

# **Medication adherence assessment practices in dialysis settings: A survey of renal nurses' perceptions**

**Running title:** Perceptions on adherence assessment practices

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**Acknowledgements**

The authors thank all renal nurses for their participation in this study. Sincere thanks goes to Renal Society of Australasia (RSA) for their support during the conduct of the study. Also, a sincere gratitude goes to Division of Pharmacy, University of Tasmania for providing pre-paid gift vouchers for the survey participants.

**Conflicts of interest statement**

The authors declare no conflicts of interest

**Funding**

None

## **Abstract**

**Aims and objectives.** To measure renal nurses' perceptions on assessing medication adherence in patients undergoing dialysis.

**Background.** Renal nurses play a vital role in caring for patients undergoing dialysis. Despite the high prevalence of medication nonadherence in chronic dialysis patients, little is known about renal nurses' perceptions and current adherence assessment practices.

**Design.** A cross-sectional survey.

**Methods.** Participants completed an online survey between March and May 2016. Five psychometric scales were used to measure perception on prevalence and contributors of nonadherence, effective methods of assessment, barriers to assessment, and confidence to assess adherence. The survey also captured current adherence assessment practices using a four-point graded response (1 = do not practice at all to 4 = practice for every patient).

**Results.** A total of 113 dialysis nurses completed the survey. The majority agreed that patients in their unit are nonadherent to their medicines (74.5%, n = 82; median = 8). Most nurses agreed that having dedicated professionals conducting medication history interviews can be effective in identifying nonadherence (88.9%, n = 96; median = 8). Objective assessment through blood results was the most frequently used method to determine nonadherence (83.2%, n = 89), with little attention being paid to patients' self-reports of adherence (55.1%, n = 59). Time constraints, administrative support, and patients' disinterest in discussing medication-related issues with the nurses were perceived as barriers to assessing adherence.

**Conclusions.** Patient self-reported measures to assess adherence were under-utilised by the renal nurses, whereas objective blood monitoring was routinely used. Overcoming dialysis

nurses' work-related barriers may facilitate the effective monitoring and promotion of medication adherence in chronic dialysis patients.

**Relevance to clinical practice.** Results from this study [emphasize](#) the need for proper assessment of dialysis patient's medication-taking behaviour during routine dialysis to ensure the benefits of prescribed therapies.

## **Key words**

adherence assessment practices, cross-sectional survey, dialysis, chronic kidney failure, medication adherence, renal nurses

## **Introduction**

Medication nonadherence often leads to poor patient outcomes in chronic diseases (Ingersoll & Cohen, 2008). The negative impact of nonadherence is such that alleviating it would result in greater public health gains than developing newer, costly therapies (Ingersoll & Cohen, 2008; Sabaté, 2003). The reasons for nonadherence depend on the disease and the complexity of the regimens prescribed (Osterberg & Blaschke, 2005). Chronic kidney disease (CKD) patients in general, and patients receiving dialysis in particular, are at high risk of medication nonadherence. This may be due to an increased burden of concomitant illness and dialysis-related problems, leading to an increased complexity of various treatment regimens (Ghimire, Peterson, Castelino, Jose, & Zaidi, 2016). In general, 50% of the patients undergoing dialysis do not adhere to part of their treatment regimen, with nonadherence to medication ranging between 12.5% and 98.6% (Ghimire, Castelino, Lioufas, Peterson, & Zaidi, 2015; Kammerer, Garry, Hartigan, Carter, & Erlich, 2007). The worsening of the underlying illness in patients undergoing dialysis following medication nonadherence has been associated with increased mortality and repeated hospitalizations, placing a substantial financial burden on the healthcare system (Ghimire et al., 2015).

## **Background**

The current research on medication adherence primarily focuses on understanding and changing the medication-taking behaviour of patients, rather than on understanding and changing the healthcare system inadequacies that may affect adherence in patients (Clyne et al., 2016; Mangan, Powers, & Lengel, 2013). Patients who had shorter consultations with their doctor or a healthcare professional that lacked a discussion on medication-related issues were found to be nonadherent to their prescribed treatment (Rifkin et al., 2010; Williams, Manias,

& Walker, 2008). Engaging patients in a meaningful conversation about their medication use may not be a straightforward solution to this problem. Healthcare professionals have reported time availability and work pressures as barriers to assessing a patient's ability to take medications, and to investigating any impediments to medication adherence (Williams et al., 2008).

Despite extensive research on the incidence, measurement, and improvement of medication adherence (Osterberg & Blaschke, 2005), little is known about the actual practices of measuring adherence in clinical settings. The extent to which renal nurses are aware of adherence measurement practices, and how much time is devoted to measuring and promoting adherence in patients undergoing dialysis, is unknown. Renal nurses working with patients get to know them well as they see them frequently, usually three times a week for a period of three-to-five hours a day. Such level of engagement provides an exceptional opportunity for the dialysis nurses to educate and promote medication adherence in patients undergoing dialysis.

Nevertheless, an understanding of dialysis nurses' perceptions of adherence assessment practices, and the likely barriers to monitoring, and improving medication adherence is essential before nurses can take part in any quality initiative targeting nonadherence. Therefore, this study was designed to understand renal nurses' perceptions on medication adherence assessment practices in patients undergoing dialysis.

## **Methods**

### **Study design**

An online cross-sectional survey method was used. We followed the STROBE guidelines for the design and reporting of this research (Vandenbroucke et al., 2007).

## **Setting and participants**

All dialysis nurses practising in Australian dialysis settings were eligible to participate. We recruited participants through the professional renal association, the Renal Society of Australasia (RSA) as recruiting them directly was not practicable due to absence of guaranteed means of identifying renal nurses individually.

## **Data collection**

An online survey was conducted for a period of three months between March and May, 2016. We coordinated with the professional association to send [information](#) that described the study's aims, and which gave a web address for the survey, to dialysis nurses through email alerts, social media posts, and e-newsletters. Reminders were sent on a fortnightly basis. After the survey was completed, we randomly selected eight participants who had opted in to win gift vouchers valued at AUD \$100. Although offering incentives to respond has been found to influence survey response (Eleanor & Cong, 2012), the draw amount was insignificant for the nursing professionals, and our intention was mainly to thank participants for their contribution.

## **Survey instrument**

During the thorough literature search, we could not identify any validated tools that particularly measured dialysis nurses' perceptions regarding adherence assessment practices. Hence we adapted a previously developed survey instrument that measured renal pharmacists' perceptions and practices of assessing adherence in dialysis settings (Ghimire, Banks, Jose, Castelino, & Zaidi, 2017). To briefly describe the instrument, it comprised seven sections that explored demographics, perceptions of the prevalence of, and contributors to nonadherence,

the perceived effectiveness of methods used to detect nonadherence, barriers to adherence assessment, and participants' confidence in assessing adherence. A 10-point Likert scale of agreement was used to measure perception (1 = strongly disagree, 10 = strongly agree). The last section comprised questions related to the current practices of assessing adherence in dialysis patients, and used four-point graded response where one meant "do not practice at all", and four meant "practice for every patient".

