Vascular Access in North America

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Yale SCHOOL OF MEDICINE

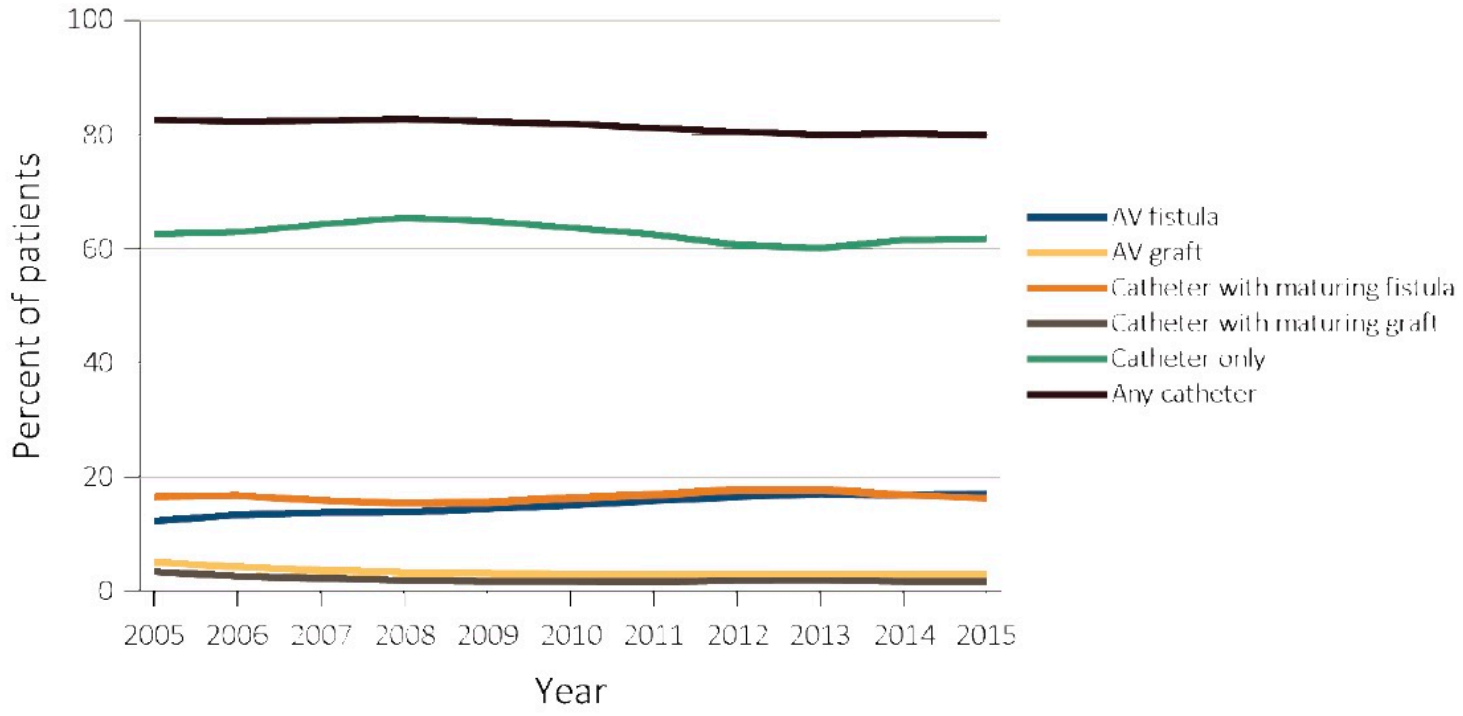
USRDS
UNITED STATES RENAL DATA SYSTEM

Chapter 3: Vascular Access

- In 2015, 80% of patients were using a catheter at hemodialysis (HD) initiation (Figure 3.1).
- At 90 days after the initiation of HD, 68.5% of patients were still using catheters. (Figure 3.7.a).
- Arteriovenous (AV) fistula use at HD initiation rose from 12% to 17% over the period 2005-2015 (Figure 3.1).
- The percentage of patients using an AV fistula or with a maturing AV fistula at HD initiation increased from 28.9% to 33.4% over the same period (Figure 3.1).
- Seventeen percent of patients used an AV fistula exclusively at dialysis initiation. This increased to 65% by the end of one year on HD, and to 72% by the end of two years (Figure 3.7.a).
- The proportion of patients with an AV graft for vascular access was 3% at HD initiation, 15% at one year after initiation, and 16% at two years (Figure 3.7.a).
