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Identification of factors associated with high-cost use of inpatient care in chronic kidney disease: a registry study

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ABSTRACT

Objective To explore factors behind inpatient admissions by high-cost users (HCUs) in pre-end-stage chronic kidney disease (CKD).

Design Retrospective analysis of CKD.QLD Registry and hospital admissions of the Queensland Government Department of Health recorded between 1 July 2011 and 30 June 2016.

Setting Queensland public and private hospitals.

Participants 5096 individuals with CKD who consented to the CKD.QLD Registry via 1 of 11 participating sites.

Main outcomes Associations of HCU status with patient characteristics, pathways and diagnoses behind hospital admissions at 12 months.

Results Age, advanced CKD, primary renal diagnosis, cardiovascular disease and hypertension were predictors of the high-cost outcome. HCUs were more likely than non-HCUs to be admitted by means of episode change (relative risk: 5.21; 95% CI 5.02 to 5.39), 30-day readmission (2.19; 2.13 to 2.25), scheduled readmission (1.29; 1.11 to 1.46) and emergency (1.07; 1.02 to 1.13), for diagnoses of the nervous (1.94; 1.74 to 2.15), circulatory (1.24; 1.14 to 1.34) and respiratory (1.2; 1.03 to 1.37) systems and other factors influencing health status (1.92; 1.74 to 2.09).

Conclusions The high relevance of episode change and other factors influencing health status revealed that a substantial part of excess demand for inpatient care was associated with discordant conditions often linked to frailty, decline in psychological health and social vulnerability. This suggests that multidisciplinary models of care that aim to manage discordant comorbidities and address psychosocial determinants of health, such as renal supportive care, may play an important role in reducing inpatient admissions in this population.

INTRODUCTION

Kidney failure is associated with considerably increased need for healthcare services compared with the general population.[1–4] Mulitmorbidity, defined as the presence of two or more associated chronic health conditions, is an important driver enhancing the complex needs of patients with chronic kidney disease (CKD).[5] Concordant conditions, that is comorbidities that are either causes (diabetes, hypertension) or consequences (cardiac

Strengths and limitations of this study

► The large, pre-dialysis patient registry, linked with a comprehensive hospitalisations data set, allows a wide-ranging exploration of factors associated with patients with chronic kidney disease (CKD) who are admitted to hospitals.

► The study focuses on the first year of patients coming into specialist care, which is a less explored area compared with the end-stage or near-end-stage kidney disease.

► The nature of the study is exploratory and hypothesis-generating.

► Undiagnosed cases and patients not presenting to Queensland public renal practice clinics are not included in this study.

► Study enrolment emphasises relatively advanced CKD that warrants specialist care, which limits its generalisability to a full spectrum of CKD.

disease, anaemia) of CKD, are well understood with both preventive and management strategies in place. Less studied is the impact and interrelation of discordant conditions such as cancer, dementia, arthritis and frailty, which also significantly contribute toward poor outcomes in CKD population, especially in hospitalised patients.[6 7] These comorbidities lead to excessive hospital admissions and readmissions, prolonged hospital stay, rehabilitation, displacement from home and higher healthcare expenditure. Improving our understanding of the distinguishing characteristics of those patients with CKD who are high-cost users (HCUs), ways through which they enter the hospital system, and diagnoses leading to admissions that differentiate them from other users, is an essential next step in reducing the health system burden of kidney disease.[8] Pathways to admissions, emergency and readmission, in particular, offer useful analytical angles that allow identification and prevention of avoidable hospitalisations at the point of entry.[9–11]

Our aim was to identify and describe HCUs in an attempt to better characterise the demographic profiles, health needs and pathways to inpatient care, associated with the high-cost outcome. With the broader objective of informing the development and targeting of models of care that seek to address the specific risk factors and needs, and incorporate strategies to prevent complications in CKD care pathways. Recent years have seen the emergence of new models of care designed to benefit patients with kidney disease at pre-dialysis stages.[12] Robust programmes such as Kidney Supportive Care[13] have been demonstrated to offer improved outcomes and quality of care to patients as well as economic benefits of lowering long-term pressures on the healthcare system due to reduced need for costly downstream healthcare services.[14] Insights from our study will guide proactive implementation of these models of care, in patient groups identified as likely to become high users of hospital care in a short to mid-term horizon.