### **Statistical analysis**

Data were entered and analysed in SPSS version 23.0 (IBM Corp., Armonk, N.Y., USA). Demographic characteristics were ascertained through descriptive analysis. Kolmogorov-Smirnov and Shapiro-Wilks tests were performed to assess normality. Perception scores were summarised using the median and the inter quartile range (IQR). Mann-Whitney or Kruskal-Wallis tests was performed to detect the differences in median scores for non-normally distributed data. The Dunn-Bonferroni test was used to identify statistically significant differences between intergroup variables as a post-hoc analysis (Dunn, 1964). Cronbach's alpha coefficient was used to measure the internal consistency reliability of the perception scales. A p value of  $< 0.05$  was considered statistically significant.

### **Ethics**

Ethics approval was granted by the Tasmanian Social Sciences Human Research Ethics Committee (reference number: H0015433).



## **Results**

A total of 113 renal nurses completed the survey. The majority of the participants were female (92.0%, n = 104), with 11-20 years of experience in renal units (47.8%, n = 54). As participants were recruited indirectly through the RSA, which has over 1800 members, including nurses, technicians, social workers, dietitians, and other allied health professionals, we could not gauge the actual survey response rate for renal nurses alone. Nevertheless, this study was not aimed at generalisability, but for developing and piloting the survey instrument to inform larger nation-wide studies in dialysis settings. The characteristics of the respondents are presented in **Table 1**.

### **Internal consistency and reliability of scales**

The overall reliability comprising all five scales demonstrated a good level of internal consistency, with an alpha score of 0.84. The following were the reliability coefficients for each scale: perceived prevalence scale (0.85), perceived contributors (0.83), perceived effectiveness (0.67), perceived barriers (0.70), and participant confidence (0.90). **Appendix 1** contains the particulars of the Inter-Item Correlation Matrix, and Cronbach's alpha coefficients for each scale.

### **Perceived prevalence and contributors of nonadherence**

The majority of renal nurses believe dialysis patients in their unit often forget to take their medicines (median = 8), rarely ask questions about medicines (median = 7), are unable to answer medicine-related questions (median = 7), and are often confused about their medicines (median = 7). The majority of the nurses thought that having limited understanding of their disease (median = 7), being prescribed with complex medication regimens (median = 7),

lacking family or social support (median = 7), having low educational backgrounds (median = 7), and low income (median = 7) contributed to medication nonadherence in dialysis patients. The majority of the participants disagreed that being older (median = 4) or male (median = 5) contributed to nonadherence behavior, however (**Table 2**).

### **Perceived effectiveness and barriers to assessing adherence**

The majority of renal nurses agreed that having dedicated professionals who take medication histories (median = 8), or having pharmacists who conduct medication reviews and reconciliations (median = 9) can be effective in assessing adherence. High median ratings were also observed for the effectiveness of assessing adherence through objective methods, such as blood results or physical assessment (median = 8), and through subjective methods, such as conducting medication history interviews (median = 8).

Renal nurses disagreed that they lacked the knowledge and skills to assess adherence (median = 2), but over one-third perceived that they lacked the time needed to undertake adherence promoting activities (median = 4). Furthermore, over a third of the participants reported that they lacked administrative support from hospital in conducting adherence promoting activities (median = 5). Nearly a quarter of the nurses also perceived that patients are not interested in discussing medication-related issues with them (median = 3) (**Table 3**).

### **Participants' confidence in assessing adherence**

Dialysis nurses' median confidence ratings were higher in terms of ability to suggest strategies to improve adherence (median = 8), followed by ability to assess patients' knowledge and beliefs about medicines (median = 8), conduct a medication history interview (median = 8), and provide medication counselling (median = 8) (**Table 3**).

### Differences in perceptions based on study demographics

Participant age significantly affected their median scores on perceived barriers ( $\chi^2$  (3,  $N = 108$ ) = 11.52,  $p < 0.01$ ). Younger nurses aged 20-30 years perceived more barriers than their elder counterparts aged 41-50 years (median: 5 vs 2,  $p < 0.05$ ), and  $\geq 51$  years (median: 5 vs 2,  $p < 0.05$ ). Similarly, significant differences were observed in perceived contributor scores based on professional designation ( $\chi^2$  (2,  $N = 108$ ) = 6.76,  $p < 0.05$ ). Registered nurses perceived more contributors to nonadherence than the nurse unit managers (median: 7 vs 5,  $p < 0.05$ ). Participants' experiences in renal units also influenced their confidence scores ( $\chi^2$  (2,  $N = 108$ ) = 6.21,  $p < 0.05$ ). Nurses with 1-10 years of experience were less confident in assessing adherence than participants with 11-20 years (median: 7 vs 8,  $p < 0.05$ ), and with  $\geq 21$  years (median: 7 vs 8,  $p < 0.05$ ) of experience (**Table 4**).

### Current practices of assessing adherence

**Figure 1** depicts the renal nurses' reports on current adherence assessment practices in dialysis centres. Assessing adherence objectively through blood results or physical assessment was routinely conducted for every patient (83.2%,  $n = 89$ ). The majority of the participants reported that pharmacists were not available for medication reviews and reconciliation activities (65.1%,  $n = 69$ ), and almost half of the participants mentioned that dedicated professionals were not assigned to conducting medication history interviews (46.7%,  $n = 49$ ). Similarly, only around half of the participants (55.1%,  $n = 59$ ) reported that medication history interviews were conducted for every patient. Patients' families or carers were asked about medication only when those patients were thought to have a high risk of adverse effects (45.8%,  $n = 49$ ).

Similarly, asking patients to bring medications and counting them was mainly practiced in high risk patients (33.0%, n = 35).

### **Qualitative comments**

The qualitative comments reinforced the survey findings regarding contributors of nonadherence, such as lack of knowledge about medicines, comorbid illnesses, tablet burden, culture and communication barriers, lack of support, forgetfulness, and relative affordability of medicines. Nurses also highlighted the need for a sustainable strategy to empower self-management in patients taking long-term medications. There was a recurring theme in the desire for a designated renal pharmacist in dialysis settings to manage medication-related issues. Furthermore, nurses reported that patients trusted their doctors with medical decisions, and preferred communicating with them rather than with the nurses. Due to long waiting times for consultations, however, their medication-related queries remain unanswered. This subsequently nurtured nonadherence behaviour in patients undergoing dialysis. The comments are given in **Appendix 2**.

