007.
4. Pisoni RL, Wikstrom B, Elder SJ, et al. Pruritus in haemodialysis patients: international results from the Dialysis Outcomes and Practice Patterns Study (DOPPS). Nephrology Dialysis Transplantation. 2006 Sep 23;21(12):3495–505.
5. Verduzco HA, Shirazian S. CKD-Associated Pruritus: New Insights into Diagnosis, Pathogenesis, and Management. Kidney Int Rep. 2020;5(9):1387–1402
6. Rastogi A, Fishbane S, Lerma E, Difelikefalin for the treatment of moderate-to-severe pruritus associated with chronic kidney disease on hemodialysis. Expert Rev of Clin Pharmacol. 2023;16(5):387–400.
7. Mathur VS, Lindberg J, Germain M, et al. A longitudinal study of uremic pruritus in hemodialysis patients. Clin J Am Soc Nephrol. 2010;5(8):1410–19.
8. Lipman ZM, Paramasivam V, Yosipovitch G, et al. Clinical management of chronic kidney disease-associated pruritus: current treatment options and future approaches. Clin Kidney J. 2021;14(Supplement_3): i16–22.
9. Fishbane S, Wen W, Munera C, et al. Safety and tolerability of difelikefalin for the treatment of moderate to severe pruritus in hemodialysis patients: pooled analysis from the phase 3 clinical trial program. Kidney Med. 2022;4(8):100513.

Streamlining the Work Process of Intravenous Cyclophosphamide Administration for Renal Care

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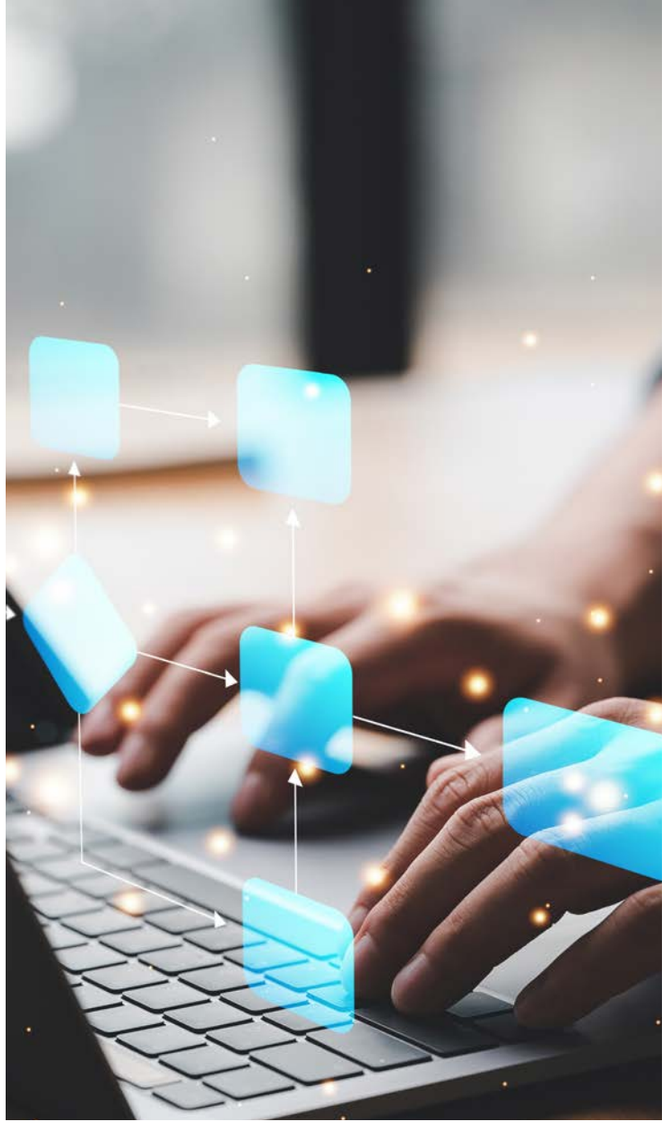

Background

Cyclophosphamide, an alkylating agent traditionally used in cancer treatment, is now increasingly applied in the management of kidney conditions such as membranous glomerulonephritis[1] and lupus nephritis[3]. Despite its therapeutic benefits, its administration requires skilled staff to minimise occupational exposure and ensure safety[2]. Clinical observations have highlighted significant delays in the administration of intravenous cyclophosphamide to renal patients following its receipt from the pharmacy. These delays are primarily attributed to a shortage of trained nurses within the area. This scarcity necessitates the recruitment of external staff, whose availability must be aligned with medication supply from the pharmacy, compounding delays in cyclophosphamide administration. Furthermore, many renal wards' staff have reported unfamiliarity with intravenous cyclophosphamide and expressed a lack of confidence in administering it safely.

Aim

This quality improvement project aimed to reduce the time from receiving intravenous cyclophosphamide from the pharmacy to its administration by 50% within six months at the Singapore General Hospital (SGH). Prompt and efficient medication administration is critical in healthcare, and achieving this goal was expected to have a meaningful impact on patient care, staff productivity, and the overall quality of service at SGH.

Methodology

This project was implemented in five wards that frequently care for renal patients requiring intravenous cyclophosphamide. To identify the underlying causes of delays in administering the medication, the project team employed a comprehensive array of analytics tools, including:

1. Cause-and-effect diagrams to visualise the complex relationships between various factors contributing to the delays.
2. Pareto charts to pinpoint the most significant causes of delays.
3. Tree diagrams to facilitate a detailed examination of the root causes and their interconnections.

Using these insights, the team adopted the Plan-Do-Study-Act framework to implement four key solutions:

1. Policy update: Reviewing and revising existing policies to ensure alignment with best practices.
2. Workflow development: Creating and implementing a consistent, evidence-based workflow to streamline the administration process.
3. Champion training: Educating and empowering a team of champions to lead and support the implementation of the new workflow.
4. Visual aid development: Designing easy-to-follow visual guides to facilitate seamless medication preparation and administration.

Results and Discussions

The implementation of this quality improvement initiative significantly streamlined the administration of intravenous cyclophosphamide. A total of 38 registered nurse (RN) champions underwent targeted training as part of the project. This training ensured the availability of skilled staff within the area, eliminating the need to source external personnel. Consequently, the preparation and administration of medications, including requisites such as IV cannulas, became more efficient, enabling timely cyclophosphamide administration.

The primary indicator of success was the reduction in time from receiving the medication from the pharmacy to starting its administration. The project achieved a dramatic reduction in this timeframe, decreasing from an estimated 120 minutes at baseline to just 30 minutes within six months. This represented a substantial time saving of 90 minutes per patient. Over the six-month project period, from June to December 2022, these interventions benefitted a total of 30 patients, delivering measurable improvements in the timely administration of cyclophosphamide.

On average, five patients per month required intravenous cyclophosphamide in the participating wards. Extrapolated over a year, this translates to an estimated annual saving of 5,400 minutes. This reduction in wait times not only enhances patient satisfaction but also has the potential to shorten hospital stays, as timely drug administration supports more efficient treatment pathways.

A staff questionnaire administered as part of the project revealed a significant increase in confidence levels regarding the safe administration of intravenous cyclophosphamide, rising from 70% before the project to 93% afterward. This demonstrates the positive impact of targeted training and process improvements on staff competence and comfort. Confidence, while not a substitute for competence, is a critical enabler of success, fostering trust, empowerment and resilience among staff[4]. Enhanced confidence is expected to translate into improved job performance, reduced errors and better patient safety. This outcome highlights the importance of investing in ongoing staff training and development initiatives.

By optimising the administration process, this initiative has generated substantial benefits for patients and healthcare professionals alike. It has improved patient outcomes while enabling a more efficient allocation of healthcare resources. To ensure sustainability, detailed workflow and administration guides are readily available in the nursing preparation room and on the SGH Infonet. Furthermore, annual refresher training is provided to address staff retention challenges and maintain proficiency among trained personnel.

Conclusions

The implementation of a streamlined process for administering intravenous cyclophosphamide at SGH achieved a significant outcome: a 75% reduction in time from receiving the medication from the pharmacy to the start of administration. This accomplishment highlights the effectiveness of process optimisation in enhancing patient care and operational efficiency.

The protocol has been fully implemented and remains in place. To ensure its continued relevance and effectiveness, it will undergo a review every three years. In addition, plans are underway to extend this protocol to Outram Community Hospital to sustain and expand the project's benefits. This achievement highlights the value of continuous quality improvement in nursing care, which is essential for delivering patient-centred care, improving clinical outcomes and fostering innovation in healthcare practices.

References

1. Fernández-Juárez, G., Rojas-Rivera, J., Logt, A.-E. V. D., Justino, J., Sevillano, A., Caravaca-Fontán, F., Ávila, A., Rabasco, C., Cabello, V., Varela, A., Díez, M., Martín-Reyes, G., Diezhandino, M. G., Quintana, L. F., Agraz, I., Gómez-Martino, J. R., Cao, M., Rodríguez-Moreno, A., Rivas, B., … Hofstra, J. (2021). The STARMEN trial indicates that alternating treatment with corticosteroids and cyclophosphamide is superior to sequential treatment with tacrolimus and rituximab in primary membranous nephropathy. Kidney International, 99(4), 986–998. https://doi.org/10.1016/j.kint.2020.10.014
2. Forges, F., Blanc, E., Raymond, B., Menguy, S., Macé, A., Hugues, M., Macron, C., Boulefrtour, W., Tinquaut, F., Guitton, J., & Simoëns, X. (2021). Evaluation of a safe infusion device on reducing occupational exposure of nurses to antineoplastic drugs: A comparative prospective study. Contamoins-1. International Archives of Occupational and Environmental Health, 94(6), 1317–1325. https://doi.org/10.1007/s00420-021-01679-x
3. Owens, K. M., & Keller, S. (2018). Exploring workforce confidence and patient experiences: A quantitative analysis. Patient Experience Journal, 5(1), 97–105. https://doi.org/10.35680/2372-0247.1210
4. Quan, X., Chen, H., Liang, S., Yang, C., Yao, C., Xu, Y., Liu, H., & An, N. (2022). Revisited cyclophosphamide in the treatment of lupus nephritis. BioMed Research International, 2022, 1–9. https://doi.org/10.1155/2022/8345737

Rethinking Informed Consent Before Dialysis Initiation

Time for a Discussion?

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It is the doctors' responsibility to ensure that patients under their care are adequately informed about their medical condition and options for treatment so that they are able to participate in decision making[1]. Informed consent for dialysis initiation is the ideal way to convey the pros and cons of dialysis treatment and to empower patients to make the right decision. Consent for medical treatment is legally enshrined in common law jurisdictions and must incorporate considerations of competence, voluntariness, and adequate provision and understanding of information, including prognosis, material risks and treatment options other than dialysis[2]. It is about time we started the discussion on how we can improve the process, especially given the fact that the benefits and risks of dialysis have shifted significantly with the growing number of older patients with significant comorbidities.

Informed consent before every dialysis session is rarely practiced internationally, and Singapore is no exception. The logistical constraints make it highly challenging and almost impractical. In the emergency situations, it is acceptable for healthcare professional to proceed with dialysis based on the principle of medical necessity. In patients who are already established on dialysis, consent is implied when patients attend the community dialysis centre to undergo treatment. The discussion that is needed is about the consenting process for a patient who is newly starting dialysis.

