Recent evaluation by nephrologists is associated with decreased incidence of tunneled dialysis catheter being used at the time of first arteriovenous access creation

Scott R. Levin, MD, MSc,[a] Andrea Alonso, MD,[a] Eduardo D. Salazar, BA,[a] Alik Farber, MD, MBA,[a] Vipul C. Chitalia, MD, PhD,[b,c,d] Elizabeth G. King, MD,[a] Thomas W. Cheng, MD, MS,[a] *and* Jeffrey J. Siracuse, MD, MBA,[a] *Boston and Cambridge, MA*

ABSTRACT

Objective: Late primary care provider (PCP) or nephrologist evaluation of patients with progressive kidney disease may be associated with increased morbidity and mortality. Among patients undergoing initial arteriovenous (AV) access creation, we aimed to study the relationship of recent PCP and nephrologist evaluations with perioperative morbidity and mortality.

Methods: We performed a retrospective review of patients from 2014 to 2022 who underwent initial AV access creation at an urban, safety-net hospital. Univariable and multivariable analyses identified associations of PCP and nephrologist evaluations <1 year and <3 months before surgery, respectively, with hemodialysis initiation via tunneled dialysis catheters (TDCs), 90-day readmission, and 90-day mortality.

Results: Among 558 patients receiving initial AV access, mean age was 59.7 ± 14 years, 59% were female gender, and 60.6% were Black race. Recent PCP and nephrology evaluations occurred in 386 (69%) and 362 (65%) patients, respectively. On multivariable analysis, unemployed and uninsured statuses were associated with decreased likelihood of PCP evaluation (unemployment: odds ratio [OR], 0.51; 95% confidence interval [CI], 0.34-0.77; uninsured status: OR, 0.05; 95% CI, 0.01-0.45) and nephrologist evaluation (unemployment: OR, 0.63; 95% CI, 0.43-0.91; uninsured status: OR, 0.22; 95% CI, 0.06-0.83) (all $P < .05$). Social support was associated with increased likelihood of PCP evaluation (OR, 1.81; 95% CI, 1.07-3.08) (all $P < .05$). Hemodialysis was initiated with TDCs in 304 patients (55%). Older age (OR, 0.98; 95% CI, 0.96-0.99), obesity (OR, 0.38; 95% CI, 0.25-0.58), and nephrologist evaluation (OR, 0.12; 95% CI, 0.08-0.19) were independently associated with decreased hemodialysis initiation with TDCs in patients receiving an initial AV access (all $P < .05$). Ninety-day readmission occurred in 270 cases (48%). Cirrhosis (OR, 2.5; 95% CI, 1.03-6.03; $P = .04$), coronary artery disease (OR, 2.31; 95% CI, 1.5-3.57), prosthetic AV access (OR, 1.84; 95% CI, 1.04-3.26), and impaired ambulation (OR, 1.75; 95% CI, 1.15-2.66) were independently associated with increased readmission (all $P < .05$). Older age (OR, 0.98; 95% CI, 0.97-0.99), prior TDC (OR, 0.65; 95% CI, 0.45-0.94), and unemployment (OR, 0.58; 95% CI, 0.39-0.86) were associated with decreased readmission (all $P < .05$). Ninety-day mortality occurred in 1.6% of patients. Neither PCP nor nephrologist evaluation was associated with readmission or mortality.

Conclusions: Recent nephrology evaluation was associated with reduced hemodialysis initiation with TDCs among patients undergoing initial AV access creation. Unemployed and uninsured statuses posed barriers to accessing nephrology care. (J Vasc Surg 2024;79:128-35.)

Keywords: Arteriovenous; End-stage renal disease; Hemodialysis; Preventive care; Tunneled dialysis catheter; Vascular access

End-stage renal disease (ESRD) can be mitigated or delayed with timely, preventive medical care of patients with chronic kidney disease by primary care providers (PCPs) and nephrologists, including hypertension and diabetes treatment and renoprotective medication use.[1-6] For patients approaching ESRD, PCPs and nephrologists create a plan for access creation to avoid initiating hemodialysis through tunneled dialysis catheters (TDCs).[7-9]

Patients acutely requiring hemodialysis receive TDCs to allow time for arteriovenous (AV) access creation and maturation. TDCs may be complicated by potentially life-threatening infection, dislodgement, deep vein thrombosis, or central venous stenosis. These outcomes increase the likelihood of catheter exchanges,

From the Division of Vascular and Endovascular Surgery,[a] and Renal Section, Department of Medicine,[b] Boston University Chobanian and Avedisian School of Medicine; and the Veterans Affairs Boston Healthcare System,[c] Boston; and the Institute of Medical Engineering and Sciences, Massachusetts Institute of Technology, Cambridge.[d]

Presented at the Vascular Annual Meeting of the Society for Vascular Surgery, National Harbor, Maryland, June 14-17, 2023.