METHODS
Data
Data on patient demographics (age, sex, indigenous status) and health status (estimated glomerular filtration rate (eGFR), renal diagnosis, comorbidities, body mass index) were extracted from the CKD.QLD Registry, a state-wide surveillance programme enrolling patients diagnosed with CKD.[15] The medical records for these patients were retrieved from the electronic systems of Queensland Government Department of Health, capturing episodes, pathways, diagnoses, procedures, costs and deaths during hospital admissions within the state between 1 July 2011 and 30 June 2016.[16] The costs were approximated relative to resource intensity of care using Queensland Health activity-based funding guidelines.[17] The combined data set was inspected for missing variables and conflicting information between the two sources. Reaching the point of kidney failure was interpreted as study exit. The determination of the study sample is presented in figure 1.

Analyses
Following a convention accepted in the health services research literature,[18] we defined and retrospectively identified HCUs as the top 10% of the study sample with respect to inpatient costs incurred during the 12-month period. We compared the HCUs against those who did not classify as HCU (henceforth referred to as the non-HCUs). To allow further insights into the sample, we presented the non-HCUs as two subgroups: those who were never admitted and those admitted at least once. The 1-year horizon served to maintain the accuracy of variables representing time-variant characteristics, such as CKD stage and comorbidities, recorded at the time of enrolment. We summarised patient characteristics (gender, indigenous status, age, the BMI, kidney function, primary renal diagnosis and comorbidities), selected outcomes at 12 months (frequent admission status, dialysis status,
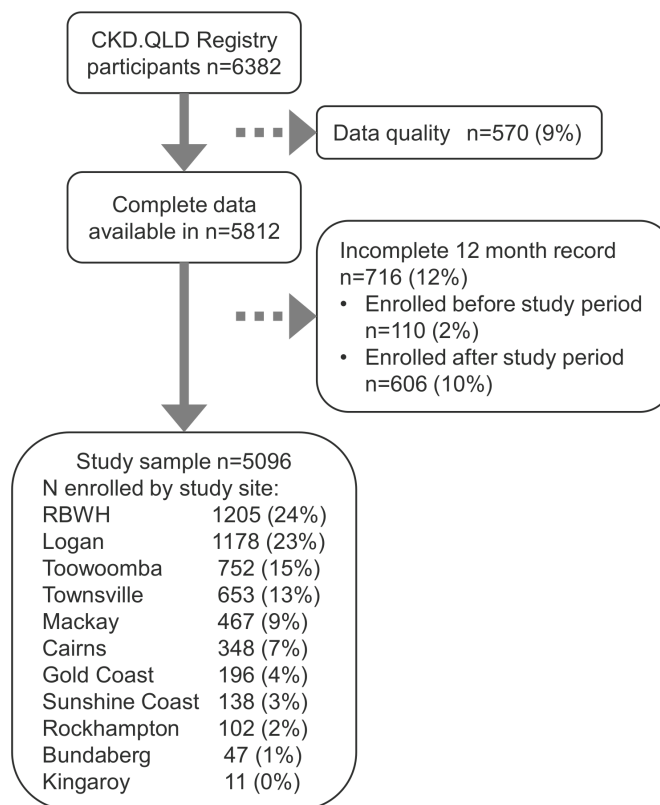

Figure 1 Selection of the study sample.

renal replacement therapy, death, and the cost outcome) using descriptive statistics, and used t-tests and Pearson's χ^2 to compare HCUs and non-HCUs. We used logistic regression to determine which patient characteristics known at the time of study enrolment predicted the HCU status at 12 months, expressed as odds ratios (ORs). We calculated relative risks (RRs) of hospitalisation pathways (elective, day-hospital, readmission and by source of referral) to find systematic differences in admission patterns between the groups. Finally, we computed RRs for major diagnostic categories (MDCs), which group International Classification of Disease (ICD) codes into 22 mutually exclusive diagnosis areas, to identify diagnoses that were relatively more common in the HCUs, and reported the major MDCs that explained at least 75% of the cost on record. Supplementary material presents means, SD and frequencies of costs by hospitalisation pathway (online supplemental table S1) and by MDC (online supplemental table S2). Expenditures occurring in different years were made comparable by adjusting for the inflation rate[19] and reported as 2015–2016 Australian dollars.