Shared decision-making before the initiation of dialysis is considered best practice globally[3]. The risks and benefits of dialysis and its alternatives should be discussed in a way that the patient and family can understand easily. The discussion should include the types of dialysis, what the treatment entails, what preparations are needed, what to expect after starting dialysis, and how it is likely to impact the lifestyle. In addition, it is ideal to extend the discussion to include the worst-case scenario in appropriate patients and encourage them to consider advance care planning. It is important to individualise the information to the life of the given patient. Over and above the legal and ethical reasons, there are practical benefits of having such a detailed discussion and documentation. It prepares the patient and families for this complex treatment with far reaching consequences. It also sets expectations in situations of unfavourable outcomes. The drawback of the current practice of discussing and documenting, which involves the patient's electronic medical record, is the lack of consistency across providers. A standardised written consent process ensures that critical aspects such as risks, benefits and alternatives are covered systematically, reducing variability and improving the overall quality of the information we provide.

Verbal consent is considered acceptable for low-risk, minor procedures. Dialysis is certainly not a low-risk procedure, especially for the increasingly large numbers of frail, elderly and highly comorbid patients we see in our practice. It is generally accepted that written consent should be obtained, particularly with more complex medical/surgical treatments or those with higher risks. It is not uncommon to see patients who face cognitive overload due to the sheer complexity of the discussions in our practice. A written consent provides proper documentation and record of the patient's expressed consent to proceed with a recommended treatment. It provides useful reference in case of any subsequent disputes which are not uncommon in nephrology practice. In a study of patients on maintenance dialysis, nearly 70% reported that the risks and burdens of dialysis had never been discussed before the commencement of dialysis treatment, and only 1% of patients recalled the option of conservative management being discussed[4]. A formal consent process, together with written material, will reinforce key information, improve comprehension and help patients to make better decisions. Compared to the current practice, it can potentially add an extra layer of transparency and patient safety.

Mental capacity assessment can have its own challenges in our patients, especially in the borderline cases. The assessment should be objective and should ideally be done by an independent assessor who is not involved in dialysis decision-making process to avoid any conflict of interest[5]. In those who are deemed to lack mental capacity, deciding if there is a reversible component due to uraemia is not always easy in those with advanced kidney disease and underlying neurodegenerative conditions such as dementia. In patients without mental capacity, the consent will need to be obtained from the donee under the Lasting Power of Attorney (LPA), who is legally empowered to act on behalf of the patient under the Mental Capacity Act 2008. Even though a donee, whose powers of decision-making are the same as those of a court-appointed deputy, there are limitations in terms of making decisions pertaining to life-sustaining therapy such as dialysis. For patients without LPA-appointed donee or court-appointed deputy, the treating nephrologist must decide based on a best interest principle.

There are many more questions which need answering before informed consent before dialysis initiation becomes a reality in Singapore. For instance, is it a one-off exercise prior to dialysis initiation, or does it need to be repeated when there is significant change in the physical, mental or functional status of the patient, or when there is a switch from one modality to another? Can the renal coordinators and social workers, who are actively involved in dialysis counselling, take charge of the consent process with the nephrologist's endorsement? The time is ripe for a discussion among the nephrology community to find answers to these questions and address the ambiguities.

It will no doubt be a major change in practice if we decide to embark on this journey and will require change in mindset. A change of this magnitude is likely to work only if it is introduced across the institutions simultaneously, and that is likely to require regulatory intervention. It would not be surprising if this became a mandatory requirement, especially there being guideline recommendations endorsing this practice[6]. If there is a change in practice at the individual institution level, it is unlikely to make significant difference to the overall outcome and is at risk of leading to confusion, especially when a patient followed in one institution is admitted to another hospital for inpatient care. There should be consensus among the nephrologists, and the practices across institutions should be harmonised for it to be effective and meaningful.

To conclude, obtaining informed consent before initiating dialysis is essential to ensure that patients have the necessary information to make well-informed decisions about their treatment options. It will be a step in the right direction for patient autonomy and will be the foundation for shared decision-making and patient-centred care. While challenges may arise during implementation, with buy-in from all the stakeholders and adequate preparation and execution, successful nationwide implementation can still be achieved.

References

1. Singapore Medical Council. Ethical code and ethical guidelines. 4.2.2. Page 11
2. Time to Improve Informed Consent for Dialysis: An International Perspective. Frank Brennan et al, Clin J Am Soc Nephrol 12: 1001–1009, 2017. doi: ttps://doi.org/10.2215/CJN.09740916
3. Consenting for Dialysis or Its Alternative. Systematic Process Is Needed. Kelly Chenlei Li and Mark A. Brown. CJASN 15: 560–562, 2020. doi: https://doi.org/10.2215/CJN.09510819
4. SongM-K, LinF-C, Gilet CA, Arnold RM, Bridgman JC, Ward SE: Patient perspectives on informed decision-making surrounding dialysis initiation. Nephrol Dial Transplant 28: 2815–2823, 2013
5. Consent in Medical Practice 3 – Dealing with Persons Lacking Capacity. Dr T Thirumoorthy and Dr Peter Loke, SMA Centre for Medical Ethics & Professionalism
6. Renal Physicians Association of America: Shared Decision Making in the Appropriate Initiation of and Withdrawal from Dialysis, 2nd Ed., Rockville, MD, Clinical Practice Guideline, 2010

Living with Alport Syndrome

Acceptance · Love · Purpose · Optimism · Resilience · Trust

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Introduction

Alport Syndrome is the most common genetic kidney disease caused by mutations in the type IV collagen genes: COL4A3, COL4A4, or COL4A5. Patients with X-linked or autosomal recessive Alport Syndrome often face a more severe phenotype and poorer renal prognosis, including early-onset kidney failure, bilateral sensorineural hearing loss requiring hearing aids and characteristic retinal changes that typically spare vision. Beyond the physical health burden, the diagnosis of a genetic kidney disease like Alport Syndrome can have profound psychological and emotional impacts on affected families. Early molecular diagnosis through genetic testing is critical, enabling the initiation of aggressive anti-proteinuric therapy to delay kidney failure before irreversible damage occurs. However, timely diagnosis remains a significant challenge due to limited access to genetic testing in resource-constrained settings, low public awareness and insufficient integration of kidney genomics into routine nephrology practice. A patient-focused Alport Syndrome workshop involving key stakeholders is essential for providing the latest updates, fostering expertise and experience sharing, building mutual support, and identifying gaps and unmet needs. Such initiatives can ultimately enhance the quality of life for individuals living with Alport Syndrome and raise the global awareness about this kidney disease.

We recently had the privilege of participating in the 'Shining a Light on Alport Syndrome' workshop, a one-day event held on August 20, 2024, for the Asia Pacific region. This workshop was co-organised by the Shaw-NKF-NUH Children's Kidney Centre, Khoo Teck Puat-National University Children's Medical Institute, the Department of Paediatrics at the Yong Loo Lin School of Medicine, National University of Singapore, and the Alport Syndrome Alliance – a global network advancing treatments and knowledge for people living with Alport Syndrome. This experience was truly eye-opening for us, as it was our first time attending a workshop created by and for individuals living with Alport Syndrome. Besides, it was heartwarming to witness individuals from diverse backgrounds – clinicians, scientists, pharmaceutical representatives and Alport Syndrome advocates coming together for meaningful collaboration and partnership to advance the field. We were honoured to meet a group of remarkable patient advocates whose lives are not defined by Alport Syndrome, but by the values that guide their journeys: Acceptance, Love, Purpose, Optimism, Resilience and Trust.

Acceptance

Receiving a genetic diagnosis of Alport Syndrome can be a devastating experience. Many patients find themselves navigating the five stages of grief: denial, anger, bargaining, depression, and finally, acceptance. This emotional journey is a deeply human one, and it's important to allow yourself the time and space to feel and process these emotions. After all, you cannot heal what you do not feel. True committed acceptance begins within; it's an inward journey where embracing the diagnosis allows patients to find the strength to move forward and live fully.

Love

The workshop highlighted AN's incredible journey with Alport syndrome. Diagnosed at the age of four, AN, now 16, leads a vibrant and fulfilling life, just like any other teenager. His journey began when his parents, alarmed by visible blood in his urine, sought answers in their resource-limited country, where genetic testing was unavailable. Determined to find clarity, they brought him to Singapore, where he was diagnosed with X-linked Alport Syndrome through genetic testing. The path to diagnosis was neither easy nor straightforward, but his parents' steadfast commitment never wavered. They stood by his side through moments of fear and uncertainty, always ready with comfort and encouragement. Their unwavering support helps AN navigate the fear of kidney failure and the potential prospect of dialysis, turning psychological distress into hope and strength.

AN shared how his parents' love has been his foundation. His mother carefully prepares nourishing meals to support his health, while his father ensures he enjoys recreational activities that bring him joy. Together, they have created an environment of stability, care and positivity. AN thrives in this loving home, finding peace in his hobbies – practicing taekwondo and playing basketball – and embracing a positive mindset to live his life fully as there is nothing he can do to reverse his kidney condition.

AN's story is a testament to the power of love: love for himself, the unconditional love of his family and the guiding love of the Lord. It is this love that has empowered him to thrive despite the challenges of Alport Syndrome.

Purpose

Despite their Alport Syndrome diagnoses, many patients live with a profound sense of purpose. Susie Gear, one of the founders of the Alport Syndrome Alliance and a patient living with Alport Syndrome herself, is a driving force in connecting with patients to reduce the isolation felt when living with a rare condition and advocating for research and collaborations that advance knowledge and treatments. When Susie's own three sons were young boys and two of them were relatively newly diagnosed, they asked to meet other young boys and families living with Alport Syndrome. Susie had not met anyone else with Alport herself, despite her own mother having two kidney transplants. The boys' wishes inspired Susie to reach out to their local clinician to find families nearby. A day spent with another family living with the same challenges was transformational for the family – it was the first time they'd met anyone who really understood what each other – children or parents – were going through. Susie realised that her own family was incredibly lucky as everyone was very positive and resilient as they'd not let Alport stop them from doing anything. With a great career in business, Susie decided to use what she had learnt in business – how to lead innovation across geographical borders – to benefit the Alport community. She decided to build a global community to develop treatments, share knowledge, and inspire patients to engage, challenge and collaborate with clinicians and laboratory scientists. Susie quicky saw the huge value that patients got meeting each other, particularly the young adults. Connecting with other patients and being involved in research seemed to help families to live a positive life, despite living with a life-long condition that impacted hearing, kidney and eyes. Feedback from the families who connect and participate inspires Susie every day to grow the network and reach out to others so they can benefit from the same support.

Sam Clarke, our event videographer and also a patient living with Alport Syndrome, reached out to connect with Susie and the team a few years ago and has tirelessly created inspiring videos, capturing the stories of Alport patients from around the world. Through Sam's lens, these stories are shared, inspiring hope and strength in others facing similar challenges. The stories also effectively explain the day-to-day challenges Alport patients live with and inspire clinicians and laboratory scientists to accelerate their work to develop treatments and advance knowledge. The patients in the videos, who share their tips for how they cope, also know their stories inspire many other young people and families.

