Title: Impact of pay-for-performance on access at first dialysis in Queensland

Running title: Pay-for-performance and dialysis

Authors

Jennie Haarsager; Department of Nephrology, Nambour General Hospital, Nambour, Queensland, Australia

Rathika Krishnasamy, PhD; Department of Nephrology, Nambour General Hospital, Nambour, Queensland, Australia; The University of Queensland, Sunshine Coast Clinical School, Nambour General Hospital, Nambour, Queensland, Australia; Australia and New Zealand Dialysis and Transplant Registry, Adelaide, South Australia, Australia

Nicholas A Gray, MBBS; Department of Nephrology, Nambour General Hospital, Nambour, Queensland, Australia; The University of Queensland, Sunshine Coast Clinical School, Nambour General Hospital, Nambour, Queensland, Australia; Australia and New Zealand Dialysis and Transplant Registry, Adelaide, South Australia, Australia

Abstract word count: 249 (250)

Text including abstract and references (excluding tables, figures) word count: 3136 (4000)
Figures and tables: 6 (8)

References: 25 (<30)

***Correspondence:** Nicholas Gray, Renal Unit, Nambour General Hospital, PO Box 547, NAMBOUR QLD 4560, Email: Nicholas.Gray@health.qld.gov.au , Ph.: +61 7 54706504, Fax: +61 7 54706129

Funding: Nil

Abstract

Aim: Commencement of haemodialysis with an arteriovenous fistula (AVF) or arteriovenous graft (AVG) is associated with improved survival compared with commencement with a central venous catheter. In 2011-12, Queensland Health made incentive payments to renal units for early referred patients who commenced peritoneal dialysis (PD), or haemodialysis with an AVF/AVG. The aim of this study was to determine if pay-for-performance improved clinical care.

Methods: All patients who commenced dialysis in Australia between 2009 and 2014 and were registered with the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) were included. A multivariable regression model was used to compare rates of commencing dialysis with a PD catheter or permanent AVF/AVG during the pay-for-performance period (2011-12) with periods prior (2009-2010) and after (2013-2014).

Results: A total 10,858 early referred patients commenced dialysis during the study period, including 2058 in Queensland. In Queensland, PD as first modality increased with time ($p<0.001$) but there was no change in AVF/AVG rate at first haemodialysis ($p=0.5$). In a multivariate model using the pay-for-performance period as reference, the odds ratio for commencement with PD or haemodialysis with an AVF/AVG in Queensland was 1.02 (95%CI 0.81-1.29) in 2009-10 and 1.28 (95%CI 1.01-1.61) in 2013-14. There was no change for the rest of Australia (0.97 95%CI 0.87-1.09 in 2009-10 and 1.00 95%CI 0.90-1.11 in 2013-14).

Conclusion: Pay-for-performance did not improve rates of commencement of dialysis with PD or an AVF/AVG during the payment period. A lag effect on clinical care may explain the improvement in later years.

Keywords: ANZDATA, pay-for-performance, dialysis, quality improvement, vascular access

Introduction

Commencing haemodialysis with an arteriovenous fistula (AVF) or arteriovenous graft (AVG) is associated with reduced infection and mortality at 1 year (1). However, there is significant variation in AVF/AVG rates at first haemodialysis among renal units in Australia (figure 1) (2). Barriers include late referral of patients to nephrology services, poor referral practices to vascular surgery, and poor evaluation for vascular access (3, 4). Furthermore, failure of a new AVF to mature may be a problem (5).

One method used by health systems to improve clinical quality is incentive payments (6, 7), although evidence for their effectiveness is mixed (8). In nephrology, various models of payment incentives have been reported primarily from the USA and UK (9), but also in the Asia-Pacific region (9, 10). In the USA, payment for sixteen clinical performance measures in out-patient dialysis was associated with improved measures of dialysis adequacy and treatment of anaemia (9). However, a review of haemodialysis quality across 12 countries found no link between end-stage kidney disease spending and mortality (9). There is concern that pay-for-performance measures only produce better documentation of current clinical practice, rather than improving clinical outcomes (8). As a result, broader quality measures have been recommended along with robust evaluation of incentive payments (11).

In 2009, Queensland Health commenced a pay-for-performance program designed to "reduce variance in clinical practice across Queensland Health, promote evidence based standardised care, and enable measurable achievement of improvements in clinical care"(12). For 2009 and 2010, payments to renal units were made for peritoneal dialysis indicators (table 1). In

2011 and 2012, the quality areas changed and included payments of $1,200 for every patient who was referred early (≥90 days from dialysis start) to a nephrologist who commenced PD or haemodialysis with an AVF/AVG.