RESULTS
The 90th percentile of the distribution of individual hospital expenditures in the final study sample (n=5096) was A$28,191; 509 (10%) individuals above this threshold qualified as HCUs. Those who were admitted at least once but did not qualify as HCUs (n=2139) accounted for 42%

of the sample. The remaining study participants (n=2448; 48%) did not have a record of admission (table 1).

Characteristics and selected outcomes

Comparing HCUs versus non-HCUs (table 1), we found no statistically significant differences in the proportions of men (55.4% vs 53.7%; p=0.475) and indigenous Australians (8.5% vs 7.3%; p=0.384). The HCU group had greater proportions of patients in age bands above 60 years, which was reflected in the statistically significant difference in mean age (69.1 vs 64.5 years; p=0.000). The body mass index was not statistically associated with hospital utilisation. HCUs had more advanced CKD, with 48.1% enrolling at stages 4 and 5, compared with 32.8% in non-HCUs (p=0.000). Differences in eGFR means reflected this pattern, with the mean eGFR of HCUs 8.2 mL/min/1.73 m^2 points lower than in the other group (p=0.000). A comparison of primary renal diagnosis categories revealed that diabetic nephropathy was more common in the HCU group (33.2% vs 23.2% in non-HCU), while glomerulonephritis and renovascular disease were less common (p=0.000). There was a clear pattern of greater prevalence and higher number of comorbidities among the HCUs compared with non-HCUs. The rates were 63.6% versus 50.2% for diabetes (p=0.000), 71.3% versus 46.5% for cardiovascular disease (p=0.000) and 86.3% versus 79.8% for hypertension (p=0.003). Multiple comorbidity status, defined as combinations of the above conditions, followed a similar pattern (p=0.000).

HCU status was associated with high chances of being frequently admitted, with 51.1% qualifying as top 10% frequent users (≥5 inpatient episodes in 12 months; p=0.000). HCUs had significantly higher admission rates for the purpose of dialysis (p=0.000), but the rates were very low overall, 1.4% in HCUs and 0.3% in others. Renal replacement therapy was reached by 7.3% of HCUs, compared with 2.9% in non-HCU (p=0.000). The proportion of patients who died within the first year of the study was considerably higher in the HCU group (19.5% vs 2.7% in non-HCU; p=0.000).

Factors known at the time of enrolment that predicted the HCU status at 12 months were advanced CKD (stage 4 OR 1.84; p=0.008 and stage 5, OR 1.82; p=0.036), diabetic nephropathy (1.61; p=0.009) and selected other renal diagnoses (1.58; p=0.006), cardiovascular conditions (2.48; p=0.000) and hypertension (1.53; p=0.028) (table 2). Individuals with primary renal diagnosis of glomerulonephritis or renovascular were less likely to be HCUs, compared with diabetic nephropathy and other primary renal diagnoses. Participants age 40 years or less were less likely to reach the HCU status (0.45; p=0.044), but within those 40 years old or above age was not a statistically significantly predictor of the outcome.

Pathways

Hospitalisation pathways were analysed across 7315 admissions, of which 2836 (38.8%) were in the top 10% costliest users. HCUs systematically differed from non-HCUs across all analysed pathways to admission (figure 2). Episode change, either within the admitting institution (48.2%) or in transfer from another hospital (51.8%), stood out as an admission pathway. The RR of this event was 5.21 (95% CI 5.02 to 5.39) in the HCU group relative to non-HCU. Episode change accounted for 17% of all admissions in the HCU group, compared with 3% in the non-HCU. HCUs were also more likely to be readmitted within 30 days of a previous admission (2.19; 2.13 to 2.25), as a scheduled readmission (1.29; 1.11 to 1.46) or as a result of an emergency presentation (1.07; 1.02 to 1.13). HCUs' admissions were less likely to be for elective procedures (0.58; 0.52 to 0.65), through the outpatient department (0.66; 0.58 to 0.74), by general practitioner (GP) or specialist referral (0.65; 0.52 to 0.78) or to take the form of day-hospital episodes (0.66; 0.58 to 0.73).