Optimism

Our patients have not lost hope, despite the challenges of living with Alport Syndrome. Instead, they are driven by the belief that treatment will be available one day. Professor Kandai Nozu and his remarkable team at Kobe University are doing pioneering work in exon-skipping therapy, which offers a glimmer of hope, standing as a testament to the possibility of transforming lives. Our genes are like instruction books that inform our bodies how to produce proteins. These instructions are written in sections called exons. A mutation (error) in one of these exon sections can cause a disease, like Alport Syndrome. Exon-skipping therapy works like an "editing" tool", it skips over the faulty exon when the body is reading the instructions to produce proteins instead of fixing the mistake directly. By skipping the faulty exon, the body can still produce a shorter but functional protein, which may help reduce the severity of Alport Syndrome. This therapy does not cure the disease but offers hope for improving symptoms and slowing disease progression.

For our patients and their families, Professor Kandai Nozu and his team are not just researchers – they are the torchbearers of hope, leading the way to a future where Alport Syndrome will have life-changing treatments.

Resilience

In the face of adversity, our patients and medical community stand as shining examples of resilience and perseverance. Resilience is not just about enduring hardship – it's about rising above it, adapting, and finding strength in having fulfilling lives. Our patients demonstrate this daily as they study, work, or support their friends and family, navigating the challenges of Alport Syndrome with courage and great determination. They refuse to be defined by their diagnosis, instead focusing on living fuller, richer lives. Their resilience inspires not just survival, but a commitment to thriving and to leading without a title.

Equally, our medical community embodies this resilience, driven by a relentless pursuit to improve the quality of life for those affected by Alport Syndrome. One of the local pioneers in driving this is Associate Professor Ng Kar Hui. Without her foundation work in this genetic testing space, we would not have achieved what we have achieved today, to ensure accessibility of genomic testing to patients with genetic kidney disease. Her tireless efforts to advance scientific understanding, explore new therapies and offer compassionate care are a testament to her dedication. She pushes the boundaries of what is possible, always striving for better outcomes, and never losing sight of the hope that fuels her work. By working together with those living with Alport Syndrome, she redefines what 'resilience' truly means.

Trust

Trust is the foundation of our unique global Alport community of patients, clinicians, laboratory scientists and pharmaceutical company representatives. It is through trust that we share our feelings, emotions, worries and successes with one another. This trusted relationship is fundamental in all the work we do together.

We may look different, speak different languages, and come from various backgrounds, cultures, values and beliefs. Yet, we are united by a common goal: improving the care and quality of life for patients living with Alport Syndrome and kidney disease. It is this shared purpose that binds and connects us together.

Conclusion

The Alport Syndrome patient workshop has been an incredible journey of shared learning, support and advocacy, uniting patients, families, clinicians, researchers and advocates to address the challenges and opportunities in this field. Yet, much work remains to be done. Raising awareness about Alport Syndrome, improving access to genetic testing for timely diagnosis and supporting affected families must remain our collective priority. This workshop is just the beginning, future gatherings can serve as platforms for amplifying patient voices, fostering multidisciplinary collaboration and driving transformative change. Let us move forward with renewed purpose and commitment to advance the science, care and advocacy that this community deserves.

Optimising Haemodialysis Care through a Novel Pharmacist-Nephrologist Model

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Introduction

Patients on maintenance haemodialysis (HD) often take multiple medications, with some requiring up to 30 doses daily[1,2]. Polypharmacy increases the risk of adverse drug reactions, errors and healthcare costs[3]. With the current care model involving both hospital and community dialysis nephrologists titrating medications, it is not surprising that these patients often face complex and potentially confusing medication regimens.

Multidisciplinary reviews have been shown to improve patient outcomes, reducing all-cause mortality and hospitalisation[4]. Vaccinations against diseases such as influenza and pneumococcal are also crucial in decreasing the likelihood of respiratory failure and mortality[5].

Prior to December 2020, Changi General Hospital (CGH) offered a pharmacist medication therapy management service for stable HD patients, involving a same-day review prior to the nephrologist consult. However, due to challenges such as the longer combined consultation time and resource constraints, the service was limited to selected patients. With medication management as the main activity during each nephrologist consult, we aim to right site the care of stable HD patients.

Pharmacist-managed services have expanded across disciplines with notable successes. Since 2018, the introduction of the Collaborative Prescribing Programme has trained pharmacists to prescribe and optimise medications effectively. Since December 2020, CGH expanded its pharmacist-managed renal service to include HD patients.

Figure 1: Standard Care and Collaborative Care Models for Stable HD Patients

This novel collaborative model involves renal pharmacists reviewing stable HD patients six months after their nephrologist visit as seen in Figure 1. These patients are on maintenance dialysis and defined as having haemodynamic stability as well as stable dialysis prescriptions and medication regimens. Their nephrologist will decide on the patient's suitability before enrolling them in either the standard care (SC) or collaborative care (CC) group. During consultations, pharmacists independently review medications alongside the patient's clinical status and their community HD centre's records. Pharmacists optimise and prescribe medications based on the collaborative prescribing framework with focus on hypertension, mineral bone disease and anaemia management, together with their pneumococcal and influenza vaccination status. Appropriate vaccines are prescribed and administered during the same visit, ensuring timely immunisation. A subsequent review occurs six months later with the nephrologist.

Since expanding the renal pharmacist-managed services in December 2020, over 600 consultations have been conducted. An evaluation was recently performed to assess the safety and vaccination rates of this collaborative care model, with the mean all-cause unplanned admissions and emergency department (ED) visits as the primary outcome.

Methodology

HD patients aged 21 and above enrolled in the CC and SC models between January 2021 and June 2022 were included. Patients under 21 and/or followed up outside CGH were excluded. Patients were matched by nearest propensity score, modelled using a multivariate logistic regression adjusted with the baseline variables. The baseline variables were adapted from the Charlson's comorbidity score and chosen because they are known to have the potential to affect outcomes. They include age, gender, ethnicity, comorbidities (diabetes, hypertension, hyperlipidemia, cerebrovascular accident (CVA), liver disease, ischemic heart disease (IHD)), and all-cause unplanned hospital admissions and ED visits. Pneumococcal and influenza vaccination records from Sunrise Clinical Manager were reviewed. The National Health Electronic Record (NEHR) as well as The National Kidney Foundation (NKF) records were not available for our review. NKF patients were excluded from the evaluation of influenza vaccination rates as they receive the annual vaccine at NKF.

The mean all-cause unplanned admissions and ED visits were assessed six months post-pharmacist consult. ED visits were defined as those with direct discharge from the ED, while admissions through the ED were counted as unplanned admissions. Outcomes were compared using a difference-in-difference approach and a negative binomial mixed-effects model, which accounts for the unequal nature of the mean and standard deviation of the outcomes, as well as the repeated measures used in the study. Additional adjustments in the model were made to account for confounders that could affect the outcomes. The incidence rate ratio (IRR) was estimated by comparing the outcome of the intervention group to the control group, adjusted for the baseline variables. The vaccination rates between the two groups were compared using Fisher's exact test.

Results

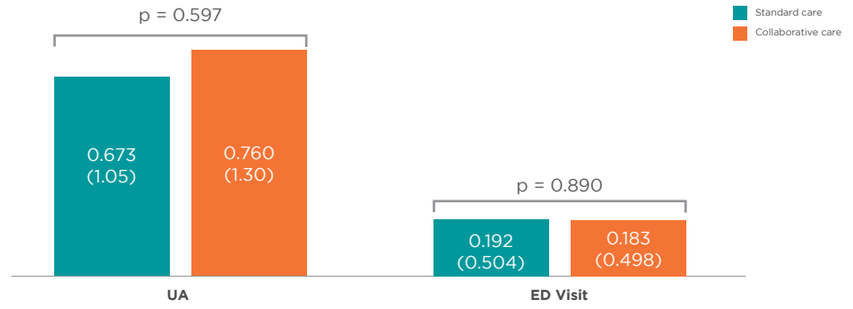
During the study period, 104 patients were enrolled in the CC group, and 342 patients in the SC group. After matching by propensity score at a ratio of 1:1, 104 patients remained in each group. Both groups had comparable baseline characteristics as seen in Table 1.

Table 1: Patient Baseline Characteristics After Matching

	Overall (N=202)	CC group (N=104)	SC group (N=104)	P-value
Age (years), mean (SD)	64.2 (11.4)	63.9 (11.9)	64.4 (10.8)	0.761
Male, n (%)	119 (57%)	57 (55%)	62 (60%)	0.575
Chinese, n (%)	102 (49%)	52 (50%)	50 (48%)	0.950
History of CVA, n (%)	25 (12%)	10 (10%)	15 (14%)	0.394
History of diabetes, n (%)	123 (59%)	59 (57%)	64 (62%)	0.573
History of hyperlipidemia, n (%)	113 (54%)	54 (52%)	59 (57%)	0.578
History of hypertension, n (%)	89 (43%)	40 (38%)	49 (47%)	0.262
History of liver disease, n (%)	17 (8%)	7 (7%)	10 (10%)	0.613
History of IHD, n (%)	87 (42%)	43 (41%)	44 (42%)	1.000
Mean unplanned admissions per patient over 6 months per visit, average (SD)	0.543 (0.850)	0.510 (0.824)	0.577 (0.878)	0.569
Mean ED visits per patient over 6 months per visit, average (SD)	0.125 (0.410)	0.106 (0.367)	0.144 (0.450)	0.500

While the CC group has a higher mean unplanned admission over 6 months (0.760 vs 0.673) in Figure 2, this group had a lower mean ED visit over the same period (0.183 vs 0.192). Moreover, there is no statistical difference noted in both outcomes (UA: p=0.597, ED: p=0.890).

Figure 2: Mean Unplanned Admissions (UA) and ED Visits per Patient Over 6 Months Post Visit



The incidence rate ratios for unplanned admissions and ED visits were lower in the CC group, though not statistically significant (unplanned admissions: p=0.932, ED visits: p=0.705).

Table 2: Incidence Rate Ratio for Unplanned Admission and ED Visits

Outcome	Incidence Rate Ratio (95% CI)	Standard error	P-value
Unplanned admissions	0.98 (0.58 – 1.65)	0.26	0.932
ED visits	0.73 (0.14 – 3.81)	0.61	0.705

In terms of vaccination rates, the CC group had significantly higher pneumococcal conjugate vaccine (PCV13) rates compared to the SC group (p=0.0113). Eligible patients in the CC group also had higher vaccination rates for pneumococcal polysaccharide vaccine (PPSV23) and influenza vaccinations, although statistical difference was not achieved. (PPSV23: p=0.207, influenza: p=0.0579).

Table 3: Various Vaccination Rates for Eligible Patients During Consult

Vaccination rate	CC group	SC group	P-value
Pneumococcal vaccination rate – PCV13 vaccine	6/35 (17%)	1/57 (2%)	0.0113
Pneumococcal vaccination rate – PPSV23 vaccine	11/35 (31%)	3/22 (14%)	0.207
Influenza vaccination rate – Quadrivalent influenza vaccine	5/67 (14%)	0/65 (0%)	0.0579

Discussion

The introduction of renal pharmacist as a collaborative prescriber has been found to be safe with no increase in all-cause unplanned admissions or ED visits. The study cohort, though having a higher proportion of non-Chinese patients and a smaller proportion of patients with diabetes, remains representative of the patient population at our institution, where there are more Malay dialysis patients. The proportion of renal patients with diabetes in our general population is approximately 67%[6], which is close to the profile of our study cohort.

The expanded renal pharmacist-managed service is unique in that the pharmacist conducts an independent consultation instead of a pre-consultation review. This allows for a comprehensive medication review and allow pharmacists to go beyond recommending vaccinations to prescribing the necessary vaccinations at the same visit for administration.

