Supplementary material

Dialysis Measurement, Analysis, and Reporting (DMAR) system

DMAR include demographics, comorbidities, laboratory values, history of pre-dialysis care and the circumstances around dialysis start, changes in dialysis modality, hospitalization, transplant, loss to follow-up, transfer out of a program, and death. In addition, all vascular access procedures and the indication for each procedure are captured, permitting construction of a longitudinal record of vascular access use, including the type of vascular access in use, the start and stop dates of each period of use, and the reason for termination for each period. To ensure data quality, two investigators (RQ and MO) double-review all data elements from clinical databases and medical records, and queries are communicated to end-users and must be addressed prior to data export and analysis.

Model building and checking

In all analyses, we assessed all demographic and clinical characteristics as candidate variables for model adjustment. We monitored variations of the exposure regression coefficients (study period) to identify variables that could be manually removed as non-confounders or non-modifiers (absolute parameter change 0.1). Data were complete for all variables except for estimated glomerular filtration rate and body mass index. During model building we tested the associations of these two covariates with outcomes, by replacing each missing datum with 10 potential imputed values obtained using the multiple imputation procedure command 'mi' in STATA. We tested whether age, diabetes, or cardiovascular disease were effect modifiers. Finally, we checked consistency of analyses that included and excluded participants that were censored or died, and therefore had shorter follow-up. We used graphical and formal tests based on the analysis of residuals to assess the validity of each model, and to check assumptions and goodness of fit. We used Stata for all analyses (www.stata.com).

Power considerations

Based on the number of people starting hemodialysis every year in the Calgary Health Region of Southern Alberta and the eligibility criteria for the present study, we expected to include about

600 incident hemodialysis patients in this study. We estimated that this sample size would have a power >90% to detect an absolute increase of 20% in either of the two independent proportions (early or late period versus pre-team period) of people using a fistula, catheter-free, in the first year of dialysis. We assumed that 75% of the total study sample would receive a fistula attempt, and used a pre-team proportion of 50% (reference) and a two-sided alpha level of 0.01 in our calculations. We also allowed for 10% attrition (i.e. people leaving the cohort before 6 months), and included a Bonferroni correction for multiple testing to account for the fact that we divided the post-team era into two separate time periods. Finally, we used a ratio of 1:2 for pre- and post-team enrolment in these calculations to account for the two post-team time periods compared to a single pre-team period.

Supplement Table 1: Procedures included in procedure rates

Fistula creations

- Fistula creation - other type
- Fistula creation - unknown type
- Brachiobasilic fistula creation
- Brachiocephalic fistula creation
- Radiocephalic fistula creation

Other Fistula procedures

- Fistula angioplasty
- Fistula collateral vein embolization
- Fistula collateral vein ligation
- Fistula fistulogram
- Fistula occlusion / removal
- Fistula thrombectomy
- Fistula thrombolysis
- Surgical exploration
- Fistula revision
- Venogram

Catheter procedures

- Central vein angioplasty
- Failed hemodialysis catheter insertion - non-tunneled
- Fibrin sheath disruption
- Hemodialysis catheter exchange - non-tunneled
- Hemodialysis catheter exchange - tunneled
- Hemodialysis catheter insertion - non-tunneled
- Hemodialysis catheter insertion - tunneled
- Hemodialysis catheter pulled/fell out - non-tunneled
- Hemodialysis catheter pulled/fell out - tunneled
- Hemodialysis catheter removal - non tunneled
- Hemodialysis catheter removal - tunneled
- Line-o-gram - non-tunneled catheter
- Line-o-gram - tunneled catheter

Supplemental Table 1: Probability of receiving a fistula creation attempt within one year of hemodialysis start

Logistic regression Number of observations = 609

Attempt	Odds Ratio	95% Confidence Interval
Time period*		
Early	1.46	0.92, 2.35
Late	0.85	0.54, 1.35
Cardiovascular disease	0.76	0.51, 1.13
Diabetes	1.35	0.93, 1.95
Age (per year)	1.02	1.01, 1.03
Male (vs. female sex)	1.47	1.02, 2.12

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation.

Supplemental Table 2: Probability of catheter-free fistula use for at least one day following fistula creation

Logistic regression Number of observations = 437

Any use	Odds Ratio	95% Confidence Interval
Time period*		
Early	0.87	0.53, 1.43
Late	0.89	0.52, 1.53
Cardiovascular disease	0.83	0.55, 1.27
Diabetes	0.89	0.59, 1.33
Age (per year)	0.99	0.98, 1.01
Male (vs. female sex)	1.99	1.34, 2.98

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation.