Diagnoses

The number of admissions per person in the HCU group was 2.66 times that of admitted non-HCU (table 3). The top seven MDCs accounted for 77.1% of inpatient expenditures. Relative to others, HCUs were at an increased risk of admissions due to issues of the nervous system (RR: 1.94; 95% CI 1.74 to 2.15), factors influencing health status (FIHS) (1.92; 1.74 to 2.09), circulatory (1.24; 1.14 to 1.34) and respiratory system (1.2; 1.03 to 1.37). HCUs were at a lower risk of admissions caused by digestive system issues (0.71; 0.56 to 0.87) or other MDCs (0.73; 0.66 to 0.81). Key FIHS that distinguished HCU from non-HCU involved the use of rehabilitation procedures (Z50, 47.4% vs 20.8%, respectively) and problems related to medical facilities and other healthcare (Z75, 13.5% vs 1.5%, respectively).

DISCUSSION

The expenditures in our sample showed a considerable degree of concentration, with 10% high-end users responsible for 65.2% of recorded expenditures. While high cost and admission frequency are correlated, only half of the HCUs qualified as frequent users, which illustrates a complication in the relationship between these two criteria. Frequency of contact with healthcare explains some, but not all, of the resulting costs. It follows that there are other important factors, such as types and severity of conditions, and perhaps differences in chronic disease management, that account for the remaining part of the expenditure variation.

We found good agreement between descriptive statistics summarising our sample and the HCU prediction model. CKD stage and key comorbidities were confirmed as predictors of health and utilisation outcomes previously documented in studies from the UK,[1] Australia,[2] Germany,[3] the USA,[4] Italy,[20] Sweden[21] and Canada.[22] We found age to be a more nuanced factor, showing the statistical association of a lower probability of HCU outcome in younger patients, but failing to explain cost variation for those over 40. Neither descriptive nor

Table 1 Patient characteristics at the time of study consent and selected 12-month outcomes

	Non-HCU		HCU	P value*
	Not admitted	**Admitted**		
n	2448	2139	509	
Male, n (%)	1319 (53.9)	1146 (53.6)	282 (55.4)	0.475
Indigenous, n (%)	125 (6.5)	133 (8.1)	32 (8.5)	0.384
Age, mean years (SD)	63 (15.9)	66.1 (15)	69.1 (13.1)	**0.000**
Age band, n (%)				**0.000**
<40	260 (10.6)	154 (7.2)	15 (3)	
40–49	235 (9.6)	163 (7.6)	32 (6.3)	
50–59	381 (15.6)	295 (13.8)	62 (12.2)	
60–69	605 (24.7)	519 (24.3)	130 (25.5)	
70–79	671 (27.4)	659 (30.8)	167 (32.8)	
≥80	296 (12.1)	349 (16.3)	103 (20.2)	
BMI, mean (SD)	31.3 (7.8)	31.1 (7.7)	31.4 (8.8)	0.788
BMI group				0.425
≤18.5	16 (1)	19 (1.3)	5 (1.5)	
18.5–25	258 (15.7)	231 (16.3)	63 (19.2)	
25–30	484 (29.5)	415 (29.3)	90 (27.4)	
>30	885 (53.9)	752 (53.1)	170 (51.8)	
eGFR, mean (SD)	44.8 (21.9)	37.3 (20.5)	33.2 (17.8)	**0.000**
CKD stage, n (%)				**0.000**
1–2	509 (21.6)	261 (12.8)	40 (8.3)	
3	1224 (52)	963 (47.1)	210 (43.6)	
4	521 (22.1)	585 (28.6)	178 (36.9)	
5	101 (4.3)	236 (11.5)	54 (11.2)	
Primary renal diagnosis, n (%)				**0.000**
Diabetic nephropathy	472 (20.9)	503 (26.1)	157 (33.2)	**0.000**
Glomerulonephritis	338 (14.9)	227 (11.8)	40 (8.5)	**0.002**
Renovascular	667 (29.5)	634 (32.8)	134 (28.3)	0.231
Other	787 (34.8)	567 (29.4)	142 (30)	0.319
Comorbidities, n (%)				
Diabetes	952 (46.5)	974 (54.5)	262 (63.6)	**0.000**
CVD	599 (38)	761 (56.5)	229 (71.3)	**0.000**
Hypertension	1376 (78.7)	1208 (81)	309 (86.3)	**0.003**
Multi-comorbidity status, n (%)				
Diabetes and CVD	327 (13.4)	444 (20.8)	147 (28.9)	**0.000**
Diabetes and hypertension	598 (24.4)	633 (29.6)	178 (35)	**0.000**
CVD and hypertension	502 (20.5)	650 (30.4)	209 (41.1)	**0.000**
Diabetes, CVD and hypertension	279 (11.4)	393 (18.4)	135 (26.5)	**0.000**
Selected outcomes at 12 months, n (%)				
≥5 inpatient admissions	0 (0)	138 (6.5)	260 (51.1)	**0.000**
Admitted for dialysis†	0 (0)	13 (0.6)	7 (1.4)	**0.000**
Renal replacement therapy	0 (0)	135 (6.3)	37 (7.3)	**0.000**
Death	27 (1.1)	95 (4.4)	99 (19.5)	**0.000**
Selected cost outcome statistics				
A$, mean (SD)	0 (0)	8091 (7155)	63 828 (42 200)	**0.000**