### **Discussion**

We reported renal nurses' perceptions on assessing medication adherence in patients undergoing dialysis. The internal consistency and reliability of the overall scale was good. The findings from this study suggest that current adherence assessment practices are suboptimal, and the methods used to screen patients' medication-taking behaviour are used less in dialysis settings. Renal nurses seemed to be confident in conducting adherence assessment activities, and their level of confidence increased with increased work experience. Lack of time, lack of

support from hospitals, and patients' disinterest in discussing medication-related issues with the nurses were perceived as barriers to assessing adherence. The majority of the nurses acknowledged that having a dedicated pharmacist would be effective in promoting adherence activities, but these services are rarely available in dialysis centres.

### **Nurses' perceptions on medication nonadherence in dialysis patients**

Health professionals are often overly optimistic about adherence behaviour in their patients (Patel & Davis, 2006), however, renal nurses in this study acknowledged the high prevalence of nonadherence behaviour in patients undergoing dialysis. Although adherence to any treatment regimen is a subject of maximum interest, one must not forget the reason why many patients do not adhere to their medications as prescribed. Often this might be an avoidance coping strategy, whereas at other times this might be due to ignorance. As each individual presents with a unique set of circumstances, efforts must be made to understand the reasons behind nonadherence. Renal nurses' perceptions, in this study, corroborated with earlier findings that patient-related factors, such as lack of knowledge about medicines, lack of social support, comorbid conditions, forgetfulness, medication burden, affordability, and culture and communication barriers could influence adherence (Brar, Babakhani, Salifu, & Jindal, 2014; Griva et al., 2013; Lindberg & Lindberg, 2008; Manley et al., 2004).

### **Current adherence assessment practices**

We observed that current adherence assessment practices are limited, and that the methods used to monitor nonadherence behaviour, such as medication history taking, and medication reviews and reconciliation by pharmacists, were only occasionally conducted, whereas objective blood monitoring was a routine practice in most settings. A recent survey on renal pharmacists'

perceptions corroborated the study's findings on current adherence assessment practices in dialysis settings (Ghimire et al., 2017). Objective blood monitoring in patients undergoing dialysis is mainly conducted to ensure that the dialysis prescription, i.e the time and type of the dialysis treatments, are optimal. Although we can also draw inferences from blood results to see if patients are adherent to their medications, particularly, phosphate binders, the reliability of these results can be questioned as they can be affected by various dietary and clinical factors. A preferable approach would be to combine objective measures with subjective ones, such as patient interviews or validated adherence assessment questionnaires (Brar et al., 2014). This may also help to overcome the subjective bias of patient self-reports (Hsu et al., 2015; Wileman et al., 2014).

### **Barriers to adherence assessment practices**

The ability to conduct adherence assessments and promotion activities in dialysis centres may largely depend upon overcoming the barriers recognized in this study, such as time and resource limitations, a lack of hospital support, and most importantly unwillingness from both patients and health professionals to actively participating in discussions to resolve medication-related issues. The delivery of adherence support activities by renal healthcare professionals will also depend upon the knowledge and skills they acquire through tailored education and training, and routine practices (Bajorek et al., 2015; Dayer, Dunn, Pace, & Flowers, 2016).

Dialysis nurses in this study largely disagreed that they lack the knowledge and skills needed to conduct adherence assessment activities, and were instead highly confident about this. The fact that dialysis nurses are involved in managing and assessing the health needs of the patients on a daily basis, and in educating patients about their diseases, prognoses, and treatments may have contributed to higher confidence scoring. Expectedly, the majority of the

renal nurses also endorsed the inclusion of dedicated professionals, especially renal pharmacists, in undertaking adherence assessment activities in patients undergoing dialysis. Positive perceptions towards pharmacists' roles may be due to past experiences of interprofessional collaborations, and awareness of the competency and contribution of pharmacists in delivering pharmaceutical care services (Chevalier & Neville, 2011; Salgado, Moles, Benrimoj, & Fernandez-Llimos, 2013; Sulick & Pathak, 1996). [Interventions by the pharmacists](#) have resulted [in](#) reduced hospitalisation, improved patient satisfaction, and reduced overall treatment expenses in patients undergoing dialysis (Salgado, Moles, Benrimoj, & Fernandez-Llimos, 2012).

### **Integrating adherence assessment practices within nursing roles**

The availability of renal pharmacy services in Australian outpatient dialysis centres is extremely limited (Salgado et al., 2012). Centres receiving pharmacy services on “as necessary” basis might call upon pharmacists for medication reviews only on occasions when a patient's condition is severe and demands inspection of their medication regimen. Although the presence of a dedicated professional or renal specialised pharmacist who can exclusively focus on medication management and adherence promoting activities would be an ideal solution, it is unlikely that this will be integrated into every dialysis centre anytime soon due to time and resource availability (Mangan et al., 2013), finances, and organizational factors (Roberts, Benrimoj, Chen, Williams, & Aslani, 2006; Salgado et al., 2012). Alternative measures include empowering the existing renal nursing services within the dialysis centres as they are the professionals who closely engage with the patients, and are ideally placed to deliver medicines, monitor patient progress, and educate patients in medication self-management to promote adherence (Emsley et al., 2015; Kammerer et al., 2007). Nevertheless, the existing

workload of the dialysis nurses and the barriers to successful incorporation of auxiliary roles, such as adherence assessment and promotion activities, need to be carefully considered in dialysis settings.

### **Implications for nursing practice**

A recent systematic review of trials that assessed the effects of nursing interventions on improving medication adherence among discharged, home-dwelling, and older adults suggested that nurse-led and nurse-collaborative interventions moderately improved medication adherence in discharged older adults (Verloo, Chiolero, Kiszio, Kampel, & Santschi, 2017). Similarly, a nurse-delivered, self-care intervention program for chronic heart failure patients has been found to be effective in improving patients' adherence (Granger et al., 2015). Designing nurse-led tailored interventions suitable for use during dialysis sessions that educate patients on problem-solving, guide behavioural change, and teach them to take action in response to wavering signs and symptoms, can be an effective self-management strategy for improving medication adherence in patients undergoing dialysis (Lindberg & Lindberg, 2008).

Renal nurses, in this study, also emphasised that sustainable strategies for empowering self-management in patients taking long-term medications, and having trusted relationships with healthcare providers, can have a significant influence on patients' adherence. Patients become truthful about taking medication only if they are comfortable to admit their difficulties with no risk of criticism, and when there is a true partnership with their healthcare providers (Martin, Williams, Haskard, & Dimatteo, 2005). Patients with CKD who express dissatisfaction due to an absence of guidance and a lack of discussion about medication-related issues during consultations are found to be less motivated to follow treatment recommendations, to hide their concerns, and to acquire nonadherence behaviours (Rifkin et



al., 2010). Therefore, it is imperative that renal healthcare professionals routinely instigate discussions on medication-related issues with the patients undergoing dialysis.

