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Figure S1. Cohort Derivation

Figure S2. Cumulative incidence functions (CIFs) of arteriovenous fistula (AVF) long-term outcomes by pre-maturation interventions. S2A: Functional primary patency loss by assisted vs. unassisted maturation; S2B: Functional primary patency loss by frequency of pre-maturation interventions; S2C: Abandonment by assisted vs. unassisted maturation; S2B: Abandonment by frequency of pre-maturation interventions. P values were obtained from Gray's test for equality of CIF.

Table S1. Codes of surgical and endovascular AVF procedures

Type of intervention	Codes
Open surgical procedures	**CPT-4 Codes**
Revision, open, arteriovenous fistula; with thrombectomy, autogenous or nonautogenous dialysis graft	36833
Revision of fistula or graft	36832
Fistula elevation or superficialization	36832
Ligation of accessory veins	36832
Open surgical procedures for treatment of steal syndrome	36832
Open repair of pseudoaneurysm	36832
Banding fistula or graft	36832
Open thrombectomy, arteriovenous fistula without revision, autogenous or nonautogenous dialysis graft	36831
Endovascular interventions	**CPT-4 Codes**
Angiogram with venous angioplasty	36147, 35476, 75978
Angiogram with arterial angioplasty	36147, 35475, 75962
Angiogram with venous angioplasty and stent	36147, 37205, 37206 (rarely +37239)
Angiography, arteriovenous shunt (e.g., dialysis patient fistula / graft)	75791 (must be present with other interventions)
Percutaneous thrombectomy	36870 (also 36147, 36148)
Percutaneous thrombectomy with venous angioplasty	36870, 36147, 36148, 35476, 75978
Percutaneous thrombectomy with arterial angioplasty	36870, 36147, 36148, 35475, 75962
Percutaneous thrombectomy with venous angioplasty and stent	36870, 36147, 36148, 37205, 37206 (rarely +37239)
Inpatient procedures	**ICD-9 Codes**
Compression of vein	459.2
Mechanical complications of vascular device, implant and graft	996.1
Other complication of vascular device, implant and graft	996.7

Table S2. Arteriovenous fistula (AVF) functional primary patency loss and abandonment, by the number of pre-maturation interventions.

Number of Pre-Maturation Interventions	Total	Maintained AVF Functional Primary Patency	AVF Functional Primary Patency Loss	Death Before AVF Functional Primary Patency Loss
	7301	*819(11.2)*	*5664(77.6)*	*818(11.2)*
0 (Unassisted)	4091	529(12.9)	3043(74.4)	519(12.7)
≥1 (Assisted)	3210	290(9)	2621(81.7)	299(9.3)
1	1676	190(11.3)	1335(79.7)	151(9)
2	847	64(7.6)	696(82.2)	87(10.3)
3	391	23(5.9)	333(85.2)	35(9)
≥4	296	13(4.4)	257(86.8)	26(8.8)
Number of Pre-Maturation Interventions	Total	Maintained AVF Functional Secondary Patency	AVF Abandonment	Death Before AVF Abandonment
	7301	*3352(45.9)*	*1847(25.3)*	*2102(28.8)*
Unassisted	4091	1849(45.2)	1090(26.6)	1152(28.2)
Assisted	3210	1503(46.8)	757(23.6)	950(29.6)
1	1676	799(47.7)	399(23.8)	478(28.5)
2	847	396(46.8)	187(22.1)	264(31.2)
3	391	189(48.3)	90(23)	112(28.6)
≥4	296	119(40.2)	81(27.4)	96(32.4)

Table S3. Odds ratios (ORs) and 95% of confidence intervals (CIs) of primary and secondary AVF patency loss without accounting for the competing risk of death.

Number of pre-maturation AVF interventions	Primary AVF Patency Loss	
	Unadjusted OR (95% CI)	**Adjusted OR (95% CI)***
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	1.53(1.37,1.72)	1.59(1.41,1.79)
1	1.35(1.17,1.55)	1.40(1.22,1.62)
2	1.59(1.31,1.92)	1.67(1.38,2.03)
3	1.98(1.48,2.64)	2.05(1.53,2.74)
≥4	2.27(1.61,3.20)	2.37(1.68,3.36)
	Secondary AVF Patency Loss	
	Unadjusted OR (95% CI)	**Adjusted OR (95% CI)***
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	1.18(1.06,1.31)	1.00(0.89,1.12)
1	0.86(0.75,0.98)	0.98(0.86,1.13)
2	0.78(0.65,0.93)	0.93(0.78,1.12)
3	0.82(0.64,1.05)	1.01(0.78,1.30)
≥4	1.04(0.80,1.35)	1.33(1.02,1.75)

*Adjusted for age, gender, race, comorbid score, functional status, facility type, facility chain status, and log time of CVC dependency.