Correspondence: Jeffrey J. Siracuse, MD, MBA, Division of Vascular and Endovascular Surgery, Boston University Chobanian and Avedisian School of Medicine, 85 E Concord St, Boston, MA 02118 (e-mail: jeffrey.siracuse@bmc.org).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

https://doi.org/10.1016/j.jvs.2023.09.021

readmissions, and compromised, future autogenous access.[10,11] Therefore, the Kidney Disease Outcomes Quality Initiative guidelines, utilized by nephrologists, had strongly recommend a "fistula first" plan for patients progressing to ESRD to ensure autogenous access.[1] Early identification of patients with deteriorating kidney function by PCPs and mitigation of barriers for nephrology referral may result in decreased TDC placements and subsequent health care resource utilization.

We aimed to determine the associations of preoperative PCP and nephrologist evaluations within 1 year and 3 months before first AV access creation, respectively, with hemodialysis initiation via TDCs, 90-day readmission, and 90-day mortality. Our secondary goal was to identify patient factors associated with PCP and nephrologist evaluations preoperatively. We performed a retrospective analysis of a granular, single-center database of patients undergoing first-time AV access creations at the largest safety-net hospital in New England.

ARTICLE HIGHLIGHTS

- **Type of Research:** Retrospective analysis of a single, urban, safety-net hospital database
- **Key Findings:** Among 558 patients receiving initial arteriovenous access, recent primary care provider and nephrologist evaluations occurred in 69% and 65%, respectively. Tunneled dialysis catheters (TDC) were present in 55%. Nephrologist evaluation was independently associated with decreased TDCs at the time of arteriovenous access creation. Unemployed and uninsured statuses were independently associated with decreased primary care provider and nephrologist evaluation.
- **Take Home Message:** Improving access to nephrologist care for patients with chronic kidney disease may decrease the likelihood of initiating hemodialysis using TDCs.

METHODS

A retrospective review was performed for all patients (n = 558) who underwent first AV access creation from 2014 to 2022 at Boston Medical Center, an urban, academic, tertiary, and safety-net hospital in Boston, Massachusetts. Given our aim to assess patients receiving their first durable access, patients who previously underwent peritoneal dialysis, prior kidney transplantation, or AV access creation were excluded. PCP evaluation within 1 year and/or nephrologist evaluation within 3 months before surgery were determined from physician and advanced practitioner notes and listed encounters in the institutional and external medical records. The details about a patient's access history and TDC use was derived from primary care, surgeon, and nephrologist notes in the electronic medical record. Prior literature has demonstrated improved health outcomes associated with these time intervals between outpatient PCP/nephrologist evaluation and dialysis initiation.[12,13] Further, many primary care assessments are yearly, and this represents what is thought to be the minimum needed for health maintenance. The 3-month period was chosen for nephrology evaluation to capture a shorter time needed to detect deteriorating kidney function, but still have time to get referred and establish a functioning access. The Boston University Institutional Review Board regarded this study as non-human subjects research, and, as such, patient consent was waived.

Patient demographics, including age (year), gender, race (White, Black, other/unknown), Hispanic ethnicity, primary insurer (Medicare, Medicaid, commercial, uninsured), employment status, social support (non-single status or living with others), education level, and non-English speaking status, were identified. Comorbidities analyzed included assisted activities of daily living (requiring assistance with at least one of six skills considered fundamental to independent living: ambulating, feeding, dressing, personal hygiene, continence, and toileting), impaired ambulatory status (relying on any assistive device [cane, walker, wheelchair] or on others to mobilize), smoking history (current <1 month, former/never), obesity (body mass index ≥30 kg/m^2), diabetes of any severity, chronic obstructive pulmonary disease of any etiology and severity, congestive heart failure (CHF) of any severity, coronary artery disease (CAD; angina or myocardial infarction history), peripheral artery disease (reduced ankle-brachial index or history of intermittent claudication or chronic limb-threatening ischemia), cirrhosis of any etiology and severity, dementia of any etiology and severity, and previous transient ischemic attack or stroke. Procedural characteristics assessed included TDC present for hemodialysis during access creation, access type created, and anesthesia type.