### **Study limitations**

Participants were not directly recruited, instead email alerts, e-newsletters, and social media posts from the professional organization were relied upon. As such, an absolute denominator for the survey response rate could not be ascertained. This may have led to the inclusion of self-selected participants who were more interested in sharing their perceptions. Nevertheless, an even amount of participation was observed from rural and metropolitan areas, as well as from public and private dialysis centres. The study findings may not be generalisable to dialysis settings across Australia, for example, New South Wales has the highest number of dialysis centres, but there was poor representation from the renal nurses. Nevertheless, the scope of this study was mainly generate baseline observations to inform larger nation-wide surveys.

### **Conclusions**

Clinicians spend a great deal of time prescribing the best possible medications for their patients, yet little attention is paid to measuring adherence and ensuring that patients are adhering to their prescribed medications. The current adherence assessment practices of renal nurses are limited to selective patients utilising objective laboratory-based values instead of patient self-reported measures. Lack of time, administrative support, and patient disinterest in communicating medication issues with the renal nurses, were commonly perceived as barriers to assessing adherence. Strengthening renal nursing services by addressing the existing barriers may be a way to improve medication adherence in patients undergoing haemodialysis.

## **Relevance to clinical practice**

The findings from this study emphasises the need for proper assessment of dialysis patient's medication-taking behaviour during routine dialysis to ensure the benefits of prescribed therapies. Recognition of medication nonadherence in patients will allow healthcare providers and patients to make a collaborative effort in developing patient-specific tailored solutions to address the problem of medication nonadherence.

## **Acknowledgements**

We would like to thank all dialysis nurses who participated in this survey. Our sincere thanks goes to Renal Society of Australasia (RSA) for supporting us while recruiting the survey participants. Likewise, we would like to thank the Division of Pharmacy, University of Tasmania for supporting with gift vouchers for the participants.

## **Conflicts of interest**

The authors declare that they have no conflict of interest.

## **Funding**

None

## **Contributions**

Conception and study design: SG, RLC, and STRZ; Data acquisition: SG, RLC, and STRZ; Data analysis/ interpretation: SG, CB, MDJ, RLC, STRZ; Manuscript preparation: SG

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### **What does this paper contribute to the wider global clinical community?**

- Little is known about the renal nurses' practices of assessing medication adherence during the routine care of patients undergoing dialysis.
- Renal nurses rely on routine laboratory results to detect medication nonadherence, with little to no attention being paid to patient engagement via self-reported measures.
- Lack of time, lack of support from hospital administration, and patients' disinterest in communicating medication-related issues to renal nurses were perceived as barriers to assessing adherence.

**Table 1.** Demographics of survey respondents (n = 113)

Variable	Category	n (%)
Age, Years		47 (range, 25-66)
	20-30	6 (5.3)
	31-40	24 (21.2)
	41-50	39 (34.5)
	≥ 51	44 (38.9)
Gender		
	Male	9 (8.0)
	Female	104 (92.0)
Level of education		
	Diploma	11 (9.7)
	Bachelors	48 (42.5)
	Graduate certificate	46 (40.7)
	Masters and doctorate	8 (7.1)
Designation		
	Enrolled Nurse	2 (1.8)
	Registered Nurse	76 (67.3)
	Nurse Practitioner	7 (6.2)
	Nurse Unit Manager	28 (24.8)
Experience in renal unit, Years		14 (range, 1-36)
	1-10	43 (38.1)
	11-20	54 (47.8)
	≥ 21	16 (14.2)
Australian Territory		
	Victoria	55 (48.7)
	Queensland	16 (14.2)
	Tasmania	16 (14.2)
	New South Wales	13 (11.5)
	Other States	13 (11.5)
Organization type		
	Public	99 (87.6)
	Private	14 (12.4)
Dialysis unit location		
	Metropolitan	52 (46.0)
	Rural	61 (54.0)

Characteristics of dialysis unit		
	Number of dialysis chairs (n = 111)	12 (range, 3-32)
	Number of 1.0 FTE nurse (n = 79)	4 (range, 1-16)
	Presence of nursing educator, Yes	49 (43.4), 0.6 FTE (range, 0.3-1.0)
	Presence of pharmacist, Yes	25 (22.1), 1.0 FTE (range, 0.4-1.0)
	In-centre haemodialysis service (HD)	83 (73.5)
	Peritoneal dialysis service (PD)	2 (1.8)
	Home haemodialysis (Home HD)	1 (0.9)
	All services (HD, Home HD, PD)	27 (23.9)

*Note:* For continuous variables, median (range); for categorical variables, numbers with percentage in parentheses; *Abbreviation:* FTE, full-time equivalent of service

**Table 2.** Perceived prevalence and contributors of nonadherence in dialysis patients

Statements	Participant's Response (%)		Median (IQR)
	Scoring $\leq 5$	Scoring $\geq 6$	
<b>Perceived prevalence</b>			
Have limited understanding of their medications (n = 112)	42.9	57.1	6 (4-8)
Rarely ask questions about medications (n = 112)	34.8	65.2	7 (4-8)
Do not take their medications as prescribed (n = 112)	44.6	55.4	6 (4-7)
Stop taking some medications when feel better (n = 111)	47.7	52.3	6 (3-7)
Are often confused about medicines (n = 111)	37.8	62.2	7 (5-8)
Change dose/dosing interval that suits lifestyles (n = 111)	48.6	51.4	6 (3-7)
Express difficulty in swallowing larger pills (n = 111)	45.9	54.1	6 (3-8)
Don't believe current medicines are helping (n = 111)	66.7	33.3	4 (3-6)
Can't answer questions about medications (n = 111)	36.0	64.5	7 (4-8)
Forget to take medications sometimes (n = 110)	25.5	74.5	8 (5-9)
<b>Perceived contributors</b>			
Older patients are more nonadherent (n = 110)	82.7	17.3	4 (2-5)
Male patients are more nonadherent (n = 110)	67.3	32.7	5 (3-7)
Patients with multiple co-morbidities (n = 109)	43.1	56.9	6 (5-8)
Patients lacking family/social support (n = 109)	28.4	71.6	7 (5-8)
Patients having low income (n = 109)	35.8	64.2	7 (5-8)
Patients having low level education background (n = 109)	29.4	70.6	7 (5-8)
Having different language/cultural background (n = 108)	34.3	65.7	7 (5-8)
Having limited understanding of disease state (n = 109)	22.0	78.0	7 (6-8)
Patients not satisfied with their treatment/care (n = 109)	40.4	59.6	6 (4-8)
Patients with complex medication regimens (n = 109)	28.4	71.6	7 (5-9)

*Note:* Perception measured on a scale of 1-10, where 1 = strongly disagree and 10 = strongly agree; n represents number of participants responding to each item in a questionnaire; *Abbreviation:* IQR, Inter-quartile range.