We used the Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) to compare the rate of early referred patients commencing dialysis with an AVF/AVG or PD catheter in Queensland in 2011 and 2012 with the preceding and following 2 years and contrast with changes in the rest of Australia (ROA).

Methods

Queensland's pay-for-performance program

Queensland's pay-for-performance program was implemented after an external review of Queensland Health recommended a new funding model for public hospitals (12). The review found wide variation in service viability and quality and concluded that "financial incentives are capable of catalysing quality-improvement efforts among hospitals". According to Ward, et al, (13) effective implementation of the pay for performance program would be enhanced by real time electronic data collection of both process and outcome indicators and robust statistical evaluation. The program cost Queensland Health approximately $8 million annually across all specialties with 5% of funds going to renal services in 2011-12 (14).

Renal practice improvement indicators were submitted to Queensland Health by the State-wide Renal Clinical Network (15). Table 1 shows approved indicators and relevant payment rates for the years 2009-2012. Payments to individual renal units were made bi-annually, but usually at least 6 months after each data collection period closed. There were no payments direct to individual clinicians. Payments to individual renal units were to be used for quality

improvement, education, training and research (table 2). The last payment from the scheme was made in March 2013, after which the project underwent external review and was closed. The Queensland State-wide Renal Clinical Network was responsible for nominating performance indicators to Queensland Health. Following feedback from the initial indicators related to PD in 2009-10 which favoured units with a high prevalence of PD patients, indicators were chosen for 2011-12 that allowed equity of access for all renal units. As a result, the indicator chosen included AVF/AVG rate for haemodialysis but also commencement with a PD catheter to allow units with high rates of PD access to the payment. Furthermore, commencement with a PD catheter was considered successful management of dialysis start.

Study design, setting and patients

This was an observational cohort study using ANZDATA, which collects data on all people receiving renal replacement therapy in Australia and New Zealand, as supplied by their treating nephrologist or renal unit. Complete details of the structure and methods of ANZDATA have been reported elsewhere (16). This study included all Australians who commenced haemodialysis or peritoneal dialysis for at least 90 days between 2009 and 2014 and were referred early (≥90 days to commencement of dialysis) to a nephrologist. Seventy-four patients with missing information on late referral status were excluded. Baseline data included age, gender, race, Australian state/territory of residence, primary renal disease, initial dialysis modality, vascular access type, smoking status, and comorbidities (diabetes, chronic lung disease, ischaemic heart disease, peripheral vascular disease and cerebrovascular disease).

The primary outcome measure was odds of commencement of dialysis in Queensland with a functional AVF or AVG or a PD catheter in 2011-2012 compared with the preceding and

following 2 years when there was no comparable incentive payment. This study was approved by The Prince Charles Hospital Human Research and Ethics Committee (HREC/16/QPCH/95).

Statistics

Results were expressed as frequencies and percentages for categorical variables and median [interquartile range (IQR)] for continuous, non-normally distributed variables. Baseline characteristics were categorised by years of commencement of dialysis (2009-10, 2011-12, and 2013-14) for Queensland and the ROA. Differences between groups were compared using one way ANOVA and Kruskal-Wallis test for continuous non-normally distributed data. Chi-square test for was used to examine categorical associations.

The primary outcome of starting dialysis with AVF/AVG or PD catheter in Queensland was determined by multivariable logistic regression with estimation of odds ratio and their 95% confidence interval. The covariates included in the model were the parameters of interest: age, gender, race, smoking status, diabetes, chronic lung disease, ischaemic heart disease, peripheral vascular disease and cerebrovascular disease. This was also examined for rest of Australia.

Sensitivity analyses examining AVF/AVG and PD catheter rates for 1) Queensland compared to ROA for each time period and 2) in all patients (late and non-late referred) commencing dialysis were undertaken using logistic regression models.

Data were analysed using Stata (version 13; StataCorp LP, College Station, TX USA). P values less than 0.05 were considered statistically significant.

Results

A total of 13,720 commenced dialysis in Australia between 2009 and 2014, of whom 10,858 (2058 Queensland, 8800 ROA) were early referred. The rate of late referred patients was lower in the period 2013-14 than the reference years for both Queensland (figure 2a) and Australia (figure 2b).

Characteristics at the commencement of dialysis of non-late referred patients in Queensland and ROA for the three time periods are shown in Table 3. In Queensland, rates of ischaemic heart disease and Caucasians commencing dialysis decreased while body mass index increased. PD as first modality increased over time for Queensland [25.1% (2009-10) to 26.3% (2010-11) to 34.2% (2011-12); p<0.001]. Commencement of haemodialysis with an AVF/AVG did not change with time for Queensland or ROA.