Outcomes evaluated were 90-day readmission (unplanned hospital admission from the emergency department or outpatient clinic in the postoperative period) and 90-day all-cause mortality.

Statistical analysis. Patient demographics, procedural characteristics, and outcomes were reported as categorical variables (number [%]), and continuous variables as mean ± standard deviation, as appropriate. To identify variables associated with recent PCP and nephrologist evaluations, univariable and multivariable analyses were performed. In univariable analysis, all variables were compared based on recent PCP visit status and recent nephrologist visit status using the *t*-test for continuous measures and the χ^2 test for categorical measures. Multivariable logistic regression was used to evaluate associations with recent PCP visit and nephrologist visit. The models included variables found to be statistically

different in unadjusted analyses (using a *P*-value < .5). Backward elimination at the 0.5 level reduced the models. The relationships were expressed as adjusted odds ratios (ORs) with corresponding 95% confidence intervals (CIs). A *P*-value < .05 was set as statistically significant. Multivariable logistic models were constructed in the same manner to identify factors associated with TDC placement and 90-day readmission. All analyses were performed using STATA 15.1 software (StataCorp). A *P* value less than .05 was set as statistically significant.

RESULTS

Demographics and comorbidities. There were 558 patients undergoing first-time AV access creation. Mean age was 59.7 ± 14 years, 59% were male, and 59% were Black (Tables I and II). The majority were unemployed (58.8%) but had a social support system (82.6%). A minority had less than primary school education (4.1%) or were non-English speaking (42.1%). Assisted activities of daily living and impaired ambulatory statuses were present in 19.4% and 34.1%, respectively. Common comorbidities were diabetes (64.7%), CHF (40%), obesity (38%), and CAD (27.4%). More than one-half had TDCs at the time of AV access creation. Access type was brachiocephalic (45.7%), brachiobasilic (23.1%), radiocephalic (15.2%), and prosthetic (12.4%). Ninety-day rates of readmission and mortality were 48.4% and 1.6%. respectively.

PCP evaluation within 1 year of AV access creation. Patients were evaluated by PCPs in 69% of cases (Table I). These patients were more likely to be older, Black, employed, and diabetic, and have Medicare, impaired ambulation, and CHF (all *P* < .001). They were less likely to dialyze through TDCs at the time of access creation (48.7% vs 67.4%; *P* < .001).

On multivariable analysis, patients with social support had increased likelihood of PCP evaluation <1 year prior to AV access creation (OR, 1.81; 95% CI, 1.07-3.08; *P* = .03) (Table III). Unemployment (OR, 0.51; 95% CI, 0.34-0.77; *P* = .001) and uninsured (OR, 0.5; 95% CI, 0.1-0.45; *P* = .01) status were associated with decreased likelihood of PCP evaluation prior to surgery.

Nephrology evaluation within 3 months of AV access creation. Patients were evaluated by nephrologists in 65% of cases (Table II). These patents were more likely to have Medicare and be employed (all *P* < .001). They were less likely to dialyze through TDCs at the time of access creation (38.4% vs 84.2%; *P* < .001) and were more likely to have PCP visits in the last year (76.5% vs 55.6%; *P* < .001).

On multivariable analysis, unemployed (OR, 0.63; 95% CI, 0.43-0.91; *P* = .02) and uninsured patients (OR, 0.22; 95% CI, 0.06-0.83; *P* = .03) had decreased likelihood of visiting nephrologists <3 months before AV access creation (Table IV).

Tunneled line at the time of AV access creation. Hemodialysis was initiated with TDCs in 304 patients (54.5%) who received initial AV access. Older age (OR, 0.98; 95% CI, 0.96-0.99), obesity (OR, 0.38; 95% CI, 0.25-0.58), and nephrologist evaluation (OR, 0.12; 95% CI, 0.08-0.19) were independently associated with decreased hemodialysis initiation with TDCs at the time of initial AV access (all *P* < .05) (Table V).

