Journal of Medical and Health Studies
ISSN: 2710-1452
DOI: 10.32996/jmhs
Journal Homepage: al-kindipublisher.com/index.php/jmhs/index

Factors Associated with Current Catheter Use Among Maintenance Hemodialysis Patients in Southern Iraq: A Cross-Sectional Study of Initial Vascular Access and Dialysis Vintage

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ABSTRACT

Relative to arteriovenous fistulas (AVFs), central venous catheters carry a greater risk of infection, cardiovascular complications, and mortality, and guidelines recommend minimizing their use. In Iraq most patients start hemodialysis through a catheter, but the factors that keep prevalent patients catheter-dependent have not been studied. This cross-sectional analysis included all 394 adults receiving maintenance hemodialysis in the five units of Thi-Qar Governorate between September 2025 and January 2026. Demographic, comorbidity, and dialysis characteristics of patients currently receiving dialysis via a catheter were contrasted with those of AVF users. Independent correlates of current catheter use were identified by multivariable binary logistic regression. At the time of study, 183 patients (46.4%; 95% CI 41.6–51.4) were dialyzing through a catheter and 211 through an AVF. The two groups were comparable in age, sex, residence, known CKD duration, diabetes, hypertension, cardiovascular disease, and number of weekly sessions. Catheter users had a much shorter dialysis vintage (11.7 ± 18.2 vs. 35.1 ± 27.8 months; $p < 0.001$). Of the 342 patients who started dialysis through a catheter, 195 (57.0%) had converted to an AVF, whereas 36 of the 52 patients (69.2%) who started with an AVF were now using a catheter. In multivariable analysis, each additional year of dialysis vintage halved the odds of catheter use (aOR 0.49 per 12 months; 95% CI 0.41–0.59), and patients who had started with an AVF had about five-fold higher odds of current catheter use than those who had started with a catheter (aOR for catheter start 0.19; 0.09–0.41). No demographic or comorbid characteristic was associated with catheter use. In Thi-Qar, catheter dependence is clustered in the early years on dialysis and among patients who initiated dialysis with an AVF, and it is not explained by patient comorbidity. Earlier fistula creation and surveillance of maturing and established fistulas should be priorities for hemodialysis services in southern Iraq.

KEYWORDS

hemodialysis; vascular access; central venous catheter; arteriovenous fistula; dialysis vintage; initial vascular access; Iraq

ARTICLE INFORMATION

ACCEPTED: 01 October 2026 **PUBLISHED:** 01 November 2026 **DOI:** 10.32996/jmhs.2026.7.12.1

1. Introduction

Vascular access type is among the small number of factors influencing hemodialysis outcomes that can be modified. Central venous catheters, when set against arteriovenous fistulas (AVFs), expose patients to more fatal and non-fatal infections, more cardiovascular events, and higher all-cause mortality [1,2], including catheter-related bloodstream infection [3], and they impair patients' quality of life [4]. Facilities that rely more on fistulas have shown lower death rates across the nations enrolled in the Dialysis Outcomes and Practice Patterns Study [@PISONI09], while access-related complications account for a substantial share of illness among people on dialysis [5,6]. The 2019 KDOQI guideline therefore recommends that each patient have an individualized life-plan for end-stage kidney disease (ESKD), in which an appropriate permanent access, usually an AVF, is planned before dialysis is needed and catheter use is kept as short as possible [7]; European guidelines likewise favor a fistula as the first-line access [8].

Practice and outcomes vary widely between countries and income groups [9,10]. According to the International Society of Nephrology Global Kidney Health Atlas, in half of the low-income countries surveyed over 75% of patients initiated hemodialysis via a temporary catheter [11], and catheter use remains high in many middle-income countries, including Egypt [12], and in some high-income settings [13]. In Iraq, national data on access practice are limited [14]. In a governorate-wide survey of Thi-Qar

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Governorate, 86.8% of patients started dialysis through a catheter, and 46.4% were still dialyzing through a catheter at the time of study [15].