Continued

Table 1 Continued

| | Non-HCU | | | |
	Not admitted	Admitted	HCU	P value*
A$, median (IQR)	0 (0)	5734 (9656)	50 588 (34 068)	**0.000**
Skewness	0	1.0024	2.761	

The non-HCU group comprises of those never admitted, and those admitted at least once. The three groups reported in the table are mutually exclusive.

Statistical significance denoted in bold for p-values < 0.05.

*T-test (continuous), Pearson's χ^2 (categorical) or Wilcoxon rank-sum test (medians) comparing HCU versus non-HCU.

†Admissions with DRG code L61Z or L68Z.

BMI, body mass index; CVD, cardiovascular disease; DRG, diagnosis-related group; eGFR, estimated glomerular filtration rate; HCU, high-cost user.

analytical approaches confirmed the indigenous status as a predictor of the HCU outcome in our sample. This was contrary to our expectations based on the known underlying gaps in health and healthcare between indigenous and non-indigenous Australians.[23]

Of the kidney disease characteristics, we found statistical evidence linking primary renal diagnosis to inpatient care utilisation. Specifically, patients whose renal disease was classified as renovascular or glomerulonephritis had lower odds of being HCUs compared with patients diagnosed with diabetic nephropathy or other types of disease. Prior evidence suggests a role for renal disease type in explaining variation in health outcomes,[24] but to our knowledge, this is the first time it has been linked to utilisation outcomes. This finding should invite further explorations of healthcare utilisation with respect to subtypes of renal disease, including those of genetic origin.[25]

HCUs had higher rates of admissions due to issues concerning the circulatory, nervous and respiratory systems and other FIHS, but the RR of an episode directly related to kidney disease was not statistically different from non-HCUs. This suggests that the HCU status tends to be driven by one or more major comorbidities, rather than CKD itself, which is also reflected in the sample baseline characteristics and our HCU prediction model. HCUs also have higher concentration of diagnoses within the top seven MDCs, which accounted for 75% of their admissions, compared with 65.8% in non-HCU, which implies a more focused catalogue of core health issues. While renal disease becomes a major factor driving hospitalisations when end-stage is reached, requiring renal replacement therapy, in pre-end stage CKD common

Table 2 Logistic regression predicting HCU status using information available at the time of study enrolment