- At one year after HD initiation, 80% of patients were using either an AV fistula or AV graft without the presence of a catheter. By two years, this number rose to 88% (Figure 3.7.a).
- By May 2016, 62.7 % of prevalent dialysis patients were using an AV fistula (Figure 3.6).
- Of AV fistulas placed between June 2014 and May 2015, 35.9% of failed to mature sufficiently for use in dialysis. Of those that did mature, the median time to first use was 111 days (Table 3.7).
- Patient age is a factor contributing to success with AV fistula; with younger age, the percent of AV fistulas that successfully matured was higher and the median time to first use was somewhat shorter (Table 3.7).

Access at Dialysis Initiation

vol 2 Figure 3.1 Vascular access use at hemodialysis initiation, from the ESRD Medical Evidence form (CMS 2728), 2005-2015



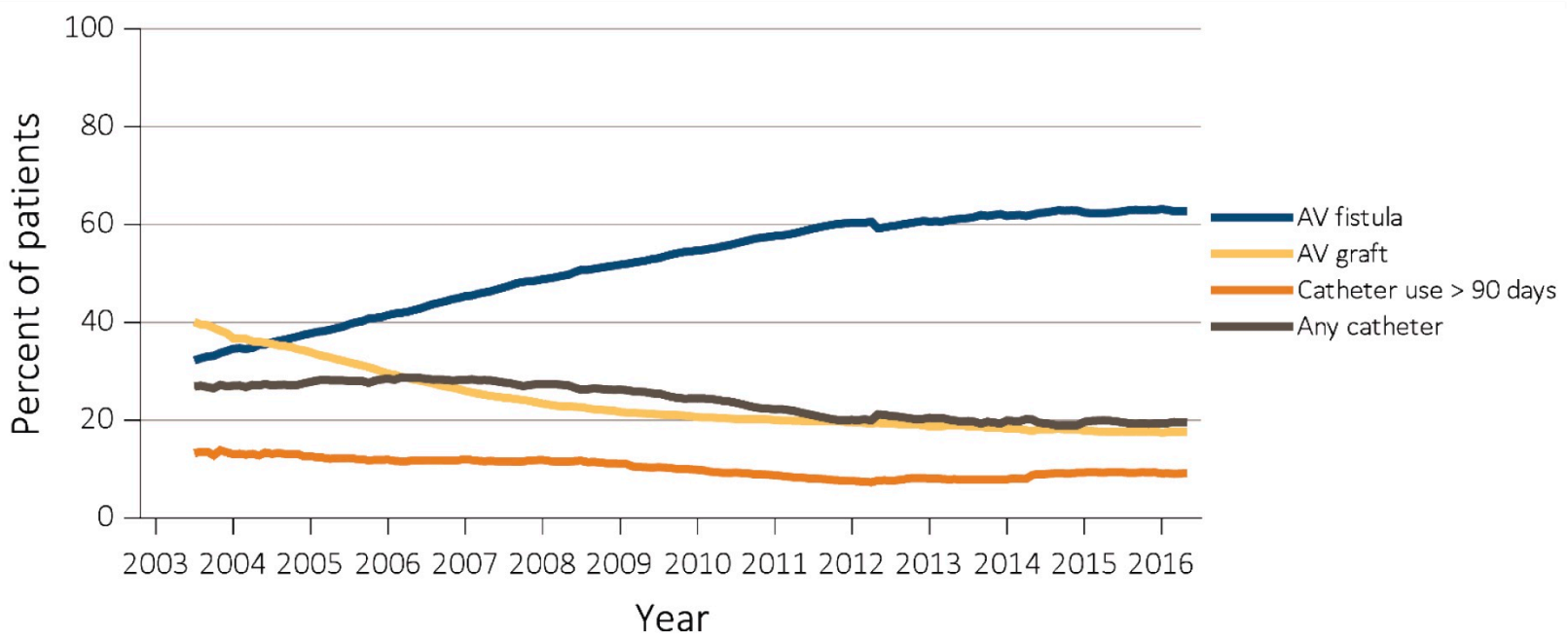
Data Source: Special analyses, USRDS ESRD Database. ESRD patients initiating hemodialysis in 2005-2015. Abbreviations: AV, arteriovenous; CMS, Centers for Medicare & Medicaid; ESRD, end-stage renal disease.