A limitation of the vaccination evaluation is the lack of information on reasons for low vaccination rates. The national drive for COVID-19 vaccination between January 2021 and June 2022 may have caused eligible patients to miss their pneumococcal and influenza vaccinations. Additionally, only all-cause unplanned admissions and ED visits were assessed. Future studies could focus on drug-related unplanned admissions and ED visits to further affirm the safety of pharmacist-managed services.

Conclusion

Our study results support the safety of this novel collaborative care model in facilitating timely clinical review by the hospital care team for the key issue of medication titration. It also supports the effectiveness of the collaborative care model, where pharmacists practise at the top of their licence and promote the accessibility of care for patients.

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References

1. Manley HJ, Cannella CA, Bailie GR, St Peter WL. Medication-related problems in ambulatory hemodialysis patients: a pooled analysis. Am J Kidney Dis. 2005 Oct;46(4):669-80
2. Joy MS. Clinical Pharmacists as Multidisciplinary Health Care Providers in the Management of CKD: A Joint Opinion by the Nephrology and Ambulatory Care Practice and Research Networks of the American College of Clinical Pharmacy. Am J Kidney Dis: 2005 Jun;45(6):1105-1118
3. Mason NA, Bakus JL. S. Strategies for reducing polypharmacy and other medication-related problems in chronic kidney disease. Semin Dial. 2010;23(1):55-61
4. Shi Y, Xiong J, Chen Y, et al. The effectiveness of multidisciplinary care models for patients with chronic kidney disease: a systematic review and meta-analysis. International urology and nephrology 2018;50:301-12.
5. Bond TC, Spaulding AC, Krisher J, McClellan W. Mortality of dialysis patients according to influenza and pneumococcal vaccination status. Am J Kidney Dis 2012; 60: 959-65; PMID:22694948
6. National Kidney Foundation Singapore. Leading cause of kidney failure: Diabetes. Last accessed on 29 December 2024, from https://nkfs.org/kidney-failure/leading-cause-diabetes/

Revitalising Care

Advanced Practice Nurse Role in a Peritoneal Dialysis Walk-in Clinic

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Background

Peritoneal dialysis (PD) is a form of kidney replacement therapy (KRT) that utilises the peritoneal membrane as a semipermeable membrane for dialysis. PD offers several advantages including home-based dialysis, lower costs, better preservation of residual kidney function and greater flexibility in scheduling. This autonomy can enhance patients' quality of life and adherence to their treatment regimen. While PD is an effective mode of KRT for patients with kidney failure, it is not without risks. Common acute complications associated with PD include peritonitis, exit site infections, fluid overload, migration of catheter, hyperglycaemia and haemodynamic instability. Understanding these complications and their management is essential in optimising patient outcomes and ensuring the effectiveness of PD as a treatment option. The previous study reported that hospitalisation rates ranged from 10% to 25% among PD patients due to complications arising from delayed recognition of symptoms and inadequate patient education[10]. Another study also showed that the risk for 30-day readmission was higher among patients on PD compared to those on in-centre haemodialysis (HD) therapy. This study suggested that specialised walk-in clinics can significantly reduce readmission rates among PD patients, emphasising the importance of accessible renal care[9].

Nurses have diversified their skills to take on roles which have been traditionally physician-led. Renal Advanced Practice Nurses (APNs) play a crucial role in the PD programme, encompassing patient assessment, education, clinical management and coordination of care. They are expected to provide a high level of care and be able to cope with the complexity of the problem[3,8]. They conduct comprehensive evaluations to determine patient suitability for PD and develop and adjust individualised treatment plans. APNs are also responsible for medication management, addressing complications such as catheter issues or fluid imbalances, and coordinating with multidisciplinary teams to ensure holistic patient care. They monitor patient progress through regular follow-ups and lab assessments, aiming to prevent complications like peritonitis, and escalate care to nephrologists or other specialists when necessary. Through these activities, renal APNs enhance the quality and effectiveness of the PD programme, improving patient outcomes and ensuring continuity of care. Numerous studies have shown that APNs can significantly reduce hospital admissions among patients receiving PD by effectively addressing complications through early intervention[1,10]. The APN role in nephrology practice is multifaceted. Another service that APNs provide is that of primary care[2]. Nurse-led interventions have been shown to have a positive impact on chronic disease management, helping patients adhere to treatment plans and prevention of PD related infection, which is crucial for the successful long-term management of dialysis therapy[1,4,7].

Method

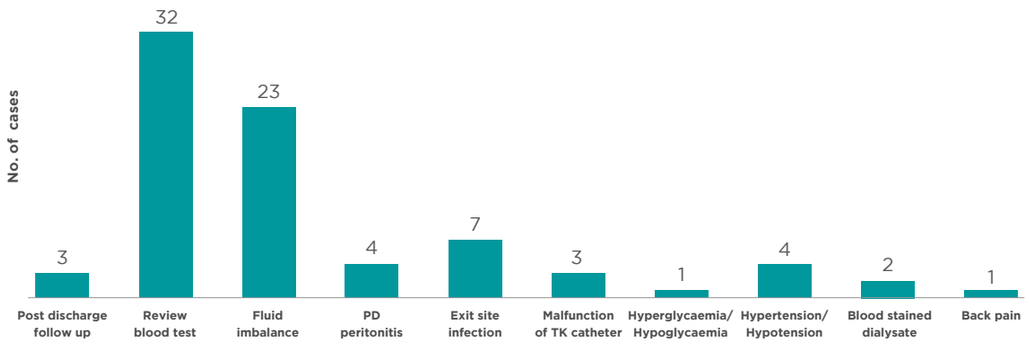
We conducted a retrospective review of 72 PD patients seen at a PD clinic managed by an APN nurse from January to December 2023. We reviewed patients' demographics, presenting complaints, APN interventions, etiology of kidney failure and hospital admission rates within 30 days post-clinic visit.

Results

The review involved 72 patients who utilised the APN-managed PD clinic in 2023. The cohort had a balanced gender distribution, with 47% females and 53% males. Most patients (83%) were of Chinese ethnicity, with Malay (13%) and Indian (4%) patients comprising the remaining group. The patients' ages ranged from 31 to over 71 years old, with nearly half (42%) falling within the 61 to 70 years age group, and 31% being over 71 years old. In the cohort, the demographic analysis revealed a high prevalence of chronic conditions among the patient population, with notable rates of diabetic mellitus (42%), hypertension (81%), hyperlipidaemia (60%), gout (24%) and ischaemic heart disease (24%).

The leading causes of kidney failure were diabetic nephropathy (42%) and glomerulonephritis (36%). The primary reasons for clinic visits included review of blood test (32 cases), fluid imbalance (23 cases), exit site infections (7 cases), peritonitis (4 cases), post discharge follow up (3 cases), malfunction of PD catheter (3 cases), blood-stained dialysate (2 cases), hyperglycaemia/hypoglycaemia (1 case), hypertension/hypotension (4 cases) and back pain (1 case) (Figure 1). No hospital admissions were recorded within 30 days following the clinic visit.

Figure 1: Primary Reason for Walk-in Clinic Visit

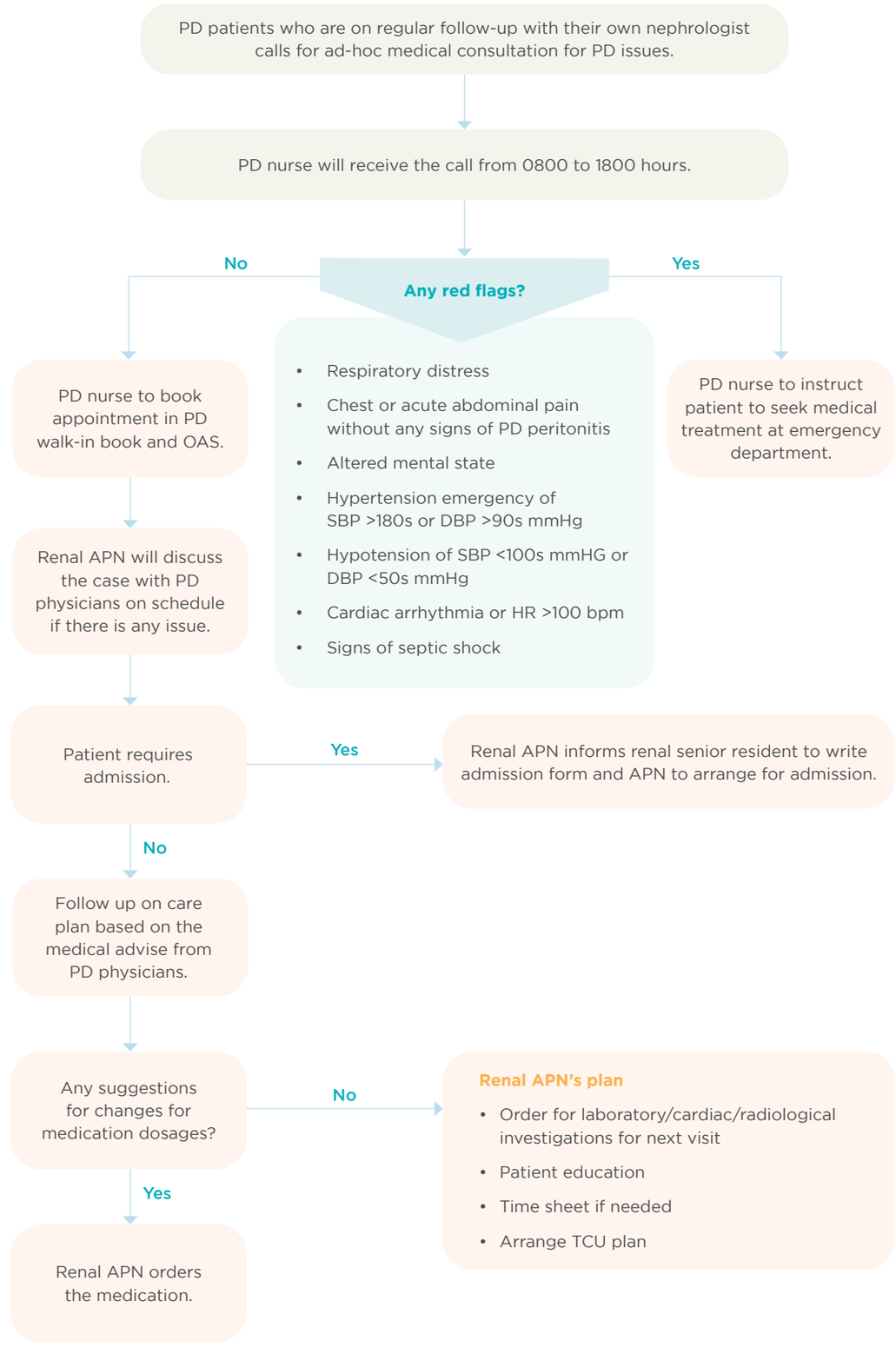


Key APN interventions are summarised in Table 1, which include comprehensive patient assessments, patient education on PD-related infection prevention, timely intervention for complications, care coordination, follow-up visits and personalised care planning based on individual patient needs. Figure 2 illustrates the APN-led Walk-In Clinic Process and Red Flags, which outline the structured workflow for patient assessment, consultation, and management of PD-related issues, highlighting critical symptoms that require urgent referral or escalation to ensure prompt and effective care.