Table S4. Odds ratios (ORs) of primary and secondary AVF patency loss and risk ratios (RRs) of frequency of post-maturation AVF interventions, excluding patients with frequency of pre-maturation interventions equal to or above 99 percentile.
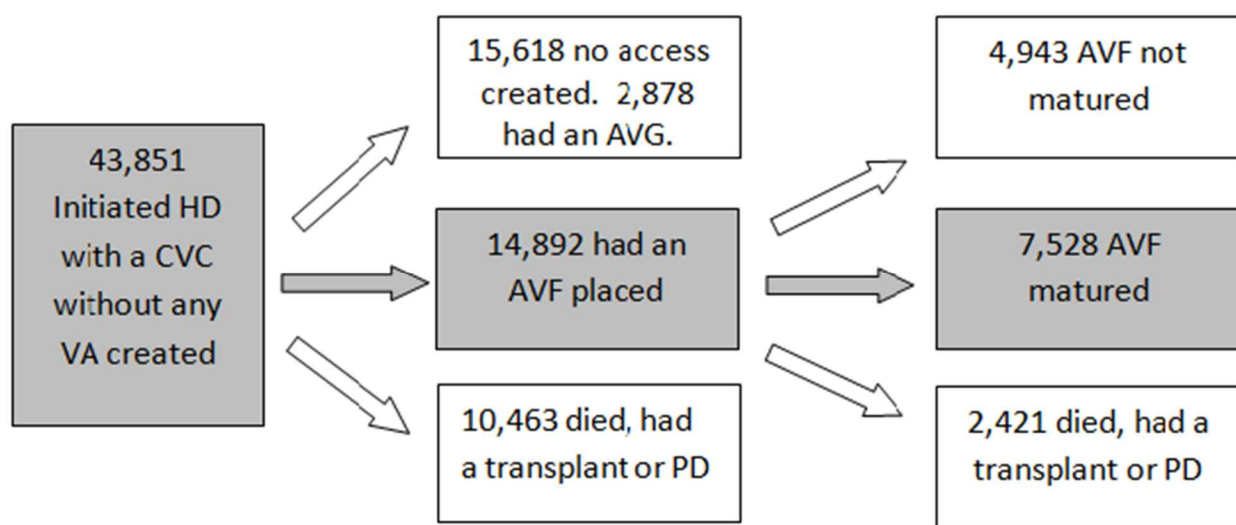
Number of pre-maturation AVF interventions	Primary AVF Patency Loss	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	1.56(1.34,1.81)	1.59(1.36,1.87)
1	1.22(1.02,1.46)	1.27(1.06,1.52)
2	1.89(1.44,2.48)	1.96(1.48,2.58)
3	2.52(1.63,3.88)	2.54(1.64,3.93)
≥4	3.58(1.88,6.79)	3.57(1.871,6.80)
	Secondary AVF Patency Loss	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	0.84(0.75,0.95)	0.98(0.87,1.11)
1	0.85(0.74,0.98)	0.96(0.83,1.11)
2	0.80(0.66,0.97)	0.94(0.78,1.15)
3	0.81(0.62,1.05)	0.96(0.73,1.26)
≥4	1.06(0.77,1.47)	1.33(0.95,1.86)
	Post-Maturation AVF Interventions	
	Unadjusted RR (95% CI)	Adjusted RR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	0.95(0.88,1.02)	1.29(1.19,1.40)
1	0.89(0.81,0.97)	1.17(1.07,1.28)
2	0.95(0.85,1.07)	1.33(1.18,1.50)
3	0.99(0.84,1.17)	1.43(1.21,1.68)
≥4	1.25(1.02,1.53)	1.84(1.50,2.25)