vol 2 Table 3.1 Vascular access used at hemodialysis initiation by patient characteristics from the ESRD Medical Evidence form (CMS 2728), 2015

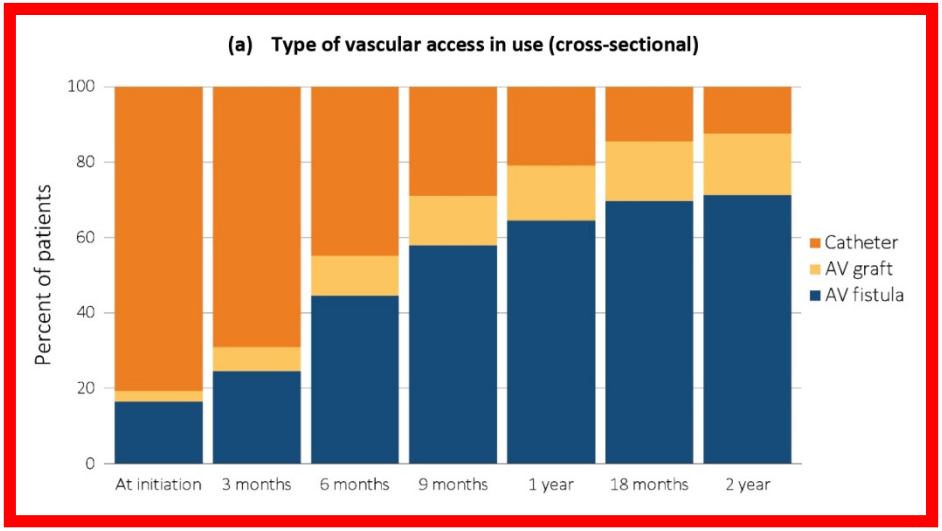
	AV fistula	AV graft	Catheter with maturing fistula	Catheter with maturing graft	Catheter only
All	17.0	3.0	16.4	1.8	61.9
Age					
0-21	7.5	0.8	9.2	0.6	81.9
22-44	13.5	1.9	16.2	1.7	66.6
45-64	16.9	2.6	17.6	1.7	61.2
65-74	18.7	3.4	16.5	1.8	59.6
75+	17.0	3.5	14.6	1.9	62.9
Sex					
Male	18.7	2.2	16.9	1.4	60.7
Female	14.6	4.0	15.6	2.2	63.5
Race					
White	17.4	2.4	16.2	1.5	62.6
Black/African American	15.5	4.5	16.4	2.5	61.1