Table 4 shows results of multivariate models for independent predictors of commencement of dialysis with an AVF/AVG or with a PD catheter in Queensland and ROA. There was no change in the primary outcome measure between the period 2009-10 and the reference period, 2011-12 when pay-for-performance applied. However, in 2013-14, patients commencing dialysis in Queensland were more likely to start dialysis with an AVF/AVG or PD catheter [odds ratio (OR) 1.28(95 % confidence interval (CI) 1.01-1.61); p=0.038], while no difference was found for the ROA. Other factors that were associated with lower odds of commencement of dialysis with an AVG/AVF or with a PD catheter in Queensland were Pacific Islander ethnicity, diabetes mellitus, ischaemic heart disease and chronic lung disease.

Two sensitivity analyses were performed. Firstly, the adjusted OR of Queensland compared to ROA (reference) for commencing dialysis with an AVF/AVG or PD catheter in each time period was evaluated. Similar to the above results, the OR for Queensland was significantly higher for 2013-14 [1.22 (95%CI1.02-1.47), p=0.03] but showed no difference in 2011-12

[0.95(95%CI0.79-1.15), p=0.6] and 2010-11[0.92(95%CI0.77-1.10), p=0.3] . The second sensitivity analysis was performed in all patients (late and early referred) who commenced dialysis during the time periods. Using 2011-12 as the reference years, the OR of commencing dialysis with an AVF/AVG or PD catheter in 2013-14 was 1.31 (95%CI 1.08-1.60); p=0.007 for Queensland and 1.07 (95%CI 0.98-1.17); p=0.1 for the ROA.

Discussion

This study has shown no change in rates of commencement of dialysis with PD or a functional AVF/AVG in the pay-for-performance years but there was improvement in the subsequent 2 years in Queensland but not ROA. This change was seen without an improvement in the rate of AVF/AVG for new haemodialysis patients and was due to an increase in PD as the initial modality.

We did not find any improvement during the payment period, but improvement was seen during following years which may be due to a lag effect. Payment lag time may contribute to this finding as previous studies show that pay for performance works best when payments are timely (9). In the Queensland program there was a delay in payments compared to when the data collection period occurred such that funds may not be transferred to a renal unit for nearly 12 months after the patient started dialysis. It may then be another 6 months before the money was spent at the local renal unit level. As a result, staff did not receive the payment for a prolonged period after the decision to create dialysis access and hence the pay-for-performance program may not be associated with the clinical indicator.

There is also a lag time between when a patient is preparing for dialysis and actually commences dialysis. Planning for dialysis may start during chronic kidney disease stage 4 but the patient may take a prolonged period until needing dialysis. Improvements in planning

dialysis (and creation of AVF/AVG or preparing for PD) as a result of the pay-for-performance scheme may therefore take a number of years to have an impact.

There were a number of factors other than pay-for-performance that may have contributed to the change found in Queensland in 2013-14. The State-wide Renal Plan 2008-2017 included strategies to increase the rate of home dialysis. The objective of this plan was to promote a goal of 50% of all incident dialysis patients undertaking PD, home haemodialysis or community based self-care haemodialysis (17). The funding model for dialysis was changed to encourage home dialysis and penalise failure to achieve a rate of 50%. Therefore, the increase in PD rates during 2013-14 may reflect this change and also explain the improvement in performance seen after the payment period. It is also possible that renal units did not have any facility based haemodialysis capacity and as a result new patients had to commence PD. The difficulty to disentangle the effect of pay-for-performance from other simultaneous improvement initiatives has been recognised (18).

Pay for performance has been shown to be more effective when incentive funds are explicit and direct (9). In the case of Queensland's pay-for-performance program, funds did not go to an individual who made the decision to refer for dialysis access. This may impact the usefulness of the payment. Nevertheless, discretionary funding is not normally available to renal units in Queensland, making the promise of incentive payments quite appealing. A recent review concluded that payments for specific purposes such as quality improvement had a greater impact than payments for physician income (19).

A formal review of Queensland's pay-for-performance program was undertaken, but the report is not publically available. All innovative programs such as pay-for-performance schemes need ongoing review for effectiveness, unintended effects and optimal duration (8). In the USA in 2004, re-imbursement was changed to encourage increased face-to-face visits

with haemodialysis patients, a care process that has been associated with fewer hospitalisations and re-hospitalisations (20) (21). A review of this scheme found increased visits but no change in quality of care, quality of life (22), all-cause hospitalisation or re-hospitalisation despite extra visits costing $US13-87 million annually (23), suggesting the payments were misdirected. On the other hand, a scheme in Taiwan targeting chronic kidney disease care found a reduced incidence of dialysis and death that was cost effective (10).