Table 1: APN Interventions

Category	APN Interventions
Comprehensive Patient Assessments	- Regular monitoring of vital signs, fluid status and catheter sites - Early detection and management of symptoms (e.g. abdominal pain, fluid overload or dehydration, fever, peritonitis)
Patient Education	- Prevention of PD-related infection and recognising complications - Guidance on diet, fluid management, and medication adherence
Timely Intervention	- Initiating treatment for exit site or tunnel tract infections and peritonitis (e.g. antibiotics) - Managing fluid overload, electrolyte imbalances and catheter malfunctions
Care Coordination	- Collaboration with nephrologists, dietitians, and social workers
Follow-up	- Regular follow-up visits and adjustments to care plans
Personalised Care Planning	- Developing individualised care plans based on patient needs and preferences

Figure 2: APN Led Walk-in Clinic Process Algorithm



Discussion

The findings of this cohort study demonstrate the significant impact of APN interventions in a walk-in clinic setting on patient outcomes for individuals undergoing PD. This outcome clearly highlights the role of APNs in improving patient management and underscores the importance of early intervention in preventing complications associated with PD. APN interventions were instrumental in managing these complications. The APNs conducted comprehensive assessments that allowed for early detection of issues such as fluid imbalance, electrolyte disturbances and infections, which were promptly addressed with targeted interventions. For instance, patients presenting with symptoms of fluid and electrolyte imbalance received timely adjustments to their dialysis regimen and fluid management plans. In addition, APNs provided extensive patient education focused on recognising early symptoms of complications and proper catheter care, empowering patients to manage their condition effectively at home. This proactive and patient-centred approach not only mitigated the risks of complications but also ensured that issues were managed before they required hospitalisation.

A key aspect of the success observed in our review is the comprehensive patient education provided by APNs. Research consistently indicates that patients who are well-informed about their treatment options and self-management strategies experience better health outcomes[5]. In our setting, APNs provided tailored education focused on prevention of PD related infection, recognising early signs of complications, managing comorbidities and understanding the importance of adhering to prescribed dialysis regimens. This proactive approach enhances patient empowerment, encouraging individuals to take an active role in their care, which is vital in chronic disease management. The zero- 30-day readmission rate post-clinic visit reinforces the notion that effective patient education can lead to improved self-management and minimise complications.

A systemic review has shown APN is superior or equal to the usual care models for the management of BP, LDL, PTH and glycaemic control in adults with CKD[6]. In our cohort, the demographic analysis revealed a high prevalence of chronic conditions among the patient population, effective management of these comorbidities is essential for preventing complications in patients undergoing PD. The APN utilised evidence-based protocols to closely monitor these conditions, enabling timely adjustments in treatment plans as needed. This integrated approach aligns with current best practice recommendations and underscores the necessity for multidisciplinary teams in managing complex patients, especially those with chronic kidney disease.

Despite the positive outcomes observed, it is essential to acknowledge the challenges that APNs face in the management of PD patients. These challenges include handling a complex patient population with multiple chronic conditions and frequent complications like peritonitis and catheter-related infections. Besides, educating patients with varying levels of health literacy and ensuring adherence to PD regimens are significant hurdles, as misunderstandings or non-adherence can lead to increased complications and hospitalisations. Moreover, ongoing training and support for APNs are crucial to ensure they remain equipped to handle the dynamic nature of patient needs in this complex area of healthcare.

Implications for Future Research

The current study highlights a promising direction for future research into the roles of APNs in renal care. While our results show no hospital admissions within 30 days post-clinic visit, further studies should explore larger patient cohorts, evaluate longer-term outcomes and assess the impact of APN-led care in rural or underserved populations. In addition, examining patient quality of life and satisfaction as outcome measures would provide a more comprehensive understanding of the effectiveness of APN interventions. We recommend that future studies should employ detailed comparative or longitudinal designs to further clarify the causal relationships and sustained benefits associated with such interventions.

Conclusion

This study highlights the potential role of APNs in improving outcomes for patients receiving PD, as demonstrated through this descriptive evaluation of outcomes within an APN-led walk-in clinic. The achievement of zero hospital admissions within 30 days post-clinic visit stands as a testament to the expertise of APNs in patient education, timely intervention and comprehensive care. As healthcare continues to evolve, integrating APN services into clinical practice will be essential for advancing patient-centred approaches in renal care.

References

1. Davis, M., & Austin, P. C. (2021). Impact of advanced practice nursing on patient outcomes in peritoneal dialysis: A systematic review and meta-analysis. Peritoneal Dialysis International, 41(3), 270-281.
2. Easom, A., & Allbritton, G. (2000). Advanced Practice Nurses in Nephrology. Advances in Renal Replacement Therapy, 7(3), 247–260.
3. Fontaine, J., Sargent, R., & Alavi, A. (2009). Impact of advanced practice nurses on patient knowledge and self-management in chronic kidney disease: A controlled trial. Kidney and Blood Pressure Research, 44(2), 284-292.
4. Htay, M., & Whitehead, D. (2021). The effectiveness of the role of advanced nurse practitioners compared to physician-led or usual care: A systematic review. International Journal of Nursing Studies Advances, 3, 100034.
5. Johnson, D. W., Dent, H., Hawley, C. M., McDonald, S. P., Rosman, J. B., Brown, F. G., & Wiggins, K. J. (2009). Associations of dialysis modality and infectious mortality in incident dialysis patients in Australia and New Zealand. American Journal of Kidney Diseases, 53(2), 290-297.
6. McCrory, G., Patton, D., Moore, Z., O'Connor, T., & Nugent, L. (2018). The impact of advanced nurse practitioners on patient outcomes in chronic kidney disease: A systematic review. Journal of Renal Care, 44(4), 197-209.
7. Morris, P. D., & Hossain, M. (2018). Impact of nurse-led interventions on hospital readmission in chronic disease management: A systematic review. International Journal of Nursing Studies, 82, 107-116.
8. Nozu, H., Tamura, H., Kudo, T., Araki, T., Sato, H., Watanabe, T., & Sasagawa, I. (2024). The role of advanced practice nurses in improving healthcare outcomes for patients with chronic kidney disease: A scoping review protocol. PLoS ONE, 19(4), e0301676.
9. Perl, J., McArthur, E., Bell, C., Garg, A. X., Bargman, J. M., Chan, C. T., Harel, S., Li, L., Jain, A. K., Nash, D. M., & Harel, Z. (2017). Dialysis modality and readmission following hospital discharge: A population-based cohort study. American Journal of Kidney Diseases, 70(1), 11-20.
10. Smith, J. R., Frankel, A. H., Holmes, C. J., Geary, D. F., & Ward, M. K. (2020). Blood pressure control in patients receiving automated peritoneal dialysis. Nephrology Dialysis Transplantation, 15(2), 202-207.

Harnessing Automation for Patient Transport Requests in Haemodialysis Care

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Abstract

The Renal Dialysis Centre (RDC) at Singapore General Hospital implemented a Robotic Process Automation (RPA) system to streamline portering requests for haemodialysis patients. Previously reliant on manual data entry into the e-Porter system, this process was labour-intensive and prone to errors, detracting from staff availability for patient care. By automating workflows using UiPath software and Visual Basic for Applications (VBA), the RDC reduced the time for each porter request from 45 seconds to 12 seconds, saving 1.34 hours daily. Staff satisfaction improved as the administrative burden was reduced, enabling greater focus on patient-centred activities. While challenges such as multi-day scheduling limitations were identified, the initiative demonstrates the potential for RPA to enhance operational efficiency and improve patient care.

Keywords: Robotic Process Automation, Workflow Efficiency, Dialysis Centre & Patient Care Optimisation

Background

The Renal Dialysis Centre (RDC) in one of the largest tertiary hospitals in Singapore, manages approximately 20,000 in-centre haemodialysis sessions annually. Effective coordination of patient transportation before and after dialysis is a cornerstone of these operations. Historically, this coordination relied on manual data entry into the hospital's e-Porter system, a process characterised by inefficiencies and prone to human error.

The manual workflow demanded repetitive input from administrative staff, reducing their availability for direct patient engagement. The reliance on human intervention increased the likelihood of errors, such as incorrect entries, leading to potential delays or misrouting of patients. Furthermore, the time-intensive nature of the task exacerbated bottlenecks, particularly in a high-volume setting like dialysis centres with high workload.

These challenges are not unique to the tertiary hospitals. Inefficiencies in manual processes are frequently reported across high-demand healthcare facilities, where administrative burdens compromise resource allocation and operational flow (Kaur, 2023; Raparthi, 2020). Recognising the need for improvement, the RDC adopted an automated solution to streamline workflows, enhance accuracy and optimise resource use.

Intervention

To address these inefficiencies, the RDC partnered with the hospital's General Services department to implement an RPA solution using UiPath software. This automation initiative sought to reduce dependency on manual input while enabling administrative staff to focus on higher-priority activities.

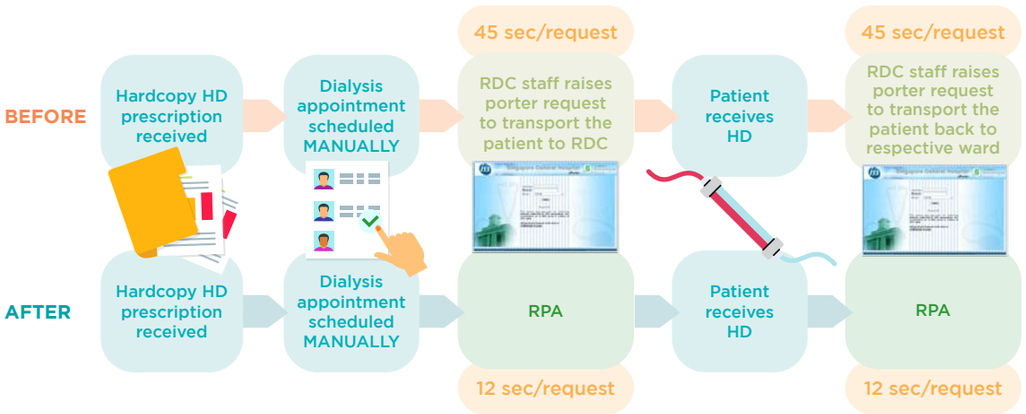
The RPA system seamlessly integrated with the RDC's scheduling framework, utilising an Excel-based tool to organise haemodialysis appointments. Through Macro Visual Basic for Applications (VBA), the system extracted patient schedules and automatically generated porter requests in the e-Porter system. This eliminated routine manual tasks, significantly reducing errors and improving the speed of request processing. Moreover, the automation process required no overhaul of existing systems, ensuring cost-effectiveness and scalability (Raparthi, 2020).

Implementation and Testing

The rollout of the RPA system was conducted in two distinct phases: testing and full implementation. During the testing phase, selected RDC staff underwent a structured training programme spanning three half-day sessions. These sessions provided hands-on experience with UiPath software, equipping staff to navigate the system, troubleshoot errors and integrate automation into their daily routines seamlessly.

Testing focused on evaluating the reliability and stability of the system under various operational scenarios, including peak patient volumes. Feedback gathered during this period informed refinements to ensure the system's alignment with the RDC's workflow needs. Following the successful testing phase, the RPA system was integrated into daily operations. Continuous feedback loops allowed the team to monitor its performance and make iterative improvements. Staff reported reduced administrative workload and an enhanced ability to concentrate on patient care, marking a significant shift in operational dynamics.