**Table 3.** Perceived effectiveness, barriers and confidence to assess adherence in dialysis patients

Statements	Participant's Response (%)		Median (IQR)
	Scoring ≤ 5	Scoring ≥ 6	
<b>Perceived effectiveness</b>			
Interviewing patients to obtain medication history (n = 108)	17.6	82.4	8 (6-9)
Asking patient's family/carer about medication (n = 108)	13.0	87.0	7 (6-8)
Measuring objective indicators such as SPL/BP (n = 108)	13.0	87.0	8 (7-9)
Asking patients to bring medications and count (n = 107)	42.1	57.9	7 (4-8)
Having a dedicated professional to take medication history (n = 108)	11.1	88.9	8 (7-9)
Conducting medication reviews and reconciliation by Pharmacist (n = 108)	13.0	87.0	9 (8-10)
<b>Perceived barriers</b>			
Lack of knowledge and skills to assess nonadherence (n = 108)	88.9	11.1	2 (2-3)
Lack of time (n = 108)	62.0	38.0	4 (2-7)
Not my role (n = 106)	94.4	5.6	2 (1-3)
Patient's disinterest on discussing medication issues (n = 108)	75.9	24.1	3 (2-5)
No support from hospital administration (n = 106)	62.3	37.7	5 (2-8)
Never thought about adherence before this survey (n = 108)	93.5	6.5	1 (1-2)
<b>Participants' confidence</b>			
Ability to conduct a medication history interview (n = 108)	14.8	85.2	8 (7-9)
Ability to provide medication counselling (n = 108)	19.4	80.6	8 (6-9)
Ability to clarify patient's medication queries (n = 108)	15.7	84.3	7 (6-9)
Ability to suggest strategies to improve adherence (n = 108)	7.4	92.6	8 (7-9)
Ability to assess patient's knowledge and beliefs about medications (n = 108)	13.0	87.0	8 (7-9)

*Note:* Perception measured on a scale of 1-10, where 1 = strongly disagree and 10 = strongly agree; n represents number of participants responding to each item in a questionnaire; *Abbreviation:* IQR, Inter quartile range; SPL, serum phosphate levels; BP, blood pressure.

**Table 4.** Differences in perceptions based on study demographics across all scales

Variables	Perceived prevalence		Perceived contributors		Perceived effectiveness		Perceived barriers		Participants' confidence	
	Median	Mean Rank	Median	Mean Rank	Median	Mean Rank	Median	Mean Rank	Median	Mean Rank
<b>Age, years <sup>a</sup></b>										
20-30	7	76.3	7	55.2	9	73.3	5	93.1**	7	33.9
31-40	6	53.7	7	60.7	8	56.2	3	62.9	8	54.2
41-50	6	54.8	7	54.3	8	58.0	2	49.2	8	56.2
≥ 51	6	56.8	7	53.7	8	48.3	2	49.8	8	55.6
<b>Gender <sup>b</sup></b>										
Male	6	52.7	7	59.8	8	58.6	2	48.6	7	57.0
Female	6	56.8	7	55.2	8	54.2	3	55.0	8	54.3
<b>Level of education <sup>a</sup></b>										
Diploma	6	49.7	6	42.4	7	38.6	3	51.8	7	38.5
Bachelors	6	51.2	7	55.3	8	61.3	3	54.2	8	55.7
Graduate certificate	7	60.0	7	57.7	8	49.4	3	57.0	8	55.2
Masters and doctorate	8	78.1	7	63.1	8	63.1	2	46.1	8	63.6
<b>Designation <sup>a</sup></b>										
Registered nurse	6	56.7	7	59.9*	8	54.8	3	54.1	8	51.7
Nurse practitioner	6	44.3	5	42.1	7	32.3	4	69.7	7	45.7
Nurse unit manager	7	55.2	5	43.5	8	55.5	2	47.8	8	60.3
<b>Experience in renal unit, Years <sup>a</sup></b>										
1-10	6	54.8	7	56.8	8	55.6	3	60.8	7	45.2*
11-20	7	60.5	7	80.6	8	55.4	2	48.6	8	59.7
≥ 21	6	47.1	6	56.0	8	48.2	3	58.4	8	62.3

*Note:* Perception measured on a scale of 1-10, where 1 = strongly disagree and 10 = strongly agree; in cases where two or more groups have equal medians, the distribution of these groups is represented by mean rank.

<sup>a</sup> Kruskal-Wallis Test. <sup>b</sup> Mann-Whitney Test.