Catheter dependence in a prevalent population can arise in two ways: patients who start with a catheter may not yet have converted to a fistula, and patients who started with a fistula may now be dialyzing through a catheter. Primary failure and loss of patency are common even in well-resourced programs [16], and older age and cardiovascular comorbidity are recognized predictors of failure to mature [17]. Even in high-income settings, many patients start dialysis with a catheter and remain exposed to catheter-related complications in the incident year [18]. Knowing which of these pathways dominates determines whether services should focus on earlier fistula creation, on maintaining existing fistulas, or on both.

This study therefore compared prevalent hemodialysis patients using a catheter with those using an AVF in Thi-Qar Governorate, and identified the demographic, clinical, and dialysis-related factors independently associated with current catheter use.

2. Materials and Methods

2.1 Study design, setting, and data source

The study had an analytical cross-sectional design, and its reporting follows the STROBE guidelines [19]. It used data from a governorate-wide survey of all five hemodialysis units of Thi-Qar Governorate, which together provide all maintenance hemodialysis in the governorate. Data were collected between September 2025 and January 2026. The overall etiological spectrum and the distribution of vascular access in this cohort are reported separately [15]; the present analysis addresses the determinants of current catheter use, which were not examined there.

2.2 Participants

Total population sampling was used, and all patients undergoing maintenance hemodialysis at the five units over the data-collection period were invited to participate. Patients were eligible if they were 18 years or older, had clinically and biochemically confirmed ESKD, were on regular maintenance hemodialysis in Thi-Qar, and gave informed consent. Patients dialyzing outside the governorate, those receiving dialysis for acute kidney injury, those with incomplete medical records, and those who declined participation were excluded. A total of 394 patients were analyzed.

2.3 Data collection and definitions

Trained medical students, supervised by a nephrologist, collected data in face-to-face interviews during routine dialysis sessions using a structured questionnaire, and every item was cross-checked against hospital records, dialysis cards, and unit registers. Variables included age, sex, residence, duration of known CKD before dialysis, dialysis vintage (months since the first maintenance hemodialysis session), number of sessions per week, the presence of diabetes mellitus, hypertension, or cardiovascular disease, and the type of vascular access both at dialysis initiation and at the time of study.

Current vascular access, the outcome of interest, was defined as the access used for the dialysis session at which the patient was interviewed and was classified as catheter (tunneled or non-tunneled central venous catheter) or AVF, following standardized access terminology [20]. Access at initiation was classified as catheter or AVF according to the access used for the first maintenance hemodialysis session.

2.4 Statistical analysis

All analyses were run in IBM SPSS Statistics 26.0 (IBM Corp., Armonk, NY, USA). Continuous data are summarized as mean ± standard deviation (SD), and categorical data as counts with percentages. Group means were contrasted with the independent-samples t-test, with Levene's test used to check homogeneity of variance and Welch's adjustment applied where this assumption did not hold. Proportions were contrasted with Pearson's chi-square test; where expected frequencies were too small, Fisher's exact test was used instead, with the Freeman–Halton extension for tables beyond 2 × 2. Wilson score intervals provided the 95% confidence intervals (CIs) for the main proportions. Current catheter use (coded 1 = catheter, 0 = AVF) was modeled as the outcome in a multivariable binary logistic regression. Age, sex, diabetes mellitus, hypertension, cardiovascular disease, dialysis vintage, and catheter use at initiation were entered simultaneously; continuous variables were entered as continuous covariates. With 183 outcome events and seven covariates, the model had more than 25 events per variable, well above the conventional minimum of ten [21]. Associations are presented as adjusted odds ratios (aORs) and 95% CIs, and the vintage estimate is additionally shown per 12 months (aOR per month raised to the 12th power). Statistical significance was set at a two-sided $p < 0.05$.