Diagram 1: Workflow Before and After Implementation



Results

The implementation of the RPA system resulted in measurable improvements across several dimensions. The time required to process each porter request was reduced from 45 seconds to 12 seconds, translating into a daily saving of 1.34 hours. This efficiency gain equated to 0.168 Full-Time Equivalent (FTE) staff time, enabling administrative personnel to focus more on patient-facing tasks.

Staff feedback reflected a marked improvement in job satisfaction, attributed to the reduction of repetitive and error-prone tasks. Receptionists reported greater ease in managing their responsibilities, allowing for enhanced coordination with patients and clinical teams. Additionally, the system contributed to workflow consistency by minimising errors in porter requests, further streamlining operations.

Limitations

Despite its notable successes, the RPA system exhibited some limitations. Technical constraints in the Macro VBA programming rendered the automation unable to process certain ward-specific requests, necessitating manual intervention. Similarly, the system struggled with complex patient needs, such as those requiring wheelchairs and oxygen support, which required additional coordination outside the automated framework.

Furthermore, the UiPath system was restricted to same-day requests, limiting its flexibility for multi-day or advance scheduling. These constraints highlight broader challenges in implementing automation within intricate healthcare environments. Future iterations of the system should incorporate AI-driven decision-making to address these complexities and enhance scheduling capabilities.

Discussion

The deployment of RPA at the RDC highlights how automation can transform healthcare workflows by alleviating administrative burdens and enabling a more patient-centred approach. The reduction in human errors and improved coordination between administrative staff and porters contributed to enhanced operational reliability and patient safety.

While the system demonstrated substantial efficiency gains, the identified limitations highlight the need for continuous refinement. Collaborating with software vendors to develop customised solutions and incorporating advanced capabilities, such as AI, will be critical in addressing these challenges.

The scalability of this initiative further emphasises its potential applicability across other hospital departments, including outpatient clinics, where similar operational inefficiencies may exist. By extending this automation model, healthcare institutions can achieve greater resource optimisation and improved patient outcomes.

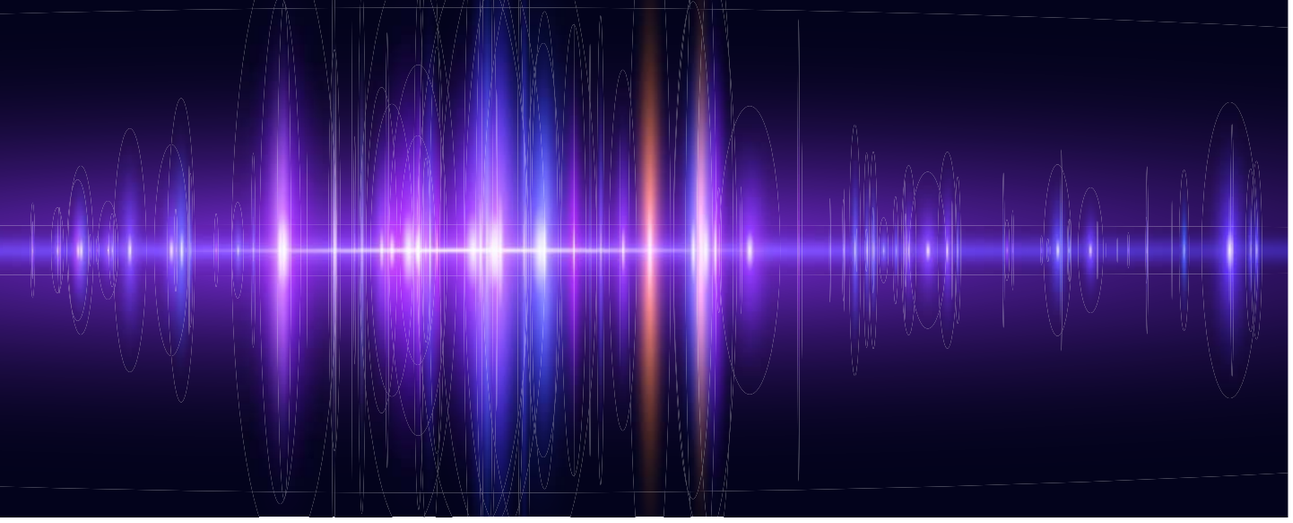
Conclusion

The introduction of Robotic Process Automation (RPA) at the RDC in Singapore General Hospital demonstrates the significant potential of automation in healthcare. By streamlining portering requests, the RDC achieved notable time savings, reduced errors and enhanced staff satisfaction.

Looking ahead, incorporating advanced scheduling features and AI-driven solutions will enable the system to handle complex cases more effectively. Expanding this initiative to other dialysis centres and departments offers a compelling opportunity to optimise healthcare delivery, enhance patient care and maximise resource allocation.

References

1. Kaur, J. (2023). Robotic process automation in healthcare sector. E3S Web of Conferences, 391, 01008. https://doi.org/10.1051/e3sconf/202339101008
2. Raparthi, M. (2020). Robotic process automation in healthcare: Streamlining precision medicine workflows with AI. Journal of Science & Technology, 1(1), 91–99. https://ddei5-0-ctp.trendmicro.com:443/wis/clicktime/v1/query?url=https%3a%2f%2fwww.thesciencebrigade.com%2fjst%2farticle%2fview%2f125&umid=CE6A2E7D-278D-BC06-A82F-8C4DF2552735&auth=6bc204c9f41dd899ed8441c0791dca42ae24634b-90b86f02e57043d38a87ec2ab00fc07468d844d9
3. The UiPath reference has been updated for APA compliance: UiPath. (n.d.). Robotic process automation. Retrieved November 19, 2024, from https://ddei5-0-ctp.trendmicro.com:443/wis/clicktime/v1/query?url=https%3a%2f%2fwww.uipath.com%2frpa%2frobotic%2dprocess%2dautomation&umid=C96DE2CB-278D-9906-B4E4-6A7AEEFEBB80&auth=6bc204c9f41dd899ed8441c0791dca42ae24634b-cec4c8976916a1d6bc749bb02291f0ef7edf1dea



‘My Voice’

Transforming End-of-Life Conversations for Dialysis Patients

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End-stage kidney disease (ESKD) rates, and consequently the number of patients on dialysis, have been steadily rising in Singapore[1]. Compared to other serious illnesses such as cancer and heart failure, ESKD patients on dialysis face more frequent hospitalisations and higher intensity treatments during their final months of life[2]. Many are ill-prepared for these urgent end-of-life (EOL) decisions. Integrating advance care planning (ACP) discussions throughout the chronic kidney disease trajectory can better prepare patients and their families for these challenging EOL choices[3-4].

However, studies by our team have uncovered several barriers to initiating ACP conversations. Healthcare providers are hesitant to engage in these conversations due to cultural taboos surrounding conversations about death, fear of upsetting patients, anticipate resistance from patients and caregivers, time constraints, and lack confidence in having ACP conversations[5-7]. On the patient side, limited awareness of their illness trajectory, prognosis, and options like dialysis withdrawal and palliative care – compounded by fatalism, perceived lack of choices, and family dominance in decision-making – further complicate these discussions[8].

As a result, conversations about patients’ EOL care goals are often postponed until a medical crisis, leaving families insufficient time to prepare for critical EOL decisions.

To address this gap, we have developed an interactive web-based tool called ‘My Voice’, designed to prepare patients and families for EOL care conversations, including decisions about dialysis withdrawal. Culturally sensitive to the local context, ‘My Voice’ educates patients and families about the illness and offers a platform for patients to express their EOL care goals to healthcare providers and loved ones. As patients’ medical conditions change, the tool allows them to revisit and update their care preferences accordingly.

Preliminary results suggest that ‘My Voice’ is well-received by patients, caregivers, and providers, who find it simple and usable. Thus, ‘My Voice’ has the potential to empower all parties to engage in these difficult but necessary discussions. The tool is currently undergoing rigorous testing to evaluate its impact on patient and caregiver outcomes, with plans to integrate it into routine clinical care.

Ultimately, ‘My Voice’ has the potential to transform EOL care for dialysis patients by fostering open, timely conversations and ensuring that care aligns with the patient’s values and goals. By facilitating better communication between patients, families and healthcare providers, it can lead to more personalised care, reduce unnecessary interventions, and support a more dignified and peaceful EOL experience.

References
1. Office NRoD. Singapore Renal Registry Annual Report 2020. Health Promotion Board: Health Promotion Board 2022.
2. Wong SP, Kreuter W, O'Hare AM. Treatment intensity at the end of life in older adults receiving long-term dialysis. Arch Intern Med. 2012;172(8):661-3; discussion 3-4.
3. Malhotra C. Advance care planning: It is time to rethink our goals. Journal of the American Geriatrics Society. 2023;71(12):3963-6.
4. Malhotra C. Reimagining and Rebranding Advance Care Planning. 2024 Age and Ageing (forthcoming)
5. Malhotra C, Chaudhry I. Barriers to advance care planning among patients with advanced serious illnesses: A national survey of health-care professionals in Singapore. Palliat Support Care. 2023:1-8.
6. Malhotra C, Ramakrishnan C. Complexity of implementing a nationwide advance care planning program: results from a qualitative evaluation. Age Ageing. 2022;51(10).
7. Malhotra C, Ramakrishnan C, Yue SG. Challenges in providing end-of-life care consistent with documented patient preferences. Ann Palliat Med. 2022;11(12):3610-9.
8. Ramakrishnan C, Widjaja N, Malhotra C, Finkelstein E, Khan BA, Ozdemir S, et al. Unravelling complex choices: multi-stakeholder perceptions on dialysis withdrawal and end-of-life care in kidney disease. BMC Nephrology. 2024;25(1):6.

The Three Musketeers of Chronic Kidney Disease-Mineral Bone Disorder

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Chronic Kidney Disease-Mineral Bone Disorder (CKD-MBD) has evolved significantly over the years and many nephrologists are no longer confident in managing all aspects of CKD-MBD. With the recently published CKD-MBD controversies conference report[1], we aim to update the nephrology community on the latest developments in the field of CKD-MBD.

Introduction

The kidney plays a pivotal role in the regulation of calcium, phosphate and parathyroid hormone homeostasis via its interaction with vitamin D and FGF-23. Bone and mineral disease are important complications associated with CKD and encompass a spectrum of different entities. Historically, renal osteodystrophy was used to describe bone pathology associated with CKD. It is not until 2009 when the Kidney Disease: Improving Global Outcomes (KDIGO) published its first bone related guideline that the term Chronic Kidney Disease-Mineral Bone Disorder (CKD-MBD) was introduced to describe a complex syndrome that encompass three complications as a result of CKD:

1. Biochemical changes in calcium, phosphate, intact parathyroid hormone (iPTH) and vitamin D,
2. Bone pathology and
3. Vascular/valvular calcification (VC)[2].

Despite advances made in the field of CKD-MBD, treatment goals for CKD-MBD in clinical practice appear to still be relating to deranged biochemical parameters. The other 2 “musketeers” of CKD-MBD – bone pathology and VC – are largely overlooked. Plasma calcium, phosphate and iPTH are routinely measured in dialysis centres and are easily accessible. KDIGO in 2009 recommended keeping iPTH at two to nine times upper limit of normal, lowering elevated phosphate levels towards the normal range, and maintaining serum calcium in the normal range. The 2017 KDIGO CKD-MBD guideline update revisited these targets but did not make changes to the 2009 recommendations, aside from minor edits[3].