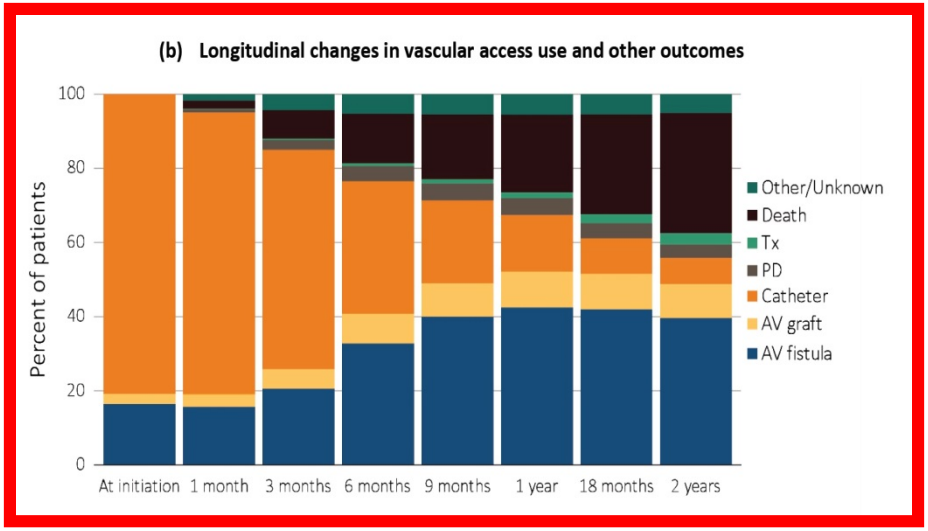
Trends in Access Type

vol 2 Figure 3.6 Trends in vascular access type use among ESRD prevalent patients, 2003-2016



Data Source: Special analyses, USRDS ESRD Database and Fistula First data. Fistula First data reported from July 2003 through April 2012, CROWNWeb data are reported from June 2012 through May 2016. Abbreviations: AV, arteriovenous; CROWNWeb, Consolidated Renal Operations in a Web-enabled Network; ESRD, end-stage renal disease.


(a) Type of vascular access in use (cross-sectional)
Percent of patients
100
80
60
40
20
0
At initiation
3 months
6 months
9 months
1 year
18 months
2 year
Catheter
AV graft
AV fistula


(b) Longitudinal changes in vascular access use and other outcomes
Percent of patients
100
80
60
40
20
0
At initiation
1 month
3 months
6 months
9 months
1 year
18 months
2 years
Other/Unknown
Death
Tx
PD
Catheter
AV graft
AV fistula

Hemodialysis Access Maintenance in the Medicare Population: An Analysis Over a Decade of Trends by Provider Specialty and Site of Service

Osman Ahmed, MD, Ketan Patel, MD, MBA, Rana Rabei, BS, Mikin V. Patel, MD, MBA, Michael Ginsburg, MD, Bishir Clayton, BS, and Bulent Arslan, MD

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Fistulagrams Performed by Specialty