3. Results

3.1 Current vascular access

Among the 394 participants, 211 (53.6%) were dialyzing through an AVF and 183 (46.4%; 95% CI 41.6–51.4) through a catheter at the time of study.

3.2 Demographic and clinical characteristics

Catheter and AVF users were similar in age (51.96 ± 18.85 vs. 54.81 ± 15.42 years; $p = 0.105$), sex (male 48.1% vs. 52.1%; $p = 0.423$), residence (rural 25.7% vs. 28.0%; $p = 0.611$), and duration of known CKD before dialysis (35.1 ± 76.4 vs. 31.4 ± 45.2 months; $p = 0.556$) (Table 1, Figure 1). In contrast, dialysis vintage was three times shorter among catheter users (11.74 ± 18.22 vs. 35.06 ± 27.78 months; $t = -9.967$; $p < 0.001$).

Table 1. Demographic and clinical profile of patients by current vascular access (N = 394)

Variable	Catheter (n = 183)	AVF (n = 211)	Test statistic	p-value
Age, years, mean ± SD	51.96 ± 18.85	54.81 ± 15.42	t = −1.624	0.105
Sex	Sex	Sex	Sex	Sex
Male	88 (48.1)	110 (52.1)	χ2 = 0.642	0.423
Female	95 (51.9)	101 (47.9)		
Residence	Residence	Residence	Residence	Residence
Rural	47 (25.7)	59 (28.0)	χ2 = 0.259	0.611
Urban	136 (74.3)	152 (72.0)		
Duration of known CKD before dialysis, months, mean ± SD	35.10 ± 76.41	31.43 ± 45.16	t = 0.589	0.556
Dialysis vintage, months, mean ± SD	11.74 ± 18.22	35.06 ± 27.78	t = −9.967	< 0.001

Data are n (%) except where indicated. Means were tested with the independent-samples t-test (Welch correction where variances were unequal; exact p for dialysis vintage = 7.3 × 10−21) and proportions with Pearson's chi-square test. AVF, arteriovenous fistula; CKD, chronic kidney disease; SD, standard deviation.

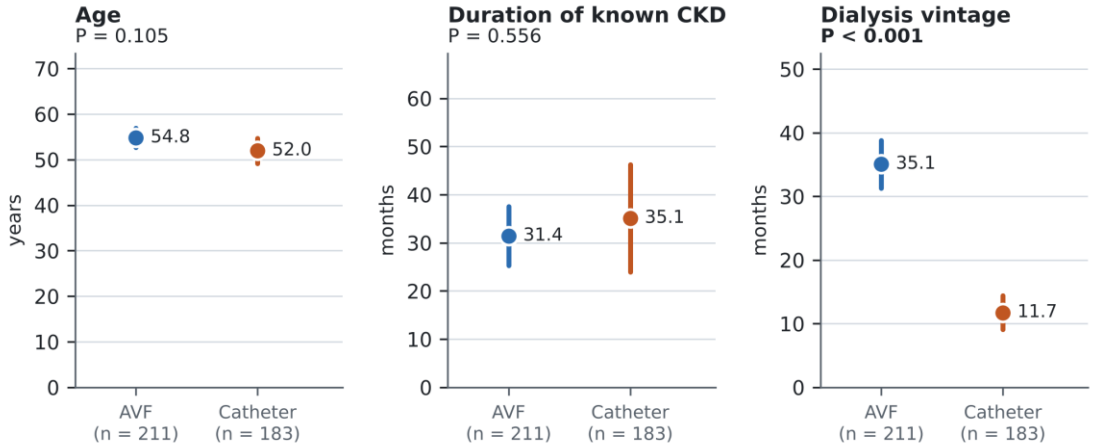


Figure 1. Age, duration of known CKD before dialysis, and dialysis vintage according to current vascular access (AVF, n = 211; catheter, n = 183). Points show group means and vertical lines the 95% confidence intervals of the mean (derived from the mean, SD, and n in Table 1); p-values are from the independent-samples t-test. AVF, arteriovenous fistula; CKD, chronic kidney disease.