CKD-associated Osteoporosis

Understanding the importance of the other 2 complications of CKD-MBD, the KDIGO 2017 guideline update recommended bone mineral density (BMD) testing, but due to the lack of evidence-based treatment options for renal bone disease, it was only indicated “if result will impact treatment decisions”. Not surprisingly, BMD was hardly performed in patients with advanced CKD locally, as most nephrologists are not familiar with interpreting BMD results or how to manage low BMD[3]. KDIGO convened a CKD-MBD guideline implementation summit in 2018 and participants from eight Eastern and Southern Asian countries with a comparable high-to-middle-income economic ranking by the World Bank, including Singapore, similarly opined that due to the lack of re-imbursement for DEXA scans in most countries and uncertainties about the safety and efficacy of anti-osteoporotic drugs in patients with advanced CKD, they would not insist on having BMD measured and reimbursed in patients with CKD G3a-G5D[4]. Patients with advanced CKD may have osteoporosis co-existing with CKD-MBD. To differentiate between the two, bone biopsy and histomorphometry are the gold standards. However, bone biopsy is invasive, and patients are mostly reluctant to undergo invasive procedures. Expertise to interpret bone biopsy is also lacking. Due to these reasons, the KDIGO 2017 guideline update de-emphasises the requirement of a bone biopsy prior to initiating antiresorptive and other osteoporosis therapy in dialysis patients. However, we do not have serum biomarkers or non-invasive imaging tools to differentiate CKD-MBD from osteoporosis. Furthermore, patients usually do not exhibit symptoms until they have a fracture.

Singapore General Hospital previously reported that 45.6% of patients who underwent kidney transplantation had low bone mass at time of the kidney transplant[5]. In Hong Kong, at least 60% of patients receiving peritoneal dialysis had low bone mass[6], depending on the sites, indicating that low bone mass is a highly prevalent complication in dialysis patients. Hence, it is not surprising that dialysis patients

develop fragility fracture. BMD testing is sometimes performed, and patients are commonly referred to non-renal specialists for the treatment of post-menopausal or age associated osteoporosis.

Osteoporosis in patients without CKD are managed with a very different approach. Bone modifying agents such as bisphosphonate and Receptor Activator of NF-kappa B ligand (RANKL) inhibitors are used, targeting mostly osteoclasts. Recently, anabolic agents such as anti-Sclerostin antibodies became available, targeting osteoblasts and, to a certain extent, osteoclasts as well. However, most of these therapies have not been studied in clinical trials specifically for patients with CKD with eGFR < 30ml/min per 1.73m^2. Studies on biphosphates have mostly excluded patients with eGFR<30mls/min/1.73m^2. Although Denosumab (RANK-ligand inhibitor) was thought to be safe in patients with eGFR >15mls/min/1.73m^2, it has not undergone the rigorous randomised clinical trials for patients with advanced CKD. Recently, the FDA put up a warning of the increased risk of severe hypocalcaemia in patients on dialysis receiving Denosumab. Patients with advanced CKD complicated by CKD-MBD have multiple reasons for low bone mass and should not be managed as osteoporosis alone without consideration of CKD-MBD, or vice versa. Hence, it is important for nephrologists to understand both CKD-MBD as well as post-menopausal or age associated osteoporosis.

The PROCEED trial comparing medical (calcimimetics) versus surgical (total parathyroidectomy) therapy observed a significantly greater improvement in low bone mass at the lumbar spine and femoral neck with parathyroidectomy compared to cinacalcet[6]. Interestingly, no improvement in bone mass was observed with either treatment at the radial site. These data suggest that treatment for advanced secondary hyperparathyroidism is useful in improving low bone mass at some sites (femoral neck and lumbar spine) in dialysis patients but not the distal radius.

As the follow up period was only 12 months, it is uncertain if bone mass will continue to increase beyond this timeframe. On the other hand, the lack of improvement in bone mass at the distal radius underscores the need to prevent bone mass loss associated with severe secondary hyperparathyroidism early in dialysis patients. It is crucial that physicians managing low bone mass in patients with advanced CKD and dialysis understand that CKD-MBD frequently co-exists with post-menopausal or age associated osteoporosis in this population.

CKD-associated Cardiovascular Disease

Although VC is highly prevalent in patients with CKD, there is so far no trial data showing therapies that could regress VC and impact outcomes. Given the lack of evidence, the KDIGO guidelines did not recommend regular screening of VC despite its high prevalence. Lateral abdominal X-Ray may detect presence or absence of abdominal aortic calcification and echocardiography may be used to assess valvular calcification, but both are non-quantitative and subjective. CT based technique is used to quantify the coronary artery calcium score and heart valves calcium scores, but it is expensive, and patients are subjected to radiation. Positive calcium balance is thought to drive VC, but there is no test available that can measure calcium balance in clinical practice. Even though there were two previous calcium balance studies suggesting that our patients with CKD are at high risk of positive calcium balance, and that we should avoid loading them with exogenous calcium supplement, recent published European calcium consensus paper expressed the concern of doing skeletal harm with too little calcium intake. Currently, a dietary calcium intake of at least 800-1000mg/day is recommended for patients with CKD[7].

VC is well-recognised as an active cell-mediated process that involves phenotypic transformation of vascular smooth muscle cells to osteoblast-like phenotype cells in uremic calcifying serum. However, we do not yet have an effective treatment that retards VC. Furthermore, there is so far no human trial showing regression in coronary artery calcium scores or heart valve calcium scores with any medical therapies. Non-calcium-based binders such as lanthanum carbonate and sevelamer carbonate were marketed for its potential in lowering phosphate and preventing VC, but evidence to support this claim remains elusive. A recent meta-analysis in 2022 by Yu et al examined different interventions to attenuate progression of vascular calcification in CKD and included 17 trials of non-calcium-based phosphate binders versus calcium-based phosphate binders. The meta-analysis concluded that there were insufficient or conflicting data regarding the different interventions for mitigation of VC in people with CKD[8].

Vitamin K was hypothesised to prevent VC by increasing calcification inhibitors Matrix GLA protein, one of the most powerful naturally occurring inhibitors of arterial calcification. Vitamin K is required as a co-factor for Matric GLA protein to undergo post translational γ-carboxylation and phosphorylation and become biologically active matrix GLA protein. Unfortunately, no randomised trials in patients with CKD have demonstrated their efficacy in preventing or retarding vascular calcification. Locally, the National University Hospital conducted a clinical trial using three times per week 360ug of oral Vit K2 over an 18-month period to see if it reduces the progression of VC in patients on haemodialysis. The result of the clinical trial was negative.

Magnesium has also been postulated to prevent VC by downregulating pathways involved in the transcription of osteoblast genes and potentially playing a role in the maturation of calciprotein particles[9]. However, there is so far no evidence to suggest that supplementing patients with magnesium can prevent VC.

Calcimimetics, when first approved in the early 2000s for the treatment of renal related hyperparathyroidism was shown in animal models to significantly retard progression of vascular calcification. It effectively manages secondary hyperparathyroidism, reduces parathyroid hormone level, and lowers plasma calcium and phosphate, all of which are important mediating factors for the process of VC. Unfortunately, the EVOLVE trial, a randomised controlled trial of cinacalcet versus placebo, did not confirm a significant benefit in reducing cardiovascular as well as all-cause mortality. However, a subgroup-analysis of the trial demonstrated a potential benefit in individuals greater than 65 years old[10]. Similarly, Wang et al in a study compared cinacalcet vs parathyroidectomy in peritoneal dialysis patients with advanced secondary hyperparathyroidism (defined as those with iPTH ≥ 800pg/mL and refractory to vitamin D analog treatment or those with baseline serum calcium precluding the use of vitamin D analog) over 12 months[6]. The trial was unable to demonstrate significant reduction in various cardiovascular surrogates including LV mass index, coronary artery calcium score, heart valve calcium score and aortic stiffness in both treatment groups, but notably, there was no progression of these cardiovascular surrogates as well.

The KDIGO organised a controversy conference on CKD-MBD titled “Progress and Knowledge Gaps Toward Personalizing Care” in October 2023. Four major aspects of CKD-MBD were discussed:
1) management of secondary hyperparathyroidism;
2) osteoporosis, bone morphology and histopathology;
3) maintenance of phosphate and calcium homeostasis; and
4) diagnostic tests and interventions for cardiovascular calcifications.

The report was recently published[1]. There is general consensus among the participants that the current PTH-centric approach may be insufficient to address the high prevalence of fracture among patients with CKD. CKD-associated osteoporosis is a new term that is used to describe a distinct

form of osteoporosis with overlapping metabolic bone disease. Treatment strategies for CKD-associated osteoporosis should be tailored to the distinct features of bone quality that are impaired in the individual, rather than following algorithms designed for postmenopausal osteoporosis or renal osteodystrophy. CKD-associated cardiovascular disease is also a new term that was proposed during the meeting to include vascular calcification and valvular calcification, which contribute to left ventricular hypertrophy and heart failure, and are associated with sudden death in CKD. Treatment of vascular calcification continues to be a challenge. Even though optimising calcium and phosphate control is considered an important aspect in optimising management of secondary hyperparathyroidism, serum calcium and phosphate do not reflect total body stores as these minerals are both largely stored in the bone. More research is required to understand the mechanisms of bone pathology and vascular/valvular calcification in kidney disease and how we can ameliorate bone and vascular/valvular pathology in patients with CKD.

Conclusion

Understanding and management of CKD-MBD have evolved to now include entities that were not traditionally included in nephrology training. It has become obvious that crosstalk between the kidneys and other organs, such as bones and cardiovascular system, is a lot more complex than what we knew. It is time for the nephrology community to embrace these changes and be holistic in managing all three components of CKD-MBD simultaneously.

Important Takeaways

- CKD-MBD is no longer about biomarkers that we measure. It is also about bone health and cardiovascular health.
- CKD-associated osteoporosis is a new term that describes a distinct form of osteoporosis in patients with CKD, with overlapping metabolic bone disease, in which renal osteodystrophy contributes significantly to impaired bone quality and increased bone fragility.
- Management of CKD-associated osteoporosis should be tailored to the distinct features of bone quality that are impaired in an individual, rather than being driven by an algorithm.
- CKD-associated cardiovascular disease is a term used to describe the complex process in which disturbed mineral metabolism is an important driver, leading to vascular calcification, valvular calcification, left ventricular hypertrophy and heart failure.