Supplemental Table 3: Probability of catheter-free fistula use during each follow-up day up to one year from hemodialysis start

Random-effects logistic regression — Number of observations = 129,029
Group variable: patient — Number of groups = 437

Day of use	Odds Ratio	95% Confidence Interval
Time period*		
Early	0.69	0.24, 1.97
Late	0.85	0.28, 2.61
Cardiovascular disease	0.42	0.17, 1.01
Diabetes	0.57	0.25, 1.33
Age (per year)	1.00	0.97, 1.03
Male (vs. female sex)	7.35	3.11, 17.3
Rho	0.85	0.83, 0.87

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. Rho: intra-class correlation coefficient.

Supplemental Table 4: Access-related procedures in the first year of hemodialysis in all study participants

Negative binomial regression Number of observations = 609

Access-related	IRR	95% Confidence Interval
Time period*		
Early	1.18	1.00, 1.37
Late	1.08	0.92, 1.27
Cardiovascular disease	1.15	1.01, 1.31
Diabetes	1.16	1.02, 1.31
Age (per year)	0.99	0.98, 1.01
Male (vs. female sex)	0.92	0.81, 1.05
Alpha	0.29	0.23, 0.37

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 5: Catheter-related procedures in the first year of hemodialysis in all study participants

Negative binomial regression Number of observations = 609

Catheter-related	IRR	95% Confidence Interval
Time period*		
Early	1.01	0.77, 1.32
Late	0.92	0.69, 1.22
Cardiovascular disease	1.34	1.01, 1.75
Diabetes	1.10	0.88, 1.38
Age (per year)	0.99	0.98, 0.99
Male (vs. female sex)	0.88	0.69, 1.09
Alpha	1.17	0.95, 1.42

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 6: Fistula-related procedures (including fistula creation attempts) in the first year of hemodialysis in all study participants

Negative binomial regression Number of observations = 609

Fistula-related	IRR	95% Confidence Interval
Time period*		
Early	1.37	1.15, 1.64
Late	1.26	1.05, 1.52
Cardiovascular disease	0.97	0.84, 1.12
Diabetes	1.21	1.05, 1.39
Age (per year)	1.01	1.00, 1.01
Male (vs. female sex)	0.98	0.85, 1.12
Alpha	0.17	0.11, 0.28

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 7: Fistula-related procedures (excluding fistula creation attempts) in the first year of hemodialysis in all study participants

Negative binomial regression Number of observations = 609

Fistula-related	IRR	95% Confidence Interval
Time period*		
Early	1.58	1.22, 2.04
Late	1.43	1.09, 1.87
Cardiovascular disease	0.94	0.77, 1.16
Diabetes	1.33	1.09, 1.63
Age (per year)	1.01	1.00, 1.02
Male (vs. female sex)	0.89	0.73, 1.09
Alpha	0.48	0.32, 0.70

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 8: Access-related procedures in the first year of hemodialysis in people who received a fistula

Negative binomial regression Number of observations = 437

Access-related	IRR	95% Confidence Interval
Time period*		
Early	1.07	0.92, 1.24
Late	1.09	0.92, 1.28
Cardiovascular disease	1.15	1.02, 1.31
Diabetes	1.14	1.01, 1.29
Age (per year)	0.99	0.99, 1.00
Male (vs. female sex)	0.85	0.75, 0.96
Alpha	0.17	0.12, 0.23

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 9: Catheter-related procedures in the first year of hemodialysis in people who received a fistula

Negative binomial regression Number of observations = 437

Catheter-related	IRR	95% Confidence Interval
Time period*		
Early	0.84	0.62, 1.14
Late	0.85	0.62, 1.19
Cardiovascular disease	1.43	1.11, 1.86
Diabetes	1.12	0.87, 1.44
Age (per year)	0.99	0.98, 1.00
Male (vs. female sex)	0.78	0.61, 1.01
Alpha	1.01	0.79, 1.30

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 10: Fistula-related procedures (including fistula creation attempts) in the first year of hemodialysis in people who received a fistula

Negative binomial regression Number of observations = 437

Fistula-related	IRR	95% Confidence Interval
Time period*		
Early	1.26	1.08, 1.47
Late	1.26	1.07, 1.49
Cardiovascular disease	1.00	0.89, 1.14
Diabetes	1.14	1.01, 1.29
Age (per year)	1.00	0.99, 1.01
Male (vs. female sex)	0.91	0.81, 1.02
Alpha	0	0, 0

*Reference category for time period is ‘before’ vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter (non-significantly different from zero in this model).