3.3 Comorbidities

The prevalence of diabetes mellitus (42.6% vs. 44.1%; p = 0.772) and cardiovascular disease (30.1% vs. 28.9%; p = 0.804) was almost identical in catheter and AVF users (Table 2, Figure 2). Hypertension was somewhat less frequent among catheter users (80.3% vs. 86.7%), although this gap did not reach statistical significance (p = 0.086).

Table 2. Comorbidities according to current vascular access (N = 394)

Comorbidity	Catheter (n = 183)	AVF (n = 211)	χ2	p-value
Diabetes mellitus	78 (42.6)	93 (44.1)	0.084	0.772
Hypertension	147 (80.3)	183 (86.7)	2.952	0.086
Cardiovascular disease	55 (30.1)	61 (28.9)	0.062	0.804

Data are n (%) of patients with each condition; groups were compared using the Pearson chi-square test. AVF, arteriovenous fistula.

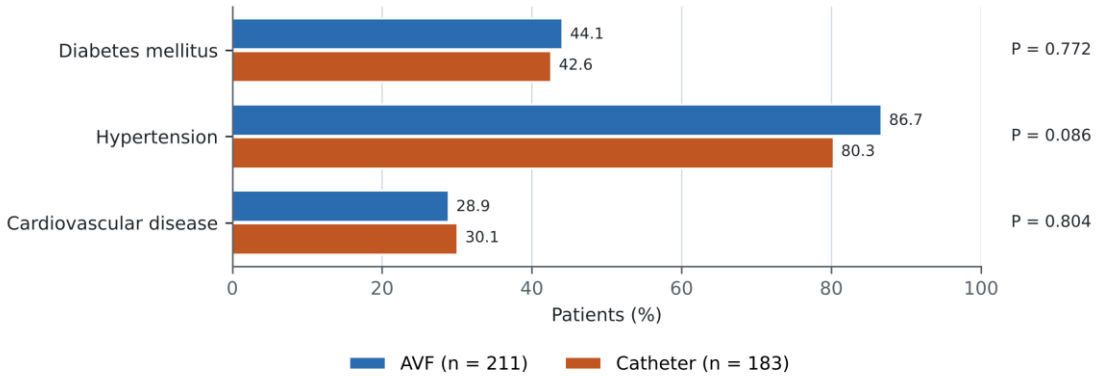


Figure 2. Frequency of diabetes mellitus, hypertension, and cardiovascular disease among AVF and catheter users (AVF, n = 211; catheter, n = 183). Bar length indicates the proportion of patients affected in each group; p-values were obtained with the Pearson chi-square test. AVF, arteriovenous fistula.

3.4 Dialysis-related characteristics and initial vascular access

The number of weekly dialysis sessions was similar in both groups (p = 0.799); about two-thirds of both catheter and AVF users dialyzed twice weekly (Table 3). Access at initiation, however, differed significantly ($\chi 2 = 12.502$; $p < 0.001$), and in an unexpected direction: a smaller proportion of current catheter users than of current AVF users had started dialysis through a catheter (80.3% vs. 92.4%).

Cross-tabulating access at initiation against current access explains this finding (Figure 3). Of the 342 patients who started with a catheter, 195 (57.0%; 95% CI 51.7–62.2) had since converted to an AVF and 147 (43.0%) remained on a catheter. Of the 52 patients who started dialysis with an AVF, only 16 (30.8%) were still using it, and 36 (69.2%; 95% CI 55.7–80.1) were now dialyzing through a catheter. Catheter dependence was therefore more frequent among patients who had started with a fistula than among those who had started with a catheter (Fisher's exact $p < 0.001$).