Table 1: Commonly Used Bone Modifying Agent and eGFR Cut-off

Drugs	Dosage	eGFR cut off
Alendronate	70mg PO weekly	eGFR>35mls/min
Ibandronate	150mg PO once monthly or 3mg IV every 3 month	eGFR >30mls/min
Risedronate	5mg PO daily or 35mg PO weekly	eGFR >30mls/min
Denosumab	60mg Subcutaneous 6 monthly	Any eGFR
Teriparatide	20-40ug Subcutaneous daily	eGFR >30mls/min
Romozuzumab	210mg Subcutaneously monthly	Not studied in CKD

Table adapted from Clin J Am Soc Nephrol 13: ccc–ccc, June, 2018[11]

References

1. Markus Ketteler et al. Chronic Kidney Disease-Mineral and bone disorder: conclusions from a Kidney Disease: Improving Global Outcomes (KDIGO) Controversies Conference. Kidney Int (2024).
2. Kidney Disease: Improving Global Outcomes (KDIGO) CKD-MBD Work Group. KDIGO clinical practice guideline for the diagnosis, evaluation, prevention, and treatment of Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD). Kidney Int Suppl S1-130 (2009).
3. KDIGO 2017 Clinical Practice Guideline Update for the Diagnosis, Evaluation, Prevention, and Treatment of Chronic Kidney Disease–Mineral and Bone Disorder (CKD-MBD). 7, (2017).
4. Wang, A. Y.-M. et al. 2017 Kidney Disease: Improving Global Outcomes (KDIGO) Chronic Kidney Disease–Mineral and Bone Disorder (CKD-MBD) Guideline Update Implementation: Asia Summit Conference Report. Kidney Int Rep 4, 1523–1537 (2019).
5. Shao, D. et al. Prevalence and Patterns of Bone Loss in the First Year After Renal Transplant in South East Asian Patients. 92, 557–563 (2011).
6. Wang, A. Y.-M., Tang, T.-K., Yau, Y.-Y. & Lo, W. K. Impact of Parathyroidectomy Versus Oral Cinacalcet on Bone Mineral Density in Patients on Peritoneal Dialysis With Advanced Secondary Hyperparathyroidism: The PROCEED Pilot Randomized Trial. American Journal of Kidney Diseases 83, 456-466.e1 (2024).
7. Evenepoel, P. et al. Recommended calcium intake in adults and children with chronic kidney disease-a European consensus statement. Nephrology Dialysis Transplantation 39, 341–366 (2024).
8. Xu, C., Smith, E. R., Tiong, M. K., Ruderman, I. & Toussaint, N. D. Interventions To Attenuate Vascular Calcification Progression in Chronic Kidney Disease: A Systematic Review of Clinical Trials. Journal of the American Society of Nephrology vol. 33 1011–1032 Preprint at https://doi.org/10.1681/ASN.2021101327 (2022).
9. ter Braake, A. D., Vervloet, M. G., de Baaij, J. H. F. & Hoenderop, J. G. J. Magnesium to prevent kidney disease-associated vascular calcification: crystal clear? Nephrology Dialysis Transplantation 37, 421–429 (2022).
10. Effect of Cinacalcet on Cardiovascular Disease in Patients Undergoing Dialysis. New England Journal of Medicine 367, 2482–2494 (2012).
11. Khairallah, P. & Nickolas, T. L. Management of Osteoporosis in CKD. Clinical Journal of the American Society of Nephrology 13, 962–969 (2018).

Utilising the Kidney Failure Risk Equation in the Malaysian Context

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The prevalence of chronic kidney disease (CKD) increases exponentially with age, with common identifiable and modifiable risk factors including diabetes mellitus, hypertension and obesity[1]. The burden of CKD in Malaysia is projected to significantly increase in the future due to the rising prevalence of diabetes and hypertension, coupled with an ageing population[2]. The socioeconomic and health consequences of this expected rise in prevalence raise concerns among stakeholders[2]. Late referral of patients with established kidney failure requiring kidney replacement therapy (KRT) to nephrologists is associated with poorer prognosis and an increase in the overall health care costs[3]. A great number of patients requiring KRT have progressed from earlier stages of CKD, and many could have been identified and referred earlier. The Kidney Disease: Improving Global Outcomes (KDIGO) 2012 guidelines utilised a “heat map” that categorised CKD based on albuminuria and eGFR, emphasising disease severity and prognosis[4]. However, while the colour-coded system effectively stratified risk, it lacked the precision and clarity offered by presenting percentages or numerical values which are often more comprehensible to patients, enabling better understanding and engagement in managing their condition. In recent years, the usage of Kidney Failure Risk Equations (KFRE)[5] has been widely adopted as it predicts future risk of CKD progression in percentages which enhances patients’ understanding of their individual risk and aids primary care physicians in making timely and appropriate referrals to nephrology services.

In many medical conditions, risk prediction equations have led to better adherence to treatment guidelines and have encouraged individual's decision-making[6, 7]. Predicting the risk of kidney failure is important for decision-making by patients, physicians and healthcare systems. Accurate risk prediction of CKD progression may aid patients' understanding about their own conditions and improve their adherence to CKD therapies. Different categories of KFRE scores place the patients at low, medium, or high risk, which determine the further actions to refer the patients to renal care[5]. For instance:

	Patients with eGFR 30-59ml/min per 1.73m² (CKD Stage 3)	Patients with eGFR 15-29ml/min per 1.73m² (CKD Stage 4)
Low risk	<5% over 5 years	<10% over 2 years
Medium risk	5-15% over 5 years	10-20% over 2 years
High risk	>15% over 5 years	>20% over 2 years

However, in our local context, we explored an alternative approach to formulating KFRE scores considering potential variations in formations and baseline determinants, such as:

1) **The numbers of variables** - 4-variable (age, gender, eGFR, and urine ACR) versus 8-variable (adding another 4 parameters such as serum albumin, serum corrected calcium, serum phosphate and serum bicarbonate)[5]

2) **eGFR calculation using** - CKD-EPI 2009[8] versus CKD-EPI 2021[9]

3) **Predicted ACR** defined as conversion of urine protein-creatinine ratio (PCR) to urine albumin-creatinine ratio (ACR) (using *https://ckdpcrisk.org/pcr2acr/*)[10]

We have collected a total of 10,391 patient data in our cohort, including patients attending primary care, diabetic and nephrology clinics in 2022 at our hospital.

Numbers of Variables

In our study, we found that the differences between the 4-variable and 8-variable models for 2-year and 5-year risk were -0.2% (p= 0.04) and -1.4% (p<0.001) respectively. Even though the difference was statistically significant, it was not clinically significant, as the magnitude of the difference is negligible. Therefore, utilising the 4-variable model is a pragmatic approach to reducing overall healthcare costs, since the additional laboratory data required by the 8-variable model may not be readily available in some settings.

Table 1: Difference in the KFRE Scores Based on 4-Variable and 8-Variable

No.	Test	Difference	p-value
1	KFRE_2year_2009_4var - KFRE_2year_2009_8var	-0.2%	0.04
2	KFRE_2year_2021_4var - KFRE_2year_2021_8var	-0.3%	0.01
3	KFRE_5year_2009_4var - KFRE_5year_2009_8var	-1.4%	< 0.001
4	KFRE_5year_2021_4var - KFRE_5year_2021_8var	-1.4%	< 0.001

Different Formulation in eGFR Calculation

In our analyses, we found that the difference in the KFRE scores (using the 4-variable model) based on the different eGFR calculators was not statistically significant. The difference was only -0.1% (p= 0.868) and -0.2% (p=0.868) using CKD-Epi 2009 and CKD-Epi 2021 respectively. This could be due to the minimal deviation in the median eGFR from creatinine-based measurements across the different CKD-Epi calculators.

Table 2: Difference in the KFRE Scores Based on eGFR Calculator Using CKD-Epi 2009 Versus CKD-Epi 2021

No.	Test	Difference	p-value
1	KFRE_2year_2009_4var - KFRE_2year_2021_4var	-0.1%	0.868
2	KFRE_2year_2009_8var - KFRE_2year_2021_8var	+0.1%	0.791
3	KFRE_5year_2009_4var - KFRE_5year_2021_4var	-0.2%	0.868
4	KFRE_5year_2009_8var - KFRE_5year_2021_8var	+0.1%	0.791

Conversion of Urine PCR to Urine ACR

Out of the total cohort, we had 5,157 patients with urine ACR only, while 10,298 patients had both combination of urine ACR and predicted urine ACR (conversion of urine PCR to urine ACR). We found that there was a significant result from this formulation, which was -2.4% and -6.5% (both p<0.001) for using urine ACR alone versus urine ACR added with predicted urine ACR for both 2-year and 5-year risks respectively (using the 4-variable model and eGFR calculation 2009). This discrepancy might lead to a higher risk score, unnecessarily increasing patients' anxiety, referrals and healthcare costs. Possible reason for this is high variability in spot urine measurements. The predicted urine ACR was derived from correlation study on the conversion from spot urine PCR to urine ACR (*https://ckdpcrisk.org/pcr2acr/*).

Table 3: Difference in the KFRE Scores Based on Urine ACR Alone Versus Urine ACR + Predicted ACR

No.	Test	Difference	p-value
1	KFRE_2year_2009_4var_acr - KFRE_2year_2009_4var_acr+pcr	-2.4%	< 0.001
2	KFRE_2year_2009_8var_acr - KFRE_2year_2009_8var_acr+pcr	-3.8%	< 0.001
3	KFRE_5year_2009_4var_acr - KFRE_5year_2009_4var_acr+pcr	-6.5%	< 0.001
4	KFRE_5year_2009_8var_acr - KFRE_5year_2009_8var_acr+pcr	-10.6%	< 0.001

Therefore, in the optimal scenario using urine ACR, KFRE 4-variable model performs equally well as the 8-variable model. However, when including those with urine PCR converted to urine ACR, the differences in KFRE become more pronounced. Therefore, we recommend using the KFRE 4-variable model with urine ACR for CKD risk prediction in local settings.

The Malaysian Society of Nephrology has started an initiative in 2024 to collaborate with major private laboratories to implement automated KRFE risk scores in laboratory reports. The next step is to integrate KFRE scores into public government health clinics to enable primary care doctors to make timely referrals to nephrology services. This process should be accompanied by adequate training and guidance for primary care doctors, as well as efforts to raise awareness and disseminate knowledge among them. Such initiatives aim to ensure timely and appropriate patient referrals, ultimately reducing overall healthcare costs.

References

1. Hooi, L.S., et al., A population-based study measuring the prevalence of chronic kidney disease among adults in West Malaysia. Kidney International, 2013. 84(5): p. 1034-1040.
2. Mustapha, F. and S. Bavanandan, National action plan for healthy kidneys (ACT-KID) 2018-2025. Ministry of Health Malaysia, 2018.
3. Kidney Disease Statistics for the United States. National Institute of Diabetes and Digestive and Kidney Diseases, May 2023.
4. Levin, A., et al., Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney international supplements, 2013. 3(1): p. 1-150.
5. Tangri, N., et al., A predictive model for progression of chronic kidney disease to kidney failure. Jama, 2011. 305(15): p. 1553-1559.
6. Leslie, W.D., S. Morin, and L.M. Lix, A before-and-after study of fracture risk reporting and osteoporosis treatment initiation. Annals of Internal Medicine, 2010. 153(9): p. 580-586.
7. Pozen, M.W., et al., A predictive instrument to improve coronary-care-unit admission practices in acute ischemic heart disease: a prospective multicenter clinical trial. New England Journal of Medicine, 1984. 310(20): p. 1273-1278.
8. Levey, A.S., et al., A new equation to estimate glomerular filtration rate. Annals of internal medicine, 2009. 150(9): p. 604-612.
9. Inker, L.A., et al., New creatinine-and cystatin C–based equations to estimate GFR without race. New England Journal of Medicine, 2021. 385(19): p. 1737-1749.
10. Sumida, K., et al., Conversion of urine protein–creatinine ratio or urine dipstick protein to urine albumin–creatinine ratio for use in chronic kidney disease screening and prognosis: an individual participant-based meta-analysis. Annals of internal medicine, 2020. 173(6): p. 426-435.

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