Supplemental Table 11: Fistula-related procedures (excluding fistula creation attempts) in the first year of hemodialysis in people who received a fistula

Negative binomial regression Number of observations = 437

Fistula-related	IRR	95% Confidence Interval
Time period*		
Early	1.45	1.14, 1.85
Late	1.45	1.12, 1.86
Cardiovascular disease	0.98	0.81, 1.18
Diabetes	1.26	1.05, 1.52
Age (per year)	1.00	0.99, 1.01
Male (vs. female sex)	0.84	0.69, 1.01
Alpha	0.19	0.11, 0.37

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Table 12: Procedures performed in non-maturing fistulas in the first year of hemodialysis

Negative binomial regression Number of observations = 437

Access-related	IRR	95% Confidence Interval
Time period*		
Early	1.29	0.59, 2.84
Late	1.67	0.76, 3.68
Cardiovascular disease	0.89	0.49, 1.61
Diabetes	1.98	1.05, 3.71
Age (per year)	0.98	0.97, 1.01
Male (vs. female sex)	0.71	0.41, 1.24
Alpha	0	-1836, 1801

*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter (non significantly different from zero in this model).

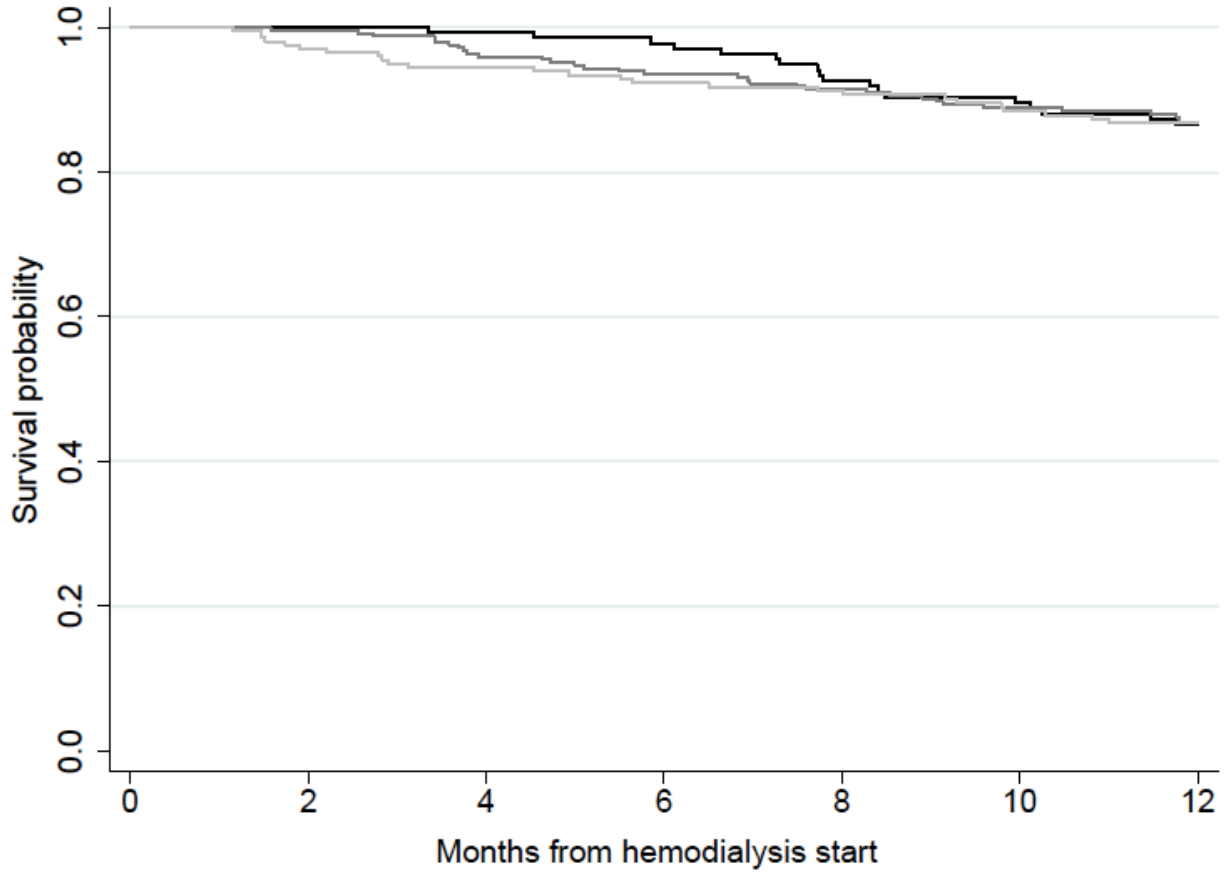
Supplemental Table 13: Access-related procedures (catheter-related procedures) in the first year of hemodialysis in people who did not receive a fistula

Negative binomial regression Number of observations = 172

Access-related	IRR	95% Confidence Interval
Time period*		
Early	1.66	0.99, 2.77
Late	1.07	0.64, 1.78
Cardiovascular disease	1.18	0.76, 1.84
Diabetes	1.19	0.78, 1.83
Age (per year)	0.98	0.97, 0.99
Male (vs. female sex)	1.23	0.81, 1.86
Alpha	1.09	0.74, 1.61