Table 3. Dialysis-related characteristics according to current vascular access (N = 394)

Variable	Catheter (n = 183)	AVF (n = 211)	Test statistic	p-value
Dialysis sessions per week	Dialysis sessions per week	Dialysis sessions per week	Dialysis sessions per week	Dialysis sessions per week
Once	8 (4.4)	11 (5.2)	Fisher = 1.20a	0.799
Twice	122 (66.7)	138 (65.4)		
Three times	49 (26.8)	60 (28.4)		
Four times	4 (2.2)	2 (0.9)		
Vascular access at initiation	Vascular access at initiation	Vascular access at initiation	Vascular access at initiation	Vascular access at initiation
Catheter	147 (80.3)	195 (92.4)	$\chi 2 = 12.502$	< 0.001
AVF	36 (19.7)	16 (7.6)		

Values are n (%). aFisher–Freeman–Halton exact test, applied because expected frequencies were too low for a chi-square test. Exact p for access at initiation = 4.1 × 10−4. AVF, arteriovenous fistula.

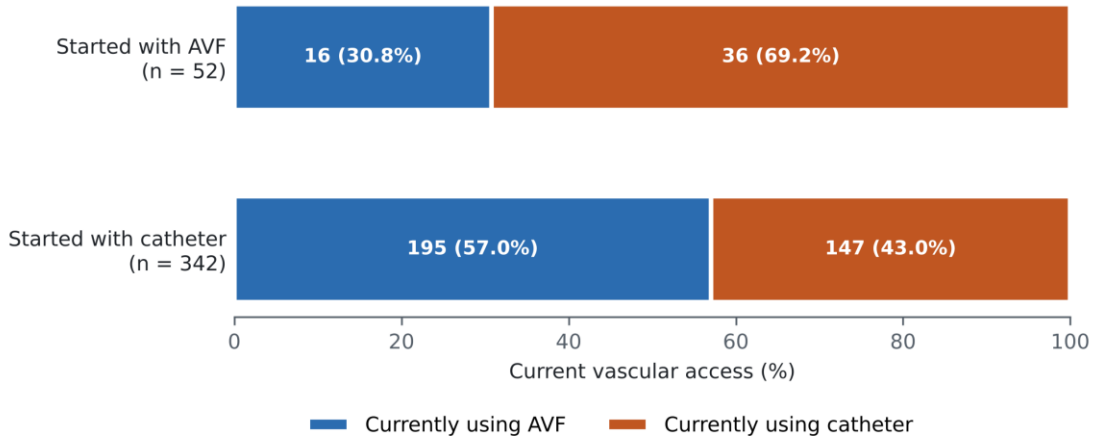


Figure 3. Access in use at the time of study, stratified by the access used to initiate hemodialysis (N = 394). Each bar shows patients who started dialysis with an arteriovenous fistula (AVF; n = 52) or a catheter (n = 342), divided by the access in use at the time of study. Values are n (% of the row). Catheters include tunneled and non-tunneled central venous catheters.

3.5 Factors independently associated with current catheter use

In multivariable logistic regression (Table 4, Figure 4), two factors were independently associated with current catheter use. Each additional month of dialysis vintage reduced the odds of catheter use by 5.7% (aOR 0.943; 95% CI 0.929–0.957; p < 0.001), equivalent to an aOR of 0.49 (0.41–0.59) per 12 months of dialysis. Patients who began dialysis on a catheter were less likely to be using a catheter now (aOR 0.189; 0.088–0.408; p < 0.001); expressed the other way round, patients who had started with an AVF had 5.3-fold higher adjusted odds (95% CI 2.5–11.4) of being catheter-dependent at the time of study. Age, sex, diabetes mellitus, hypertension, and cardiovascular disease were not associated with catheter use.