Our study has several limitations. Firstly, the data for Queensland includes people managed by private hospitals, where staff did not receive pay-for-performance. In Queensland, 19% of dialysis patients are treated in a private hospital (24). Secondly, there is no data available on funds paid for each indicator during each time period for each of the 9 renal units in Queensland Health. Thirdly, our data are observational and it is possible that confounders such as the Queensland Health Plan 2008-2017 (17) designed to increase home dialysis therapy rates resulted in the change rather than the incentive payments. Lastly, ANZDATA has not undergone a large audit although a single centre audit found good agreement between medical records and ANZDATA accuracy of data on AVF/AVG at first haemodialysis (Kappa 0.73) (25).

In conclusion, we have demonstrated an improvement in rates of commencement of dialysis with PD or an AVF/AVG in the two years following incentive payments that was not seen in the ROA. Whether this change is a result of the payments or other factors is uncertain.

Acknowledgements

The authors gratefully acknowledge the contributions of the Australian and New Zealand nephrology community in providing information for and maintaining the ANZDATA database.

The data here have been supplied by ANZDATA. The interpretation and reporting of these data are the responsibility of the authors and in no way should be seen as an official policy or interpretation of the ANZDATA.

The authors declare no conflicts of interest.

References

1. Polkinghorne KR, McDonald SP, Atkins RC, Kerr PG. Vascular access and all-cause mortality: a propensity score analysis. J Am Soc Nephrol. 2004;15(2):477-86.

2. Registry ANZDATA. ANZDATA Registry. 38th Report, Chapter 4: Haemodialysis. 2016.

3. Lopez-Vargas PA, Craig JC, Gallagher MP, Walker RG, Snelling PL, Pedagogos E, et al. Barriers to timely arteriovenous fistula creation: a study of providers and patients. Am J Kidney Dis. 2011;57(6):873-82.

4. Donca IZ, Wish JB. Systemic barriers to optimal hemodialysis access. Semin Nephrol. 2012;32(6):519-29.

5. Lok CE, Allon M, Moist L, Oliver MJ, Shah H, Zimmerman D. Risk equation determining unsuccessful cannulation events and failure to maturation in arteriovenous fistulas (REDUCE FTM I). J Am Soc Nephrol. 2006;17(11):3204-12.

6. Steel N, Maisey S, Clark A, Fleetcroft R, Howe A. Quality of clinical primary care and targeted incentive payments: an observational study. Br J Gen Pract. 2007;57(539):449-54.

7. Ryan AM, Krinsky S, Kontopantelis E, Doran T. Long-term evidence for the effect of pay-for-performance in primary care on mortality in the UK: a population study. The Lancet. 2016;388(10041):268-74.

8. Petersen LA, Woodard LD, Urech T, Daw C, Sookanan S. Does pay-for-performance improve the quality of health care? Ann Intern Med. 2006;145(4):265-72.

9. Dor A, Pauly M, Eichleay MA, Held PJ. End-stage renal disease and economic incentives: the international study of health care organization and financing. Int J Health Care Finance Econ. 2007 Sep;7(2-3):73-111.

10. Hsieh H-M, Lin M-Y, Chiu Y-W, Wu P-H, Cheng L-J, Jian F-S, et al. Economic evaluation of a pre-ESRD pay-for-performance programme in advanced chronic kidney disease patients. Nephrology Dialysis Transplantation. 2016:gfw372.

11. Fishbane S, Miller I, Wagner JD, Masani NN. Changes to the end-stage renal disease quality incentive program. Kidney Int. 2012;81(12):1167-71.

12. Duckett S, Daniels S, Kamp M, Stockwell A, Walker G, Ward M. Pay for performance in Australia: Queensland's new Clinical Practice Improvement Payment. J Health Serv Res Policy. 2008;13(3):174-7.

13. Ward M, Daniels SA, Walker GJ, Duckett S. Connecting funds with quality outcomes in health care: a blueprint for a Clinical Practice Improvement Payment. Australian Health Review. 2007;31(5):54-8.

14. Clinical Practice Improvement Payment (CPIP) User Guide Phase 111. In: Queensland Health CfHI, Patient Quality Improvement Service, editor. Herston, QLDMarch 2011.

15. Service CfHIPSaQI. Clinical Practice Improvement (CPIP) User Guide Phase III. Queensland Government, 2011.

16. McDonald SP, Russ GR, Kerr PG, Collins JF, Australia, New Zealand D, et al. ESRD in Australia and New Zealand at the end of the millennium: a report from the ANZDATA registry. Am J Kidney Dis. 2002;40(6):1122-31.

17. Health Q. Queensland Health Renal Plan Part 1. 2007. Retrieved from https://publications.qld.gov.au/storage/f/2014-06-10T03%3A03%3A31.250Z/renal-services-plan-part-1.pdf

18. Eijkenaar F, Emmert M, Scheppach M, Schöffski O. Effects of pay for performance in health care: a systematic review of systematic reviews. Health policy. 2013;110(2):115-30.