Ninety-day readmission and mortality. Readmission occurred in 270 cases (48%). Complications AV access, TDCs, and ESRD accounted for 17.4%, 8.5%, and 30.4% of readmissions, respectively. The remaining 43.7% of readmissions were non-ESRD medical- or trauma-related. Cirrhosis (OR, 2.5; 95% CI, 1.03-6.03), CAD (OR, 2.31; 95% CI, 1.5-3.57), prosthetic AV access (OR, 1.84; 95% CI, 1.04-3.26), and impaired ambulation (OR, 1.75; 95% CI, 1.15-2.66) were independently associated with increased readmission (all *P* < .05) (Table VI). Older age (OR, 0.98; 95% CI, 0.97-0.99), TDC presence (OR, 0.65; 95% CI, 0.45-0.94; *P* = .02), and unemployment (OR, 0.58; 95% CI, 0.39-0.86) were associated with decreased readmission (all *P* < .05). Ninety-day mortality occurred in nine patients (1.6%). There were no significant differences in mortality for patients with vs without PCP visits (1.8% vs 1.2%; *P* = .57) and patients with vs without nephrologist visits (2.2% vs 0.5%; *P* = .13).

DISCUSSION

Among patients who received first AV access in the largest safety-net hospital in New England, uninsured and unemployment statuses were associated with decreased pre-dialysis care by PCPs and nephrologists. Patients with social support were more likely to have PCP visits in the prior year. Lack of evaluation by nephrologists was significantly associated with hemodialysis initiation in these patients using TDCs. However, preoperative PCP and nephrology evaluations were not associated with 90-day postoperative readmissions, which appeared to be driven by comorbidities and prosthetic access placement.

Barriers to PCP and nephrologist access may result in long-term, detrimental effects on chronic kidney disease prognosis due to delayed disease recognition, risk-factor modification, and measures to preserve renal function.[14] Increased PCP access after Medicaid expansion has been associated with improved medication compliance, decreased inpatient admissions, and increased diabetes screening and monitoring.[15] In our study, lack of social support was associated with decreased likelihood of PCP evaluation. This may relate to decreased recognition of or motivation to address new health problems, increased difficulty remembering appointments, and decreased ability to obtain transportation.[16] A systematic review of 17 studies and 2362 patients with ESRD demonstrated a positive correlation between social support and

Table I. Patient characteristics and outcomes stratified by primary care provider (*PCP*) visit within 2 year prior to first arteriovenous (AV) access creation

	Total N = 558	PCP visit n = 386	No PCP visit n = 172	*P* value
Demographics				
Age, years	59.7 ± 14	61 ± 13.3	56.8 ± 15	<.001
Male gender	329 (59)	224 (58)	105 (61)	.5
Race				
White	117 (21)	78 (20.2)	39 (22.7)	.02
Black	338 (60.6)	247 (64)	91 (52.9)	
Other/unknown	103 (18.5)	61 (15.8)	42 (24.4)	
Hispanic ethnicity	124 (22.2)	85 (22)	39 (22.7)	.86
Primary insurer				
Medicare	209 (37.5)	158 (40.9)	51 (29.7)	<.001
Medicaid	258 (46.2)	168 (43.5)	90 (52.3)	
Commercial	78 (14)	59 (15.3)	19 (11)	
Uninsured	12 (2.2)	1 (.3)	11 (6.4)	
Unemployed status	230 (41.2)	139 (36)	91 (52.9)	<.001
Social support present	461 (82.6)	326 (84.5)	135 (78.5)	.086
Less than primary school education	23 (4.1)	18 (4.7)	5 (2.9)	.34
Non-English speaking	235 (42.1)	161 (41.7)	74 (43)	.77
Medical history				
Assisted activities of daily living status	108 (19.4)	83 (21.5)	25 (14.5)	.054
Impaired ambulatory status	190 (34.1)	145 (37.6)	45 (26.2)	.009
Current smoking	84 (15.1)	55 (14.2)	29 (16.9)	.43
Obesity	212 (38)	154 (39.9)	58 (33.7)	.17
Diabetes	361 (64.7)	264 (68.4)	97 (56.4)	.006
Chronic obstructive pulmonary disease	47 (8.4)	36 (9.3)	11 (6.4)	.25
Congestive heart failure	223 (40)	171 (44.3)	52 (30.2)	.002
Coronary artery disease	153 (27.4)	120 (31.1)	33 (19.2)	
Peripheral arterial disease	102 (18.3)	73 (18.9)	29 (16.9)	.56
Cirrhosis	26 (4.7)	19 (4.9)	7 (4.1)	.66
Dementia	32 (5.7)	29 (7.5)	3 (1.7)	.007
Transient ischemic attack or stroke history	368 (65.9)	265 (68.7)	103 (59.9)	.04
Nephrologist visit <3 months	362 (64.9)	277 (71.8)	85 (49.4)	<.001
Procedural details				
Tunneled dialysis catheter present	304 (54.5)	188 (48.7)	116 (67.4)	<.001
Access type				
Radiocephalic	85 (15.2)	62 (16.1)	23 (13.4)	.72
Brachiocephalic	255 (45.7)	176 (45.6)	79 (45.9)	
Brachiobasilic	129 (23.1)	86 (22.3)	43 (25)	
Other autogenous	20 (3.6)	12 (3.1)	8 (4.7)	
Prosthetic graft	69 (12.4)	50 (13)	19 (11)	
General anesthesia use	107 (19.2)	70 (18.1)	37 (21.5)	.35
Outcomes				
90-day readmission	270 (48.4)	201 (52.1)	69 (40.1)	.009
90-day death	9 (1.6)	7 (1.8)	2 (1.2)	.57