Table 4. Independent predictors of current catheter use: multivariable binary logistic regression (N = 394)

Variable	aOR [Exp(B)]	95% CI	p-value
Age (per year)	0.993	0.979–1.008	0.357
Sex (male vs. female)a	0.877	0.548–1.404	0.584
Diabetes mellitus (yes vs. no)	0.845	0.506–1.411	0.520
Hypertension (yes vs. no)	0.804	0.413–1.562	0.519
Cardiovascular disease (yes vs. no)	1.176	0.685–2.019	0.556
Dialysis vintage (per month)	0.943	0.929–0.957	< 0.001
per 12 monthsb	0.494	0.413–0.590	< 0.001
Catheter at initiation (yes vs. no)	0.189	0.088–0.408	< 0.001

Dependent variable coded 1 = current catheter, 0 = current AVF; all covariates were entered simultaneously. Exact p-values: dialysis vintage 1.1 × 10−15; catheter at initiation 2.1 × 10−5. aReference category: female. bDerived from the per-month estimate (aOR and confidence limits raised to the 12th power); not a separate model term. aOR, adjusted odds ratio; AVF, arteriovenous fistula; CI, confidence interval.

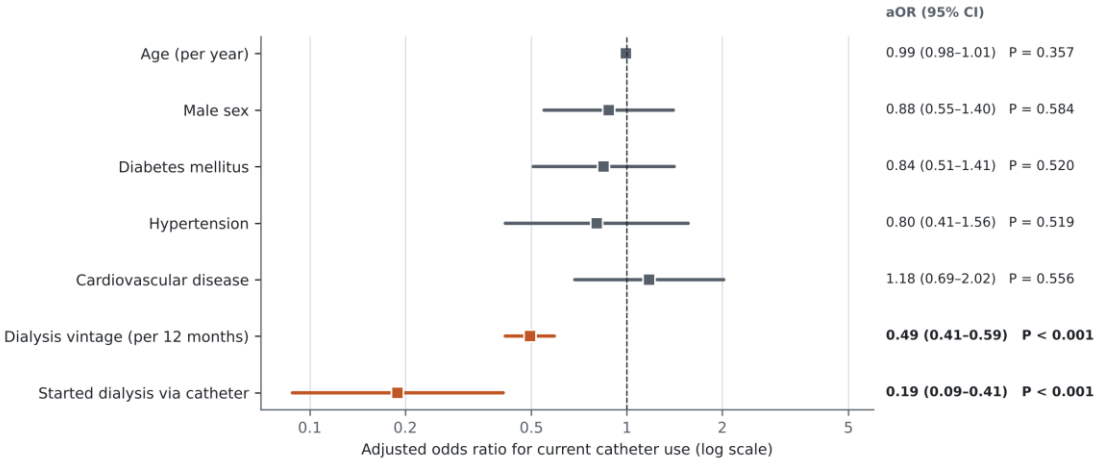


Figure 4. Adjusted odds ratios for current catheter use from the multivariable logistic model. Each square is a point estimate and each horizontal bar its 95% confidence interval, plotted on a log scale; the vertical dashed line denotes no association (odds ratio = 1). The estimate for dialysis vintage is expressed per 12 months (derived from the per-month estimate). Significant associations are shown in color and bold. aOR, adjusted odds ratio; CI, confidence interval.

4. Discussion

Almost one in two patients on maintenance hemodialysis in Thi-Qar Governorate was using a catheter. Catheter dependence was not related to age, sex, residence, diabetes, hypertension, or cardiovascular disease. It was instead determined by two features of the access history: time on dialysis, with the odds of catheter use halving for each additional year, and the type of initial access, with patients who had started with a fistula being more, not less, likely to be catheter-dependent.

4.1 Dialysis vintage and the catheter-to-fistula pathway

Because 86.8% of patients started dialysis through a catheter, a fistula in this population is usually created after dialysis has begun. The strong association with vintage indicates that most patients do eventually convert, but slowly: catheter users had been on dialysis for a mean of under one year, whereas fistula users had been on dialysis for almost three years. Each month spent on a catheter carries an excess risk of bacteremia and central venous stenosis [1,3,7], and most of these catheters were non-tunneled

[15], which are intended only for short-term use. The interval between dialysis initiation and fistula use is therefore a direct target for improvement. KDOQI recommends that access planning begin well before dialysis, so that the fistula is mature at the first session [7]; in Thi-Qar, where most patients present late [15,22], a realistic interim goal is to refer every incident catheter patient for fistula creation within the first weeks of dialysis and to monitor the time to first cannulation.