	OR	95% CI	P value
Male	0.86	0.68 to 1.1	0.231
Indigenous	1.25	0.7 to 2.23	0.461
Age band			
<40	0.45	0.21 to 0.98	**0.044**
40–49	1.10	0.65 to 1.86	0.722
50–59	1.17	0.79 to 1.75	0.431
60–69	Ref.		
70–79	0.97	0.7 to 1.35	0.870
≥80	1.27	0.88 to 1.86	0.205
CKD stage			
1–2	Ref.		
3	1.20	0.78 to 1.84	0.401
4	1.84	1.18 to 2.88	**0.008**
5	1.82	1.04 to 3.19	**0.036**
Primary renal diagnosis			
Renovascular	Ref.		
Diabetic nephropathy	1.61	1.13 to 2.3	**0.009**
Glomerulonephritis	1.20	0.71 to 2.03	0.501
Other	1.58	1.14 to 2.19	**0.006**
Comorbidities			
Diabetes	1.11	0.81 to 1.52	0.509
CVD	2.48	1.87 to 3.28	**0.000**
Hypertension	1.53	1.05 to 2.25	**0.028**
Constant	0.02	0.01 to 0.05	**0.000**

Statistical significance denoted in bold for p-values < 0.05.
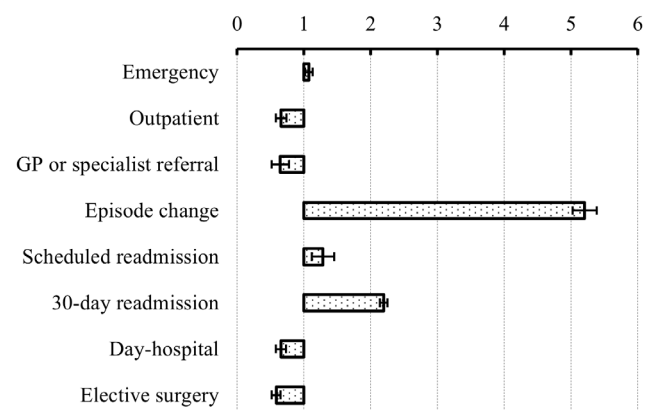CKD, chronic kidney disease; CVD, cardiovascular disease.

Figure 2 Relative risk of hospitalisation pathways in HCU versus non-HCU groups. HCU, high-cost user; GP, general practitioner.

Table 3 Admission rates in top seven categories contributing to expenditures

Category	Non-HCU	HCU	RR (95% CI)
Any admission	4479	2836	
MDC (% of sample expenditure)			
Circulatory system (20.2%)	681	534	**1.24 (1.14 to 1.34)**
Kidney and urinary tract (15.3%)	826	489	0.93 (0.83 to 1.04)
Musculoskeletal system and connective tissue (12.6%)	315	225	1.13 (0.96 to 1.29)
Digestive system (8.3%)	470	212	**0.71 (0.56 to 0.87)**
Factors influencing health status (8%)	207	251	**1.92 (1.74 to 2.09)**
Respiratory system (7.9%)	290	220	**1.2 (1.03 to 1.37)**
Nervous system (4.8%)	160	197	**1.94 (1.74 to 2.15)**
Other (22.9%)	1530	708	**0.73 (0.66 to 0.81)**

Test statistic for equal distribution between groups: $\chi^2(21)=336.6996$, p=0.000.
Statistical significance denoted in bold for p-values < 0.05.

HCU, high-cost user; MDC, major diagnostic category; RR, relative risk.

reasons behind inpatient admissions are heart failure (31.7% of circulatory system admissions), myoneural disorders (nervous system, 16.8%), pneumonia (respiratory system, 28.2%) and FIHS (rehabilitation, 45.8%). Although the first three conditions are well known in patients with CKD, the forth common cause, FIHS, is less understood. According to ICD-10 codes Z00-Z99, FIHS consists of codes that are designated as the principal, or first listed, diagnosis in situations when a person with a resolving disease, injury or chronic condition requires specific aftercare.[26] Some of the 16 Z-code categories, including counselling, follow-up, aftercare and miscellaneous codes, are directly applicable to management of admitted patients with CKD.