\* P < 0.05; \*\* P < 0.01

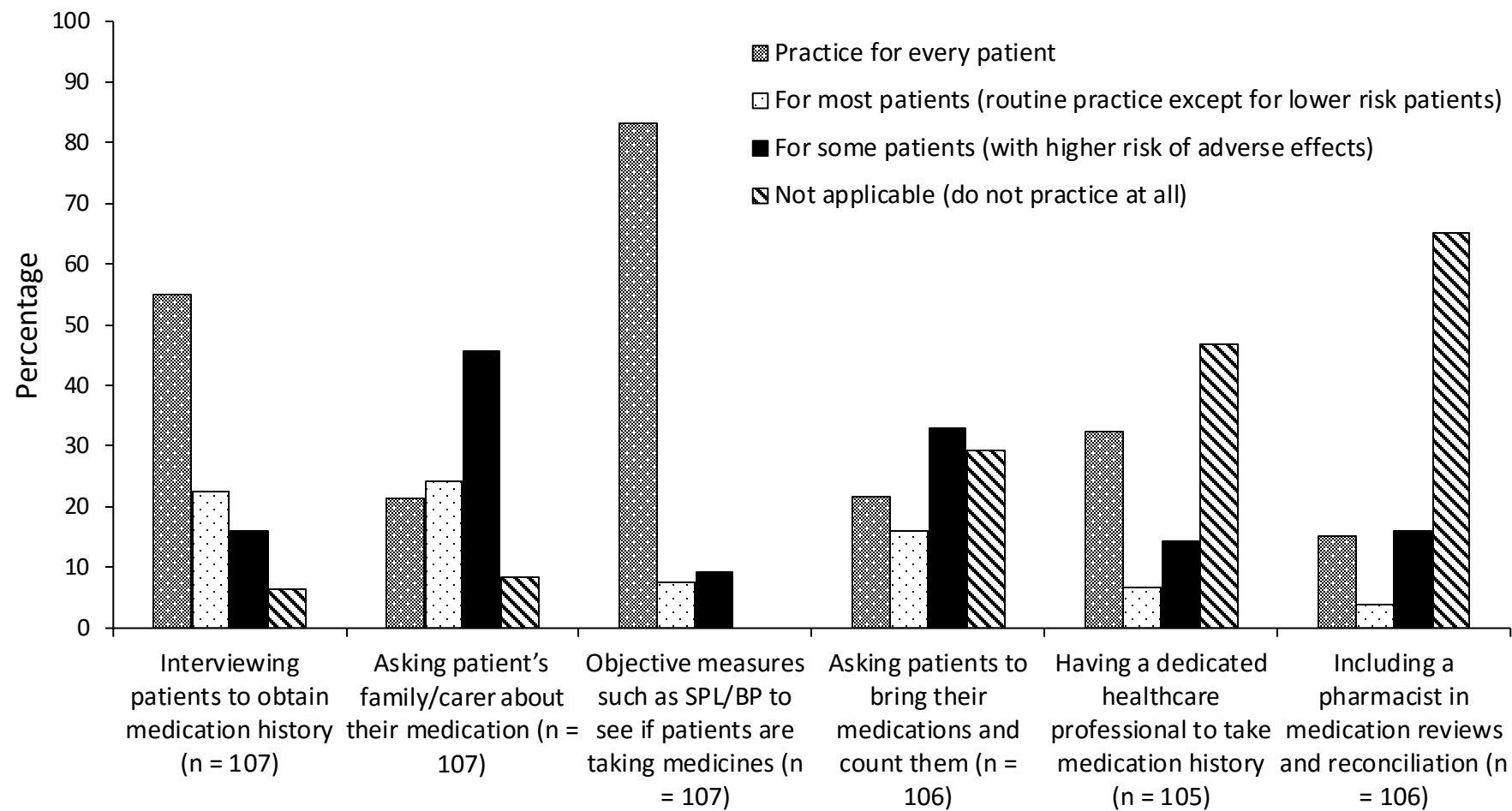
## Figure legends

**Figure 1.** Nurses' reports on current practices of assessing medication adherence in dialysis patients in Australia

## Supplementary Data

**Appendix 1.** Inter-item correlation matrix and Cronbach's alpha coefficients for each [scale](#)

**Appendix 2.** Comments on perceptions and current practices



## **Supplementary Data**

**Appendix 1.** Inter-item correlation matrix and Cronbach's alpha coefficients for each scale

**Appendix 2.** Comments on perceptions and current practices

## Appendix 1. Inter-item correlation matrix and Cronbach's alpha coefficients for each scale

Prevalence scale	1	2	3	4	5	6	7	8	9	10
1. Have limited understanding of medications	<b>0.85</b>									
2. Rarely ask questions about medications	0.59**	<b>0.85</b>								
3. Do not take their medications as prescribed	0.46**	0.32**	<b>0.83</b>							
4. Stop taking some medications when feel better	0.24*	0.17	0.52**	<b>0.83</b>						
5. Are often confused about medicines	0.49**	0.50**	0.60**	0.53**	<b>0.82</b>					
6. Change dose/dosing interval that suits lifestyles	0.12	0.22*	0.48**	0.37**	0.32**	<b>0.85</b>				
7. Express difficulty in swallowing larger pills	-0.06	-0.01	0.35**	0.43**	0.35**	0.29**	<b>0.86</b>			
8. Do not believe current medicines are helping them	0.16	0.16	0.30**	0.53**	0.40**	0.28**	0.51**	<b>0.84</b>		
9. Can't answer questions about current medications	0.57**	0.46**	0.36**	0.43**	0.71**	0.10	0.21**	0.38**	<b>0.83</b>	
10. Forget to take medications sometimes	0.34**	0.26**	0.56**	0.59**	0.58**	0.45**	0.35**	0.43**	0.52**	<b>0.83</b>

Note: Bold values indicates Cronbach's alpha coefficients if item deleted.

\*\* . Correlation is significant at  $p < 0.01$  level (2-tailed).

\*. Correlation is significant at  $p < 0.05$  level (2-tailed).

Contributors scale	1	2	3	4	5	6	7	8	9	10
1. Older patients are more nonadherent	<b>0.84</b>									
2. Male patients are more nonadherent	0.45**	<b>0.83</b>								
3. Patients with multiple co-morbidities	0.23*	0.19**	<b>0.83</b>							
4. Patients lacking family/social support	0.19*	0.30**	0.30**	<b>0.80</b>						
5. Patients having low income	0.21*	0.23*	0.33**	0.67**	<b>0.81</b>					
6. Patients having low level education background	0.18	0.33**	0.29**	0.66**	0.67**	<b>0.80</b>				
7. Having different language/cultural background	0.06	0.05	0.36**	0.44**	0.38**	0.47**	<b>0.83</b>			
8. Having limited understanding of disease state	0.08	0.25**	0.21*	0.64**	0.47**	0.63**	0.38**	<b>0.81</b>		
9. Patients not satisfied with their treatment/care	0.09	0.22*	0.04	0.29**	0.15	0.22*	0.16	0.39**	<b>0.84</b>	
10. Patients with complex medication regimens	0.13	0.28**	0.39**	0.55**	0.50**	0.49**	0.32**	0.69**	0.45**	<b>0.80</b>

Note: Bold values indicates Cronbach's alpha coefficients if item deleted.

\*\* . Correlation is significant at  $p < 0.01$  level (2-tailed).

\*. Correlation is significant at  $p < 0.05$  level (2-tailed).

<b>Effectiveness scale</b>	1	2	3	4	5	6
1. Interviewing patients to obtain medication history	<b>0.66</b>					
2. Asking patient's family/carer about medication	0.41**	<b>0.58</b>				
3. Measuring objective indicators such as SPL/BP	0.17	0.31**	<b>0.65</b>			
4. Asking patients to bring medications and count	0.07	0.40**	0.29**	<b>0.65</b>		
5. Having a dedicated healthcare professional (Nurse/ Doctor/Pharmacist) to take medication history	0.23*	0.39**	0.18	0.29**	<b>0.58</b>	
6. Medication reviews and reconciliation by pharmacist	0.16	0.17	0.09	0.16	0.59**	<b>0.64</b>

*Note:* Bold values indicates Cronbach's alpha coefficients if item deleted.

\*\* . Correlation is significant at  $p < 0.01$  level (2-tailed).

\*. Correlation is significant at  $p < 0.05$  level (2-tailed).