Data are presented as number (%) or mean ± standard deviation.

Table II. Patient characteristics and outcomes stratified by nephrologist visit within 3 months to a year prior to first arteriovenous (AV) access creation

	Total N = 558	Nephrologist visit n = 362	No nephrologist visit n = 196	*P* value
Demographics				
Age, years	59.7 ± 14	60 ± 13.4	59.1 ± 15	.44
Male gender	329 (59)	210 (58)	119 (60.7)	
Race				
White	117 (21)	76 (21)	41 (20.9)	.8
Black	338 (60.6)	222 (61.3)	116 (59.2)	
Other/unknown	103 (18.5)	64 (17.7)	39 (19.9)	
Hispanic ethnicity	124 (22.2)	84 (23.2)	40 (20.4)	.45
Primary insurer				
Medicare	209 (37.5)	141 (39)	68 (34.7)	.03
Medicaid	258 (46.2)	166 (45.9)	92 (46.9)	
Commercial	78 (14)	52 (14.4)	26 (13.3)	
Uninsured	12 (2.2)	3 (.8)	9 (4.6)	
Unemployed status	230 (41.2)	136 (37.6)	94 (48)	.02
Social support present	461 (82.6)	303 (83.7)	158 (80.6)	.36
Less than primary school education	23 (4.1)	14 (3.9)	9 (4.6)	.68
Non-English speaking	235 (42.1)	148 (40.9)	87 (44.4)	.42
Medical history				
Assisted activities of daily living status	108 (19.4)	71 (19.6)	37 (18.9)	.83
Impaired ambulatory status	190 (34.1)	120 (33.1)	70 (35.7)	.54
Current smoking	84 (15.1)	60 (16.6)	24 (12.2)	.17
Obesity	212 (38)	148 (40.9)	64 (32.7)	.06
Diabetes	361 (64.7)	238 (65.7)	123 (62.8)	.48
Chronic obstructive pulmonary disease	47 (8.4)	29 (8)	18 (9.2)	.63
Congestive heart failure	223 (40)	142 (39.2)	81 (41.3)	.63
Coronary artery disease	153 (27.4)	100 (27.6)	53 (27)	.88
Peripheral arterial disease	102 (18.3)	64 (17.7)	38 (19.4)	.62
Cirrhosis	26 (4.7)	16 (4.4)	10 (5.1)	.72
Dementia	32 (5.7)	22 (6.1)	10 (5.1)	.64
Transient ischemic attack or stroke history	368 (65.9)	240 (66.3)	128 (65.3)	.81
Primary care provider visit <1 year	386 (69.2)	277 (76.5)	109 (55.6)	<.001
Procedural details				
Tunneled dialysis catheter present	304 (54.5)	139 (38.4)	165 (84.2)	<.001
Access type				
Radiocephalic	85 (15.2)	58 (16)	27 (13.8)	.02
Brachiocephalic	255 (45.7)	174 (48.1)	81 (41.3)	
Brachiobasilic	129 (23.1)	82 (22.7)	47 (24)	
Other autogenous	20 (3.6)	15 (4.1)	5 (2.6)	
Prosthetic graft	69 (12.4)	33 (9.1)	36 (18.4)	
General anesthesia use	107 (19.2)	72 (19.9)	35 (17.9)	.56
Outcomes				
90-day readmission	270 (48.4)	182 (50.3)	88 (44.9)	.22
90-day death	9 (1.6)	8 (2.2)	1 (0.5)	.13

Data are presented as number (%) or mean ± standard deviation.