Emergency presentations leading to inpatient admissions are typically associated with high cost.[10] While rates of emergency admissions were higher in HCU than non-HCU, the RR point estimate was 1.07, suggesting only a small (albeit statistically significantly) increase. The implication of this was that there were other pathways leading HCUs to inpatient care. One possible interpretation is that heavy users' demand for inpatient care is somewhat predictable, demonstrated in our study by the rates of scheduled and 30-day readmissions, and also corroborated by lower rates of admissions by GP or specialist referral, from the outpatient department, or for elective procedures. In addition, episode change emerged as a major pathway accounting for 17% of episodes in HCUs, compared with 3% in the non-HCU group. A further inspection revealed that a high proportion of these admissions was for the purposes of rehabilitation of major and minor complexity, which was consistent with the increased RR of FIHS (45.8% of admissions in this category, vs 4.4% in the non-HCU group).

The combination of FIHS as one of the major factors linked to admissions, and episode change as a common pathway in HCUs, suggests that, after the initial admission for traditional risk factors, costs are driven by conditions such as rehabilitation, counselling, follow-up and aftercare planning, associated with discordant comorbid conditions like cancer, dementia, arthritis, fractures and frailty. These conditions often demand more carer services, displacement from home, moving to transitional or residential aged care services and nursing home placements. Frailty is a state of increased vulnerability to physical stressors and is associated with increased risk of poor clinical outcomes, more so in patients with CKD compared with general population. This occurs due to a combination of degeneration of physiological systems, decline in psychological health and inadequate social support, which are all common risk factors in CKD.[6] These discordant factors can be addressed in a multidisciplinary model of care, often involving other specialities like geriatrics and rehabilitation, which prevents prolonged hospitalisations. International societies have increasingly recognised these problems and developed guidelines under the broad term renal supportive care, although the primary focus of their application has so far been on end-stage disease.[27]

Our results suggest these models of care have an important role to play at earlier stages as well, and may enable strategies for reducing hospitalisations. Identifying the factors contributing to eventual high cost can direct these models of care in two ways. Firstly, by targeting the groups of patients who are likely to experience escalating healthcare needs, predictably leading to hospitalisations. Secondly, by allowing these programmes to focus on those areas of need where key improvements can be achieved, and hospitalisations averted. For example, an early intervention from allied health, involving occupational therapists and social workers, and offered to patients showing signs of FIHS, would seek to prevent

prolonged hospitalisations by way of transfer of care to a residential or transitional care setting, and a nursing home placement.[28 29]

In considering which diagnoses and pathways can be linked to potentially preventable hospitalisations, one has to keep in mind the considerably higher death rate in the HCU group compared with the rest of the sample (19.5% vs 2.7%). While proximity of death is a major factor contributing to healthcare costs,[30] its application to explaining costs is retrospective by nature (which is why this variable was not part of our HCU prediction model), and many of the episodes taking place around the time of death may not be avoidable or amenable to secondary prevention.

Although exploratory in nature, our study has considerable strengths. The large pre-dialysis registry, linked with a comprehensive hospitalisations data set, provides an opportunity for a wide-ranging analysis of factors associated with patients with CKD who are admitted to hospitals. The data are collected in the first year of consent, when patients came into specialist care, rather than towards the end of progressive CKD journey known to be associated with higher costs. Still, our analyses inherited the limitations of the data sources, in terms of information available to researchers and data quality. Undiagnosed cases of CKD and patients not presenting to Queensland public renal practice clinics were not included in the CKD.QLD Registry and are, therefore, not represented in this study. This shortcoming was alleviated by the extensive network of participating renal practice clinics in Queensland.[15] However, because the study enrolment places emphasis on advanced CKD that warrants a referral and self-selection to attend specialist care, its generalisability to a broader spectrum of CKD may be limited.

CONCLUSION

The episode change pathway and FIHS account for a large share of inpatient care in the HCU group, which makes them major candidate areas for averting admissions. Models of care that incorporate strategies to identify, assess and manage discordant comorbidities in a holistic, multidisciplinary method, and seek to address psychosocial risk factors, such as renal supportive care, have the potential to optimise costs and provide quality care for this vulnerable population.

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