*Adjusted for age, gender, race, comorbid score, functional status, facility type, facility chain status, and log time of CVC dependency.
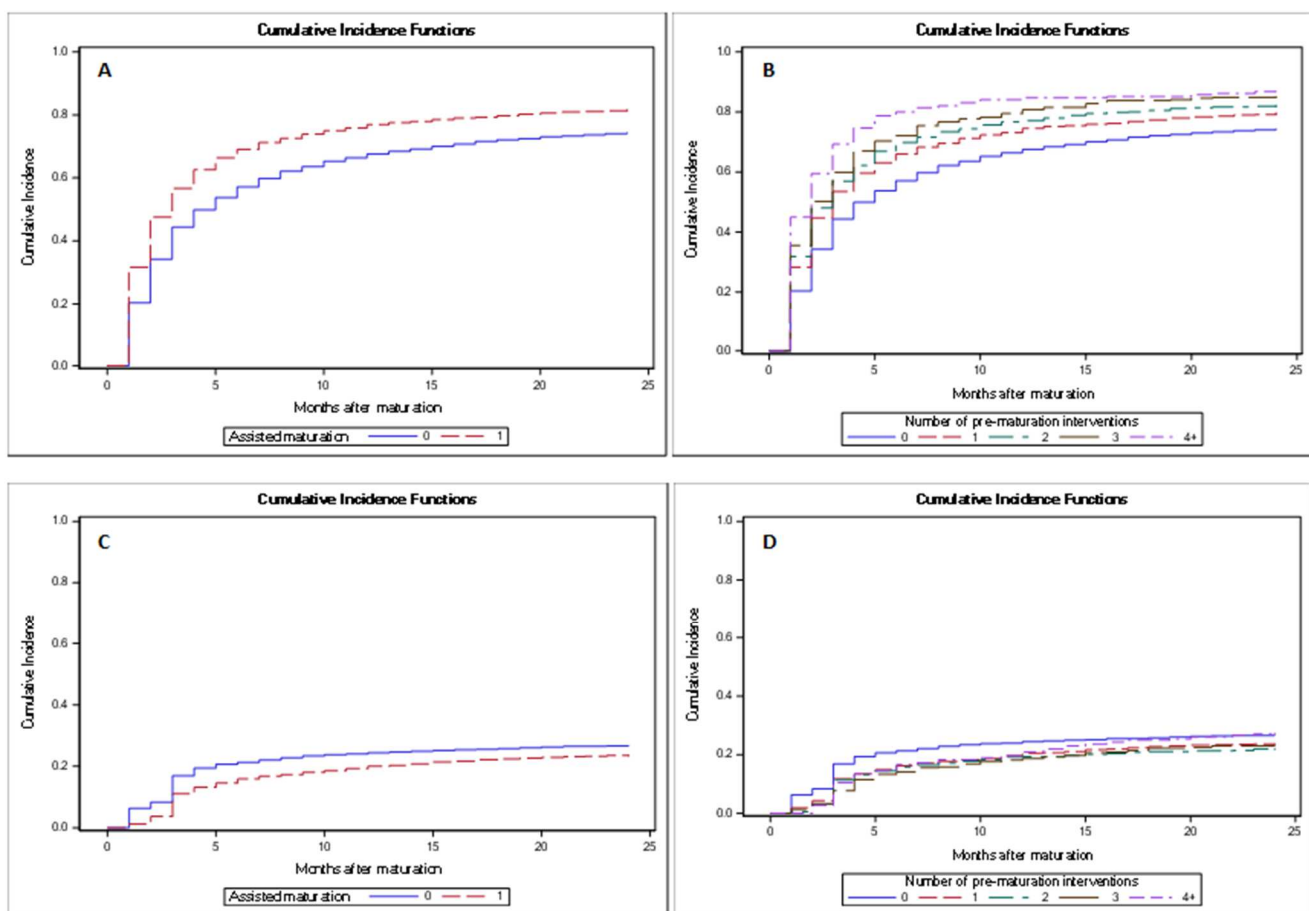
Table S5. Odds ratios (ORs) of primary and secondary patency loss and risk ratios (RRs) of frequency of post-maturation intervention, after counting interventions in the same month of maturation as pre-maturation interventions.

Number of pre-maturation AVF interventions	Primary AVF Patency Loss	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	1.57(1.37,1.80)	1.62(1.41,1.87)
1	1.22(1.04,1.44)	1.27(1.07,1.49)
2	1.72(1.37,2.15)	1.79(1.43,2.24)
3	2.19(1.59,3.01)	2.36(1.72,3.25)
≥4	2.92(2.02,4.22)	3.04(2.10,4.38)
	Secondary AVF Patency Loss	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	0.90(0.80,1.01)	1.03(0.92,1.16)
1	0.86(0.75,1.00)	0.97(0.84,1.13)
2	0.88(0.74,1.04)	1.00(0.84,1.20)
3	0.86(0.69,1.08)	1.04(0.82,1.31)
≥4	1.13(0.90,1.42)	1.40(1.10,1.77)
	Post-Maturation AVF Interventions	
	Unadjusted RR (95% CI)	Adjusted RR (95% CI)*
0 (Unassisted)	1.00	1.00
≥1 (Assisted)	1.02(0.94,1.10)	1.39(1.28,1.51)
1	0.93(0.84,1.02)	1.20(1.09,1.32)
2	0.91(0.80,1.02)	1.28(1.14,1.44)
3	1.10(0.95,1.28)	1.60(1.38,1.85)
≥4	1.48(1.27,1.73)	2.27(1.94,2.64)

*Adjusted for age, gender, race, comorbid score, functional status, facility type, facility chain status, and log time of CVC dependency.

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┌────────────────┐      ┌─────────────────┐      ┌─────────────────┐
│                │ ───▶ │ 15,618 no access│      │ 4,943 AVF not   │
│                │      │ created.  2,878 │      │ matured         │
│                │      │ had an AVG.     │      │                 │
│  43,851        │      └─────────────────┘      └─────────────────┘
│  Initiated HD  │      ┌─────────────────┐      ┌─────────────────┐
│  with a CVC    │ ───▶ │ 14,892 had an   │ ───▶ │ 7,528 AVF       │
│  without any   │      │ AVF placed      │      │ matured         │
│  VA created    │      └─────────────────┘      └─────────────────┘
│                │      ┌─────────────────┐      ┌─────────────────┐
│                │ ───▶ │ 10,463 died, had│      │ 2,421 died, had a│
│                │      │ a transplant or PD│    │ transplant or PD │
└────────────────┘      └─────────────────┘      └─────────────────┘
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Supplemental Figure 1 (Figure S1)

Supplemental Figure 2 (Figure S2)