4.2 Initial vascular access and current catheter use

Most notably, over two-thirds of patients who started dialysis with an AVF were now using a catheter. This pattern was independent of vintage and comorbidity in the multivariable model. Because the dates of fistula creation and the reasons for the change of access were not recorded, this cross-sectional study cannot determine why these patients were now using a catheter, and the finding should not be read as an estimate of fistula failure. One possible explanation is misclassification: some patients recorded as starting with an AVF may have had a fistula created that was not yet usable, and dialysis may in fact have started through a catheter. Nonetheless, the finding indicates that starting dialysis with a fistula does not guarantee continued fistula use, and that these patients also need ongoing access follow-up.

4.3 Patient characteristics

In contrast to studies from high-income countries, in which older age and coronary and peripheral vascular disease predict failure of fistula maturation [17], neither age nor cardiovascular disease, nor sex or diabetes, was associated with catheter use in Thi-Qar. The absence of patient-level associations, together with the strong associations with access history, suggests that in this setting catheter dependence is determined chiefly by when access is created and how well it is maintained afterwards, rather than by patient suitability for a fistula. This interpretation is consistent with reports from other low- and middle-income settings, in which catheter use reflects funding, surgical capacity, and referral pathways more than patient characteristics [11,12].

4.4 Strengths and limitations

This study benefits from complete population-level coverage, which includes every hemodialysis unit in the governorate, the verification of interview data against medical records, and a multivariable model with a large number of events per covariate.

Several limitations should be acknowledged. First, being cross-sectional, the study observed each patient's access history at only one moment. The dates of fistula creation, first cannulation, and any change of access were not recorded, so access patency could not be analyzed as a time-to-event outcome, and the reasons for switching from a fistula to a catheter are unknown. Second, survivor bias is likely: patients who died early, who are more often catheter users, are under-represented, so the true burden of catheter use may be higher. Third, tunneled and non-tunneled catheters were analyzed together because of the small number of tunneled catheters. Fourth, vessel mapping, the number of previous access attempts, surgeon experience, and the availability of salvage procedures were not recorded, and residence was not included in the multivariable model. Finally, access at initiation was based on records and recall and may be misclassified, as discussed above.

4.5 Implications

Three priorities follow from these findings. First, the time from dialysis initiation to fistula creation and first cannulation should be measured and shortened, with every incident catheter patient referred for access surgery promptly. Second, a vascular access program with clinical surveillance of maturing and established fistulas should be established so that patients who have a fistula continue to use it. Third, when a catheter is unavoidable, tunneled rather than non-tunneled catheters should be used [7]. Prospective registration of access events in Thi-Qar would allow these measures to be evaluated.

5. Conclusion

Catheter dependence among prevalent hemodialysis patients in Thi-Qar Governorate is greatest early in the dialysis course and among those who initiated dialysis with an AVF, and it is not explained by age, sex, or comorbidity. Timely fistula creation after dialysis initiation and structured surveillance of existing fistulas are the interventions most likely to reduce catheter use in southern Iraq.

Declarations

Ethical approval: Ethics approval for the study was granted by the Ethics Committee of the College of Medicine, University of Thi-Qar, and administrative permission was obtained from the Thi-Qar Health Directorate.

Informed consent: Every participant provided informed consent before enrollment.

Data availability: The dataset analyzed here can be obtained from the corresponding author on reasonable request.

Author contributions: A.L.K. Al-Abdullah: conceptualization, methodology, investigation, formal analysis, writing – original draft, and writing – review & editing. The final version was read and approved by the author.

Acknowledgements: The author is grateful to the staff of the hemodialysis units of Thi-Qar Governorate, the medical students who assisted with data collection, and the patients who took part in the study.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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