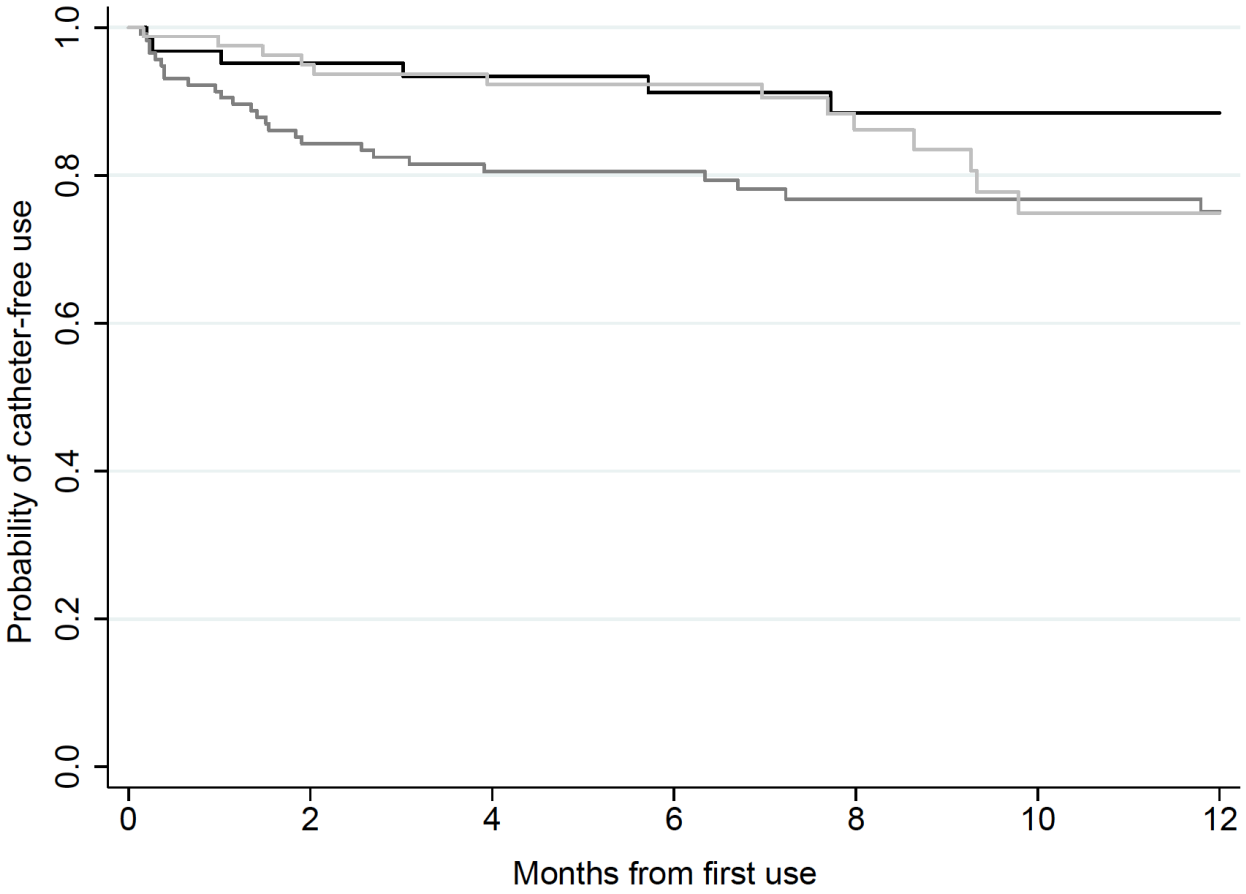
*Reference category for time period is 'before' vascular access team implementation (2004-2005); early and late categories refer to the years 2006-2008 and 2009-2011 folllowing vascular access team implementation. IRR indicates incidence rate ratio; alpha: over-dispersion parameter.

Supplemental Figure 1: Participant Survival



Legend: Most participants were in the study and alive at the end of the first year of hemodialysis. There were no differences in mortality by period (Hazard Ratio and 95% Confidence Intervals were 0.94 (0.53–1.68) and 1.04 (0.57–1.91) respectively in the early (dark grey) and late period (light grey) relative to the pre-team period (black; N=609; Cox regression model adjusted for age, sex, diabetes and cardiovascular disease).

Supplemental Figure 2: Assisted functional patency



Legend: Assisted (secondary) survival of the fistula from the date of the first catheter-free use to the date of its last catheter-free use. Hazard Ratio and 95% Confidence Intervals were 2.73 (1.12–6.67) and 1.67 (0.63–4.41) respectively in the early (dark grey) and late period (light grey) relative to the pre-team period (black; N=264; Cox regression model adjusted for age, sex, diabetes and cardiovascular disease).