Table III. Multivariable analysis of primary care provider (PCP) visit within 1 year prior to first arteriovenous (AV) access creation

	OR	95% CI	*P* value
Social support present	1.81	1.07-3.08	.03
Unemployed status	0.51	0.34-0.77	.001
Uninsured status (ref. = Medicare)	0.05	0.01-0.45	.01
Dementia	3.19	0.92-11.04	.07
Less than primary school education	1.78	0.61-5.17	.29
Black race (ref. = white race)	1.44	0.88-2.34	.14
Coronary artery disease	1.4	0.85-2.3	.18
Transient ischemia attack or stroke history	1.29	0.86-1.97	.23
Diabetes	1.28	0.85-1.91	.24
Congestive heart failure	1.27	0.83-1.96	.28
Medicaid (ref. = Medicare)	0.78	0.53-1.17	.24
Other/unknown race (ref. = white race)	0.78	0.43-1.41	.41
Current smoking (ref. = never/former smoking)	0.77	0.46-1.29	.32

CI, Confidence interval; *OR*, odds ratio; *ref*, reference.

Table IV. Multivariable analysis of nephrologist visit within 3 months prior to first arteriovenous (AV) access creation

	OR	95% CI	*P* value
Unemployed status	0.63	0.43-0.91	.02
Uninsured status (ref. = Medicare)	0.22	0.06-0.83	.03
Current smoking (ref. = never/former smoking)	1.46	0.87-2.46	.15
Social support present	1.42	0.88-2.29	.15
Obesity	1.37	0.95-1.99	.1
Hispanic ethnicity	1.3	0.84-2.01	.24

CI, Confidence interval; *OR*, odds ratio; *ref*, reference.

Table V. Multivariable analysis of tunneled dialysis cather (TDC) present at first arteriovenous (AV) access creation

	OR	95% CI	*P* value
Age, years	0.98	0.96-0.99	.01
Obesity	0.38	0.25-0.58	<.001
Nephrologist visit <3 months	0.12	0.08-0.19	<.001
Uninsured status (ref. = Medicare)	3.7	0.37-37.36	.27
Diabetes	1.26	0.82-1.93	.29
Unemployed status	0.86	0.57-1.32	.5
Social support present	0.81	0.47-1.38	.44
Hispanic ethnicity	0.8	0.49-1.29	.36
Medicaid (ref. = Medicare)	0.77	0.5-1.19	.25
Primary provider visit <1 year	0.7	0.45-1.09	.12
Chronic obstructive pulmonary disease	0.58	0.28-1.2	.14

CI, Confidence interval; *OR*, odds ratio; *ref*, reference.

treatment adherence.[16] In a prospective survey of 1851 patients with ESRD aged >65 years assessing health-related quality of life, social support was associated with improved cognitive function and non-frailty status.[17] Additionally, we found that unemployment and uninsured statuses were barriers to PCP evaluation, which has been demonstrated previously in the general ESRD population.[18,19] Our findings reinforce the need of

Table VI. Multivariable analysis of 90-day readmission after first arteriovenous (AV) access creation

	OR	95% CI	*P* value
Cirrhosis	2.50	1.03-6.03	.04
Coronary artery disease	2.31	1.5-3.57	<.001
Prosthetic access (ref. = radiocephalic)	1.84	1.04-3.26	.04
Impaired ambulatory status	1.75	1.15-2.66	.01
Age, years	0.98	0.97-0.99	.01
Tunneled dialysis catheter present	0.65	0.45-0.94	.02
Unemployed status	0.58	0.39-0.86	.01
Less than primary school education	1.86	0.77-4.52	.17
Chronic obstructive pulmonary disease	1.31	0.68-2.53	.42
Assisted activities of daily living status	1.29	0.8-2.07	.30
Primary care provider visit <1 year	1.26	0.84-1.88	.26
Peripheral arterial disease	1.26	0.77-2.05	.36
Male gender	0.87	0.6-1.27	.48
Social support present	0.79	0.48-1.3	.36
Other autogenous access (ref. = radiocephalic)	0.42	0.14-1.24	.12