19. Scott A, Liu M, Yong J. Financial Incentives to Encourage Value-Based Health Care. Medical Care Research and Review. 2016 pii: 1077558716676594. [Epub ahead of print].

20. Slinin Y, Guo H, Li S, Liu J, Ensrud K, Gilbertson DT, et al. Association of provider–patient visit frequency and patient outcomes on hemodialysis. J Am Soc Nephrol. 2012; 23: 1560-7.

21. Erickson KF, Winkelmayer WC, Chertow GM, Bhattacharya J. Physician visits and 30-day hospital readmissions in patients receiving hemodialysis. J Am Soc Nephrol. 2014;25(9):2079-87.

22. Mentari EK, DeOreo PB, O'Connor AS, Love TE, Ricanati ES, Sehgal AR. Changes in Medicare reimbursement and patient-nephrologist visits, quality of care, and health-related quality of life. Am J Kidney Dis. 2005;46(4):621-7.

23. Erickson KF, Winkelmayer WC, Chertow GM, Bhattacharya J. Hemodialysis Hospitalizations and Readmissions: The Effects of Payment Reform. Am J Kidney Dis. 2017; 69: 237-246

24. Gray NA, Dent H, McDonald SP. Dialysis in public and private hospitals in Queensland. Intern Med J. 2012;42(8):887-93.

25. Gray NA, Mahadevan K, Campbell VK, Noble EP, Anstey CM. Data quality of the Australia and New Zealand Dialysis and Transplant Registry: a pilot audit. Nephrology. 2013;18(10):665-70.

Table 1: Queensland Health Renal Clinical Performance Indicators and payments

Year	Improvement Indictors	Payments
2009-2010	1. Patients with a diagnosis of end stage kidney disease receiving peritoneal dialysis are screened for nasal carriage of Staphylococcus aureus at least annually 2. Patients with a diagnosis of end stage kidney disease receiving peritoneal dialysis who tested positive for the nasal carriage of Staphylococcus aureus receive mupirocin treatment	$500 per indicator $500 per indicator
2011-2012	1. Proportion of patients known to a nephrologist for 3 months or greater who commence dialysis through a functional arteriovenous fistula, arteriovenous graft, or Tenckhoff catheter 2. Patients who have received a renal transplant in the last 2 years who have undergone qualitative BK virus PCR serum testing in the past 6 months	$1,200 per indicator $195 per indicator

Table 2: Uses of Queensland Health pay-for-performance funds †

Category	Examples
Information Technology	• Patient Outcome database upgrade • Computer and laptop
Clinical Area Resources	• Educational tools for patients • Paediatric play equipment • Navman for community cars • Speech therapy equipment • New furniture
Human Resource	• Clinical project officer for Telehealth • After-hours provision of allied health
Professional Development	• Staff education and teamwork training • Library Books • Texts, training, improved workflow design etc.
Building/Office Modifications	• Construction of a resuscitation simulation centre • Modification to clinical work area
Projects and Research	• Project for policy and procedure work • Offline research time

† Adapted from Queensland Health Clinical Practice Improvement Payments User Guide

Table 3: Baseline characteristics of each period for Queensland and Rest of Australia among early referred patients

	Qld 2009-10	Qld 2011-12	Qld 2013-14	P value	ROA 2009-10	ROA 2011-12	ROA 2013-14	P value
Number	622	697	739		2510	3131	3159	
Age categories				0.003				0.6
<18 years	16(2.6)	12(1.7)	11(1.5)		38(1.5)	35(1.2)	38(1.2)	
18-44 years	85(13.7)	115(16.5)	106(14.3)		315(12.5)	408(13.0)	425(13.5)	
45-54years	94(15.1)	113(16.1)	114(15.4)		375(15.0)	501(16.0)	498(15.7)	
55-64years	116(18.7)	162(23.2)	199(26.9)		582(23.2)	733(23.4)	716(22.7)	
65-74years	147(23.6)	169(24.3)	163(22.1)		654(26.0)	768(24.5)	836(26.4)	
>75 years	164(26.4)	126(18.1)	146(19.8)		546(21.7)	686(21.9)	646(20.5)	
Gender (male %)	60.8	57.4	63.6	0.05	61.0	61.9	62.2	0.6
Race				<0.001				<0.001
Caucasian (%)	511(82.2)	536(76.9)	562(76.0)		1956(77.9)	2322(74.2)	2080(65.9)	
Asian (%)	28(4.5)	25(3.6)	24(3.3)		211(8.4)	314(10.0)	329(10.4)	
Pacific Islanders (%)	14(2.3)	32(4.6)	40(5.4)		66(2.6)	91(2.9)	93(2.9)	
Indigenous Australian	56(9.0)	92(13.2)	74(10.0)		212(8.4)	284(9.1)	347(11.0)	