<b>Barriers scale</b>	1	2	3	4	5	6
1. Lack of knowledge and skills to assess nonadherence	<b>0.64</b>					
2. Lack of time	0.47**	<b>0.61</b>				
3. Not my role	0.37**	0.27**	<b>0.69</b>			
4. Patient not interested in discussing medication issues	0.22*	0.29**	0.26**	<b>0.67</b>		
5. No support from hospital administration	0.43**	0.49**	0.19	0.35**	<b>0.65</b>	
6. Never thought about adherence before this survey	0.25**	0.29**	0.19	0.22*	0.05	<b>0.71</b>

*Note:* Bold values indicates Cronbach's alpha coefficients if item deleted.

\*\* . Correlation is significant at  $p < 0.01$  level (2-tailed).

\*. Correlation is significant at  $p < 0.05$  level (2-tailed).

<b>Confidence scale</b>	1	2	3	4	5
1. Ability to conduct a medication history interview	<b>0.88</b>				
2 .Ability to provide medication counselling	0.74**	<b>0.87</b>			
3. Ability to clarify patient's medication queries	0.62**	0.77**	<b>0.88</b>		
4. Ability to suggest strategies to improve adherence	0.63**	0.61**	0.60**	<b>0.89</b>	
5. Ability to assess patient's knowledge and beliefs about medications	0.63**	0.57**	0.62**	0.72**	<b>0.89</b>

*Note:* Bold values indicates Cronbach's alpha coefficients if item deleted.

\*\* . Correlation is significant at  $p < 0.01$  level (2-tailed).

\*. Correlation is significant at  $p < 0.05$  level (2-tailed).

## Appendix 2. Comments on perceptions and current practices

Themes	Exemplar quotes
<b>Lack of sustainable strategy for empowering self-management</b>	
- Medication self-management	Nonadherence also includes poor management of having their medications available to them at all times, places etc. It is not the patients' intention to be nonadherent. Sometimes it's just difficult to take all medications at all times. In fewer cases, patients intentionally do not take their medication for reasons such as; they think they do not need it, it's not doing anything, they don't know what it's for, or due to the side effects. It's the nurses who may be able to change these latter habits. <b>N104</b>
	Lack of acknowledgment of pts need to have individual self-management strategies and various different approaches to empowering self-management. <b>N94</b>
	Lack of chronic conditions self-management strategies and lack of ability to empower self-management that is truly patient centred (staff). <b>N94</b>
- Adjusting to lifestyles	Mostly younger pts adjust their medications to what suits them or how they feel. <b>N55</b>
	Not taking meds as prescribed is limited i.e. long term younger patients are more likely to adjust tablets i.e. Antihypertensive. <b>N29</b>
- Priority of life events	Stressful home situations mean that their own life is put on hold as they are more worried about others and medications isn't a priority. <b>N14</b>
- Disinterest	Have found that the patients who are most non-adherent, are the ones not interested in learning about them. <b>N93</b>
	They do receive enough education and support from our health system. However, they do not follow instructions or/and are compliant with medications and haemodialysis. <b>N108</b>
- Respect to choice	Some of our home patients make well informed decisions about their medications that we don't necessarily agree with! Sometimes we have to agree amongst ourselves with the medical staff as well, to respect their choices. <b>N18</b>
<b>Knowledge and understanding about medicines</b>	
- Limited understanding of medicines	Some patients do not take phosphate binders correctly - e.g. they don't take with food. The way these are prescribed sometimes says TDS rather than take with food. <b>N19</b>
	Some patient even don't know what medication they are supposed to take. <b>N27</b>
	Often patients need to know that binders need some flexibility according to when they eat. <b>N36</b>
	Our 2 older patients have very little understanding/ interest/ control in their medications. They leave it all to their wives. <b>N41</b>
- Good understanding of medicines	If patients have a good understanding about why they need to take their prescribed medications and the consequences of not doing so, adherence probably increases. Blood results help as then they can see what happens if they don't take their medications and it reinforces the reasons for taking them. <b>N45</b>
	This clinic has all Patients who are interested in their health and well-being. Their understanding to their medication is good. <b>N6</b>
	Pts in our dialysis unit are very informed regarding their medications.... Potential for future transplant used as a motivator. <b>N114</b>
- Lack of tolerability or perceived benefit	Difficult for patients to comprehend well enough that the long term outcomes are worse than taking a large tablet load now i.e. PO <sub>4</sub> binders. <b>N68</b>
	Phosphate binders to be had with meals is often omitted by the patients. <b>N60</b>
	My patients are very empowered about their meds especially binders. <b>N56</b>
	Phosphate binders have the poorest compliance.



	Main problems are with Phosphate binders: Forget, avoid and wrong timing is frequent despite continuing education by dialysis nurses. <b>N37</b>
	A lot of patients find it difficult to adhere to their phosphate binder regimens. Those with Webster packs are generally compliant, but definitely less knowledgeable about their meds. Non-adherence tends to be higher with phosphate binders. <b>N92</b>
	Generally medications taken as prescribed agent for e.g. phosphate binders and other meds due at 'odd' times during the day. <b>N106</b>
<b>Clinic locations</b>	
- Long waiting times for consultation	As we are a satellite dialysis unit, we do not have a renal doctor on site to answer pts medication questions as they arise. they wait a long time between renal clinic appointments and often forget their questions about medications before they attend. <b>N64</b>
<b>Lack of discharge counselling</b>	
	When patient discharge no clearly explain or remind them any change or what medication they should continuous.
	Lack of health literacy (patients). <b>N94</b>
<b>Professional competence and trust</b>	
- Perceived competence	Many patients will only listen to information about medication compliance from their renal doctor or GP. They do not accept the information from a nurse with the same degree of weight or respect. <b>N64</b>
- Professional trust	Staff attitude is very dictatorial and non-adherence is viewed as 'deviant' thus pts often provide the answers they think the staff wants to hear and the true discussion of why non-adherence occurs hardly ever occurs as pts fear being labelled as 'deviant'. <b>N94</b>
	Pts will frequently tell you they are taking their medicines when in fact they are not. <b>N63</b>
	At times feel the patients just say they forgot or yes I'm taking them, only to see their blood results tells us they are not. <b>N71</b>
<b>Relative affordability</b>	
	The cost of medications is an issue for some, their medicines run out and they don't have any money to buy them. <b>N65</b>
	Pts with low income tend to use old medications before swapping to new prescription due to cost. <b>N103</b>
	People let their scripts run out, don't see a GP to renew them and often tell the dialysis nurse when they have already run out. This is often the case for indigenous patients. <b>N57</b>
	Blister packs are helpful, but many can't/won't pay the extra needed to have them provided. On the other hand, having blister packs often do not help with phosphate binders. Difficult even with a pharmacist input. <b>N8</b>
Prescription refill	Failure to fill script at pharmacy resulting in no medication to be taken. <b>N14</b>
<b>Culture and communication barriers</b>	
	Indigenous status is a good indicator of overall health status. <b>N21</b>
	Increased number of patients live in aged care facility, they receive good care but can cause confusion with duplication and communication regarding medication. <b>N95</b>
<b>Forgetfulness, role of dose administration aid and support</b>	
- Forgetfulness	There is a high number of elderly patients in our unit, a lot of them don't seem to retain much information or forget quite easily what was told to them. <b>N44</b>
	Forgetfulness is a factor. <b>N68</b>
	Patients not always good with memory but if they have meds with them, this might be better. Probably would forget, counting doesn't reveal when or how they took them. <b>N12</b>
- Decreased cognitive function	Regarding limited understanding, it has more to do with their cognitive state, not their knowledge of the disease. <b>N8</b>