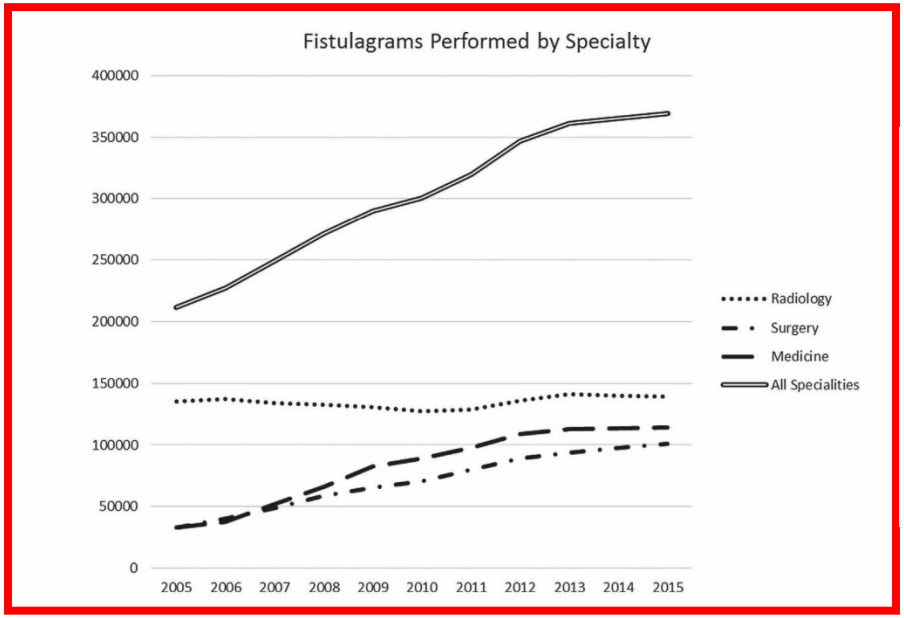
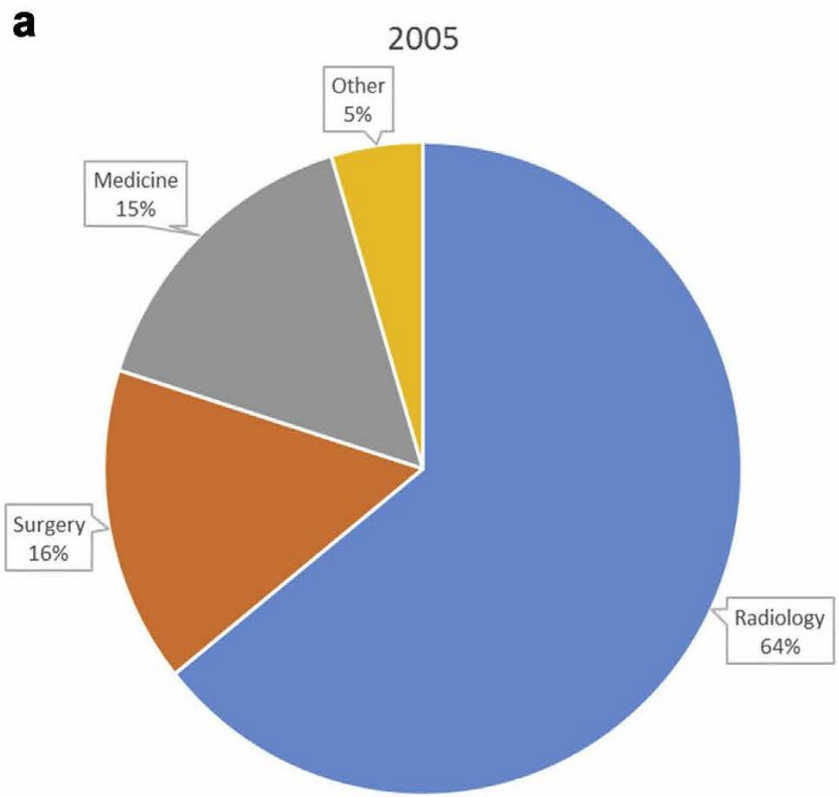


Table 2. Annual Frequency of Hemodialysis Access Angiography (2005–2015)

Specialty	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	% change
Diagnostic radiology	109196	108972	107994	104259	101112	100854	99909	99901	91269	87124	86372	-20.90%
Interventional radiology	26368	28316	25989	28155	29296	26644	28760	36330	49700	52459	52995	100.98%
Radiology total	135564	137288	133983	132414	130408	127498	128669	136231	140969	139583	139367	2.81%
Vascular surgery	16971	21352	26749	34981	41077	47732	57713	64806	68575	71771	74685	340.07%
General surgery	16157	19252	22275	23581	24220	22596	21883	24206	25185	25692	26424	63.55%
Surgery total	33128	40604	49024	58562	65297	70328	79596	89012	93760	97463	101109	205.21%
Nephrology	28362	35115	47996	59520	73274	77980	85297	94838	97539	96653	99059	249.27%
Internal medicine	4328	2220	4060	6563	9018	11297	12208	14291	15337	16878	15035	247.39%
Medicine total	32690	37335	52056	66083	82292	89277	97505	109129	112876	113531	114094	249.02%
Overall total	211181	227206	248846	271785	289821	300840	319650	346519	361045	364980	368955	74.71%

Distribution of Specialties 2005-2015