(%) Other (%)	13(2.1)	12(1.7)	39(5.3)		65(2.6)	120(3.8)	310(9.8)	
Primary renal disease				0.6				0.006
Diabetes (%)	205(33.0)	254(36.4)	256(34.6)		937(37.3)	1254(40.0)	1286(40.7)	
Glomerulonephritis (%)	126(20.3)	130(18.7)	138(18.7)		621(24.7)	709(22.6)	659(20.9)	
Vascular/Hypertension (%)	102(16.4)	121(17.4)	110(14.9)		348(13.9)	432(13.8)	462(14.6)	
Polycystic (%)	50(8.0)	47(6.7)	67(9.0)		191(7.6)	189(6.0)	200(6.3)	
Other (%)	139(22.3)	145(20.8)	168(22.8)		413(16.5)	547(17.5)	552(17.5)	
BMI (kg/m2) (Median +/- IQR)	27.4(23.5-31.6)	27.9(24.1-32.6)	28.2(24.3-32.7)	0.02	27.3(23.8-31.8)	27.6(23.8-32.5)	27.6(24.0-32.4)	0.2
Current or previous smoker (%)	322(51.8)	384(55.1)	379(51.3)	0.4	1322(52.7)	1755(56.4)	1646(53.2)	0.01
Diabetes (%)	277(44.6)	326(46.9)	346(47.1)	0.6	1225(48.9)	1604(51.3)	1645(52.2)	0.03
Ischaemic heart disease (%)	236(38.0)	231(33.2)	208(28.2)	<0.001	922(36.7)	1118(35.7)	1001(31.7)	<0.001

Cerebrovascular Disease (%)	75(12.1)	75(12.1)	62(8.4)	0.07	300(11.9)	389(12.4)	351(11.1)	0.2
Peripheral vascular disease (%)	116(18.7)	135(19.3)	104(14.1)	0.01	511(20.3)	584(18.6)	526(16.7)	0.002
Chronic lung disease (%)	80(12.9)	82(11.7)	75(10.1)	0.3	330(13.2)	424(13.5)	396(12.5)	0.5
Initial modality PD (%)	156(25.1)	184(26.3)	252(34.2)	<0.001	701(28.0)	794(25.4)	956(30.3)	<0.001
AVF/AVG at first HD (%)	243(52.2)	260(51.0)	263(54.6)	0.5	937(51.9)	1250(54.2)	1110(51.1)	0.1
AVF/AVG at first HD or commenced PD first (%)	399(64.2)	444(64.1)	515(70.4)	0.02	1638(65.3)	2044(65.9)	2066(66.0)	0.8

Qld, Queensland; ROA, rest of Australia; BMI, body mass index, IQR, interquartile range; PD, peritoneal dialysis; AVF, arteriovenous fistula; AVG, arteriovenous graft; HD, haemodialysis

Table 4: Multivariate logistic regression for predictors of starting dialysis with peritoneal dialysis or haemodialysis with an AVF/AVG among early referred patients in Queensland and rest of Australia

Variable	QLD		ROA	
	OR (95% CI)	p	OR (95% CI)	p
2010/11	1.02(0.81-1.29)	0.8	0.97(0.87-1.09)	0.6
2011/12(pay-for-performance period)	Reference		Reference	
2013/2014	1.28(1.01-1.62)	0.038	1.01(0.91-1.13)	0.9
Age				
<18 years	0.71(0.34-1.51)	0.4	0.57(0.37-0.89)	0.01
18-44 years	0.80(0.58-1.11)	0.2	0.74(0.63-0.87)	<0.001
45-54years	1.18(0.86-1.63)	0.3	0.86(0.74-0.99)	0.04
55-64years	Reference		Reference	
65-74years	1.14(0.86-1.53)	0.5	0.97(0.85-1.11)	0.6
>75 years	0.74(0.55-0.99)	0.05	0.87(0.76-1.02)	0.05
Male	1.05(0.86-1.26)	0.6	1.28(1.16-1.42)	<0.001
BMI	1.00(0.98-1.01)	0.7	1.00(1.00-1.01)	0.1
Race				
Caucasian	Reference		Reference	
Asian	1.44(0.84-2.48)	0.2	1.26(1.07-1.49)	0.006
Pacific Islanders	0.50(0.31-0.79)	0.003	0.64(0.49-0.83)	0.001
Indigenous Australian	0.76(0.55-1.05)	0.09	0.60 (0.51-0.71)	<0.001 0.8
Other	0.88(0.50-1.55)	0.7	1.03(0.84-1.27)	
Current or	1.00(0.80-1.19)	0.9	0.97(0.88-1.07)	0.5