- Role of reminders	Tablet load is a factor. Difficult to generalize here, but people with low education, difficult culture, language etc. are assisted by using dosettes etc. <b>N68</b>
	Patients bringing in medications (Webster packs) do present usually reflect good adherence.
	Webster packs assist. <b>N112</b>
	Getting a copy of Webster pack medication list for people on multiple meds/elderly/memory issues. <b>N93</b>
<b>Role of comorbid illness</b>	
- Comorbid illness	Diabetics seem to be the most affected by non-adherence. <b>N31</b>
	Diabetics the most non-compliant with medications. <b>N31</b>
	Often with so many comorbidities medications themselves are making the patients feel unwell. <b>N36</b>
- Tablet burden	Some patient's express frustration at having to take so many tablets, especially phosphate binders. <b>N45</b>
	Large pill load doesn't help. <b>N65</b>
	Many have polypharmacy and this can add to their confusion over medication but also the taking of them, they just would like to sit and eat a meal without having to take a cupful of medicines. <b>N8</b>
	Patients have so many tablets to take. They require large amounts of water to take them (eats into their fluid restriction) Some meds need to be chewed (not palatable). Often meds in blister packs and don't correspond with times meds need to be taken (binders). <b>N79</b>
- Recent changes with medicines	Patients often get confused, particularly when there are dosage changes. Asking them to bring in their medications and to show you what they are taking can highlight variances between what they have been prescribed. <b>N8</b>
<b>Need for designated renal pharmacists</b>	
Lack of designated renal pharmacists	Have been requesting a renal pharmacist for years! <b>N20</b>
	All other department in this hospital have a dedicated pharmacist but not the dialysis unit. <b>N89</b>
	I'm the pharmacist. Much as we would like to have a dedicated healthcare professional to deal with these issues we don't have one. <b>N86</b>
	Rarely see the pharmacist and do not see her giving pts education. <b>N57</b>
	There is no staff development nose attached to my hospital as it was thought we did not need one specific to the dialysis unit. We share the SND from the next ward but they are flat out, stressed and one has just resigned. For a major teaching hospital it is shocking. <b>N57</b>
	Attempting to get a pharmacist for Dialysis... Currently available for inpatients .... Able to contact them, however very limited service... <b>N29</b>
	I often ring pharmacy to check when last obtained. <b>N71</b>
	Don't have a pharmacist connected to unit. <b>N58</b>
	We have an excellent relationship with community pharmacist which potent a use as a resource tool. <b>N56</b>
	Our patients use different pharmacies and our hospital pharmacists does not see our pts. <b>N65</b>
	We don't have a pharmacist on site here, but in other areas where I worked this was very helpful & reassuring to patients. <b>N18</b>
	Ideally dedicated healthcare professionals should be engaged in medication history taking and reviews but doesn't happen in the dialysis unit. Most patients are assessed at clinic or nephrologists' appointments only. <b>N11</b>
	A pharmacist goes through medications if patient has been in hospital. Prior to discharge. Not done routinely with O.P. <b>N79</b>
	We used to spend a lot of time doing up med profiles and getting patients to bring in their medications and liaising with local pharmacies. This was very time

	consuming and patients wouldn't bother to tell you when a medication was changed. We now rely on local pharmacies to send a copy of medication profile to us. <b>N16</b>
	Including pharmacist in medication reviews only in inpatients. <b>N13</b>
<b>Perceived barriers</b>	
- Lack of time	Time is poor on a typical nursing shift, particularly as nurses seem to take on every increasing roles and responsibilities. Medication is, however, as essential component of thorough and holistic nursing care. I find that some patients find it boring or repetitive to discuss medications, so perhaps it should not be done too often. <b>N104</b>
- Lack of training	Lack of training for renal nurses in this area. <b>N94</b>
	I have been working in renal system for few years. I have a lot of knowledge of renal medicines. However, I still feel myself need more comprehensive study and in services. There will be helpful to have self-learning package. <b>N108</b>
- Staff shortage	When the above actions are combined, it may make a difference, but difficult to achieve with patient/professional ratios. <b>N104</b>
<b>Multidisciplinary role</b>	
	How to build up the beliefs of medication and is more important haemodialysis will give them better health outcomes. Of course the better health outcome could bring them normal life and enjoy life. I think the social worker should be involved more. <b>N107</b>
	More social worker input and regularly interview and blood tests for patients. <b>N108</b>
- Role of nurse	It is part of the dialysis nurse role to help pts with education and understanding of adherence to medication regimen. <b>N68</b>
	Discussing/liasing/monitoring pts meds/pathology and reporting to RMO as integral part of a renal nurse role. <b>N106</b>
	Need to initiation for nursing staff on coordination whenever medication/dosage/pathology-this info needs to be consistently fed back to the patients. <b>N106</b>
<b>Ongoing education</b>	
	I always talk to my patients regarding their medications and if they take them or not. If I am not sure about any of their medication, I'll search to found out. <b>N15</b>
	We utilise a monthly 'report card' to discuss pathology results and potential to improve outcomes i.e. taking meds at appropriate times... <b>N29</b>
	We take routine blood pre- and post- dialysis every month and then the nurse unit manager, nurse practitioner, pharmacist, and renal nephrologist meet to discuss the results and make any relevant changes to the patient's medications based on these results. The clinical nurse or nurse unit manager then goes to each patient to discuss the blood results and talk about their medications plus adherence to these. <b>N45</b>
<b>Current practices</b>	
	Serum PO <sub>4</sub> and BP are not solely done to check med compliance, but are routinely done on all patients. Poor results act as a flag for checking medications. Interviewing for med history is meant to be done for all patients - not always attended. <b>N93</b>
	Unless symptomatic, medication history not reviewed. Education more likely to change behaviours but not identifying issues unless problem arise. <b>N12</b>
	We ask patients to bring in their meds, but we don't count them to see how many they have taken. We treat them as adults and therefore educate them regarding how and when to take. They have to take some responsibility unless they have other medical/psycho social issues that impact on this. <b>N8</b>

Note: N = Nurse participant (with a number to indicate the participant ID for example, N5 is the fifth respondent).