CI, Confidence interval; *OR*, odds ratio; *ref*, reference.

providers and health care systems to address social determinants of health in the ESRD population.[18,19]

Unemployment and uninsured statuses were also associated with decreased likelihood of timely nephrology referral before AV access placement in our patients. Early evaluation by nephrologists has been shown to prevent progression of chronic kidney disease and increase the likelihood of patients having functioning autogenous access at the time of dialysis initiation.[20] In a systematic literature review, earlier nephrology referral and dialysis initiation were associated with improved long-term mortality.[20] Renal function declined less in patients with early referral to nephrologists.[20] Other reasons for delayed nephrologist evaluation that may not have been captured in our study include PCPs not appreciating deteriorating renal function and limited nephrologist availability.[21-26] Although we did not analyze this here, there is a subset of patients that use TDCs as their definitive access. Our previous analysis showed that these included long-term patients that would not be included here with multiple failed accesses and limited options due to anatomy as the indications. However, other identified factors such as severe comorbidities and not wanting an AV access would be applicable to new hemodialysis patients.[10] It can also be difficult to properly time an AV graft creation when there is no autogenous vein available, and these patients may end up with a TDC.

Our study had several limitations. It is a single-center, retrospective analysis of a safety-net population that may not be generalizable to the broader ESRD population. Our study focused on an AV access creation-only cohort. Among patients not receiving AV access creation, readmission may have been lower for patients without TDCs as they may not have had an impending need for hemodialysis. We are also only seeing the patients referred for AV access, and there may be patients that initialize with a TDC that we are not capturing. Out-of-network PCP and nephrology evaluations may not have been captured in our chart review. Whether patients not evaluated by nephrologists had detectable decline in renal function or acute unexpected changes in renal function precipitating TDC access could not be determined.

CONCLUSIONS

Recent nephrology evaluation was associated with reduced hemodialysis initiation with TDCs among patients receiving initial AV access creation. Unemployed and uninsured statuses pose barriers to accessing PCP and nephrology care. Future quantitative and qualitative analysis to evaluate reasons for limited preventive care in these subgroups is warranted.

AUTHOR CONTRIBUTIONS

Conception and design: SL, JS
Analysis and interpretation: SL, AA, ES, AF, VC, EK, TC, JS
Data collection: SL, ES, JS
Writing the article: SL, AA, ES, JS
Critical revision of the article: SL, AA, ES, AF, VC, EK, TC, JS
Final approval of the article: SL, AA, ES, AF, VC, EK, TC, JS
Statistical analysis: SL, JS
Obtained funding: Not applicable
Overall responsibility: JS

DISCLOSURES

J.J.S. reports education grants from WL Gore and BD. A.F. reports principal investigator for the BEST-CLI trial (NCT02060630).