previous smoker				
Diabetes	0.72(0.58-0.88)	0.002	0.75(0.68-0.83)	<0.001
Ischaemic heart disease	0.67(0.53-0.83)	<0.001	0.75(0.68-0.83)	<0.001
Cerebrovascular disease	0.81(0.59-1.10)	0.2	1.06(0.92-1.23)	0.4
Peripheral vascular disease	0.92(0.70-1.19)	0.5	0.79(0.70-0.89)	<0.001
Chronic lung disease	0.55(0.40-0.70)	<0.001	0.71(0.62-0.81)	<0.001

Qld, Queensland; ROA, rest of Australia; BMI, body mass index

Figure Legends

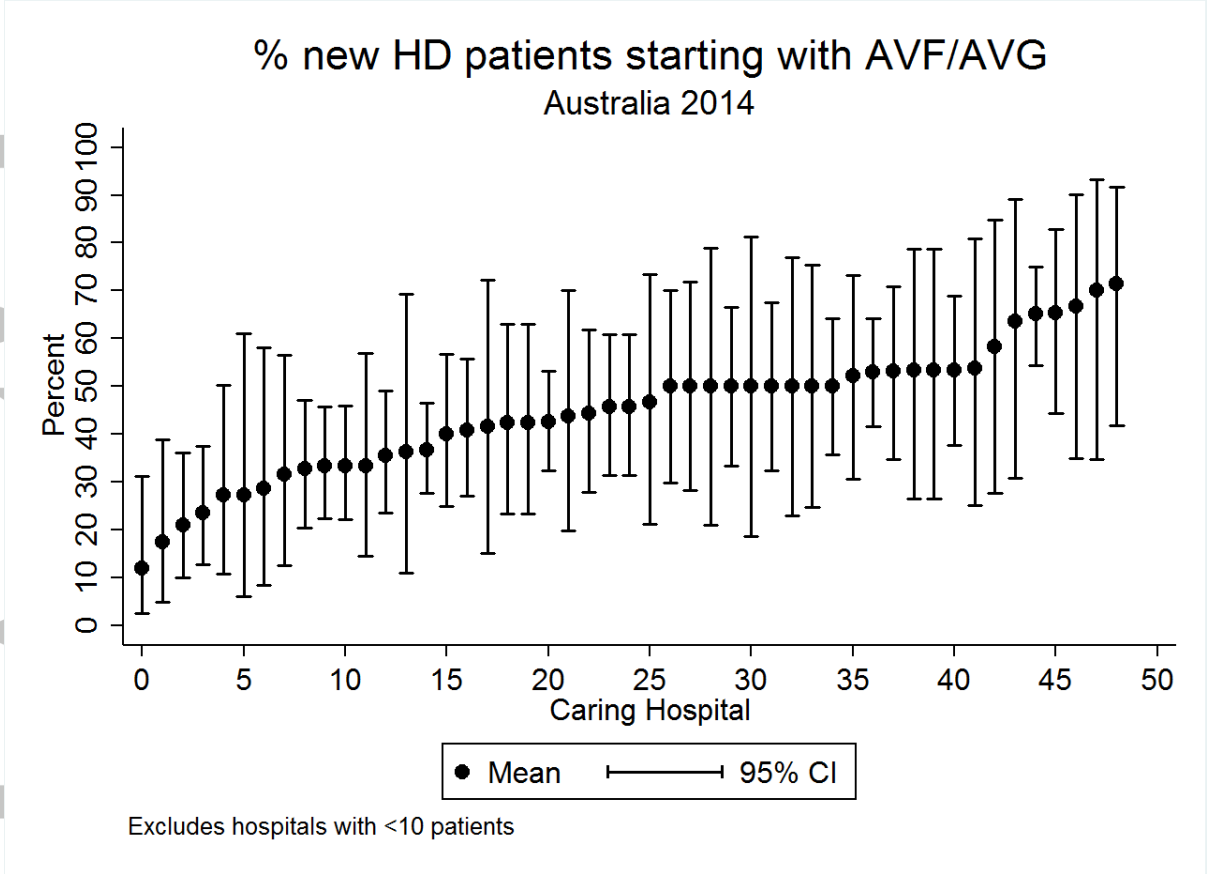

Figure 1: Variation in arteriovenous fistula / arteriovenous graft rate at first haemodialysis in Australia by treating renal unit (reproduced with permission ANZDATA)