REFERENCES

1. Lok CE, Huber TS, Lee T, et al. KDOQI clinical practice guideline for vascular access: 2019 update. Am J Kidney Dis 2020;75:S1-164.
2. Johansen KL, Chertow GM, Gilbertson DT, et al. US renal data system 2022 annual data report: epidemiology of kidney disease in the United States. Am J Kidney Dis 2023;81:A8-11.
3. Daugirdas JT, Depner TA, Inrig J, et al. KDOQI clinical practice guideline for hemodialysis adequacy: 2015 update. Am J Kidney Dis 2015;66:884-930.
4. Zarkowsky DS, Arhuidese IJ, Hicks CW, et al. Racial/ethnic disparities associated with initial hemodialysis access. JAMA Surg 2015;150:529.
5. Rich NC, Vartanian SM, Sharief S, Freitas DJ, Tuot DS. A mixed-methods investigation of incident Hemodialysis access in a safety-net population. BMC Nephrol 2017;18:279.
6. Fischer MJ, Stroupe KT, Kaufman JS, et al. Predialysis nephrology care and dialysis-related health outcomes among older adults initiating dialysis. BMC Nephrol 2016;17:103.
7. Ryan TJ, Farber A, Cheng TW, et al. Factors associated with a tunneled dialysis catheter in place at initial arteriovenous access creation. J Vasc Surg 2021;73:1771-7.
8. Levin SR, Farber A, Eslami MH, et al. Association of Medicaid expansion with tunneled dialysis catheter use at the time of first arteriovenous access creation. Ann Vasc Surg 2021;74:11-20.
9. Arhuidese IJ, Orandi BJ, Nejim B, Malas M. Utilization, patency, and complications associated with vascular access for hemodialysis in the United States. J Vasc Surg 2018;68:1166-74.
10. Castro V, Farber A, Zhang Y, et al. Reasons for long-term tunneled dialysis catheter use and associated morbidity. J Vasc Surg 2021;73:588-92.
11. Ravani P, Palmer SC, Oliver MJ, et al. Associations between hemodialysis access type and clinical outcomes: a systematic review. J Am Soc Nephrol 2013;24:465-73.
12. Wang V, Zepel L, Diamantidis CJ, Smith VA, Scholle SH, Maciejewski ML. Annual wellness visits and care management before and after dialysis initiation. BMC Nephrol 2021;22:164.
13. Hazara AM, Allgar V, Twiddy M, Bhandari S. A mixed-method feasibility study of a novel transitional regime of incremental haemodialysis: study design and protocol. Clin Exp Nephrol 2021;25:1131-41.
14. Greer RC, Liu Y, Cavanaugh K, et al. Primary care physicians' perceived barriers to nephrology referral and Co-management of patients with CKD: a qualitative study. J Gen Intern Med 2019;34:1228-35.
15. Nee R, Yuan CM, Hurst FP, Jindal RM, Agodoa LY, Abbott KC. Impact of poverty and race on pre-end-stage renal disease care among dialysis patients in the United States. Clin Kidney J 2017;10:55-61.
16. Mendu ML, Waikar SS, Rao SK. Kidney disease population health management in the era of accountable care: a Conceptual framework for optimizing care across the CKD spectrum. Am J Kidney Dis 2017;70:122-31.
17. Sung E, Levin SR, Kariveda R, et al. Hemodialysis access outcomes for patients with unstable housing. J Am Coll Surg 2023;236:118-24.
18. Kilchenstein D, Banta JE, Oh J, Grohar A. Cost barriers to health services in U.S. Adults before and after the implementation of the affordable care act. Cureus 2022;14:e21905.
19. Sommers BD, Blendon RJ, Orav EJ, Epstein AM. Changes in utilization and health among low-income adults after Medicaid expansion or expanded private insurance. JAMA Intern Med 2016;176:1501-9.
20. Slaven A, Hsu J, Schelling JR, et al. Social support in older adults with CKD: a report from the CRIC (chronic renal insufficiency Cohort) study. Kidney Med 2021;3:776-84.e1.
21. Sitjar-Suñer M, Suñer-Soler R, Masià-Plana A, Chirveches-Pérez E, Bertran-Noguer C, Fuentes-Pumarola C. Quality of life and social support of people on peritoneal dialysis: mixed methods research. Int J Environ Res Public Health 2020;17:4240.
22. Sousa H, Ribeiro O, Paúl C, et al. Social support and treatment adherence in patients with end-stage renal disease: a systematic review. Semin Dial 2019;32:562-74.
23. Peter S, Wang M, Chu CD, Tuot DS, Chattopadhyay A, Chen JH. Gaps in nephrology referral care utilization in patients at high-risk of progression to kidney failure. AMIA Annu Symp Proc 2023;2022:866-73.
24. Sullivan MK, Jani BD, Rutherford E, et al. Potential impact of NICE guidelines on referrals from primary care to nephrology: a primary care database and prospective research study. Br J Gen Pract 2023;73:e141-7.
25. Black C, Sharma P, Scotland G, et al. Early referral strategies for management of people with markers of renal disease: a systematic review of the evidence of clinical effectiveness, cost-effectiveness and economic analysis. Health Technol Assess 2010;14:1-184.
26. Lo C, Teede H, Ilic D, et al. Identifying health service barriers in the management of co-morbid diabetes and chronic kidney disease in primary care: a mixed-methods exploration. Fam Pract 2016;33:492-7.

Submitted Jun 30, 2023; accepted Sep 17, 2023.