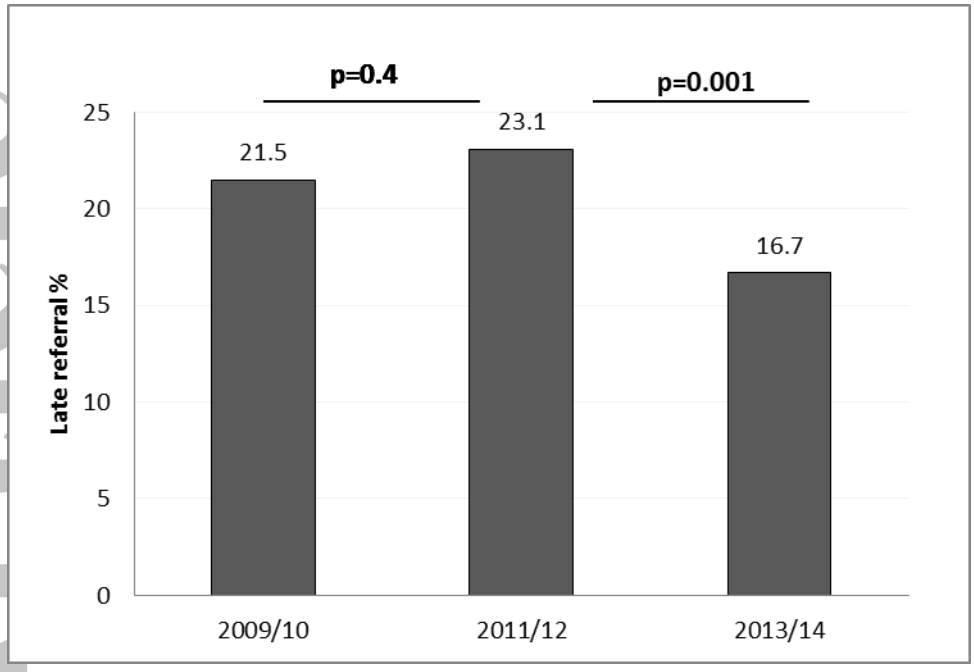

Figure 2a

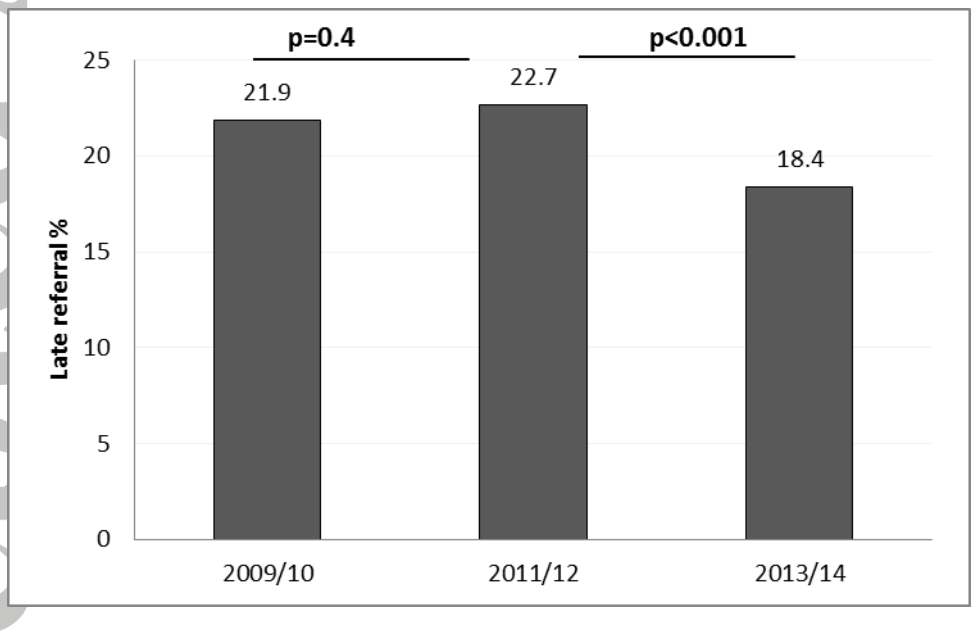

Figure 2b

Figure 2: Late referral rates (<90 days to dialysis start) to a nephrologist in Queensland (2A) and rest of Australia (2B) 2009-2014

SUMMARY AT A GLANCE

- This study was performed to determine the effect of pay-for-performance program implemented in 2011-2012 by Queensland Health. It was incentive payments to renal units for early referred patients who commenced PD or HD with an AVF/AVG. In 2013-2014, the odds ratio for commencement of PD or HD with AVF/AVG was 1.28 (95% CI 1.01-1.61). The effect of pay-for-performance program on clinical care was clear, though it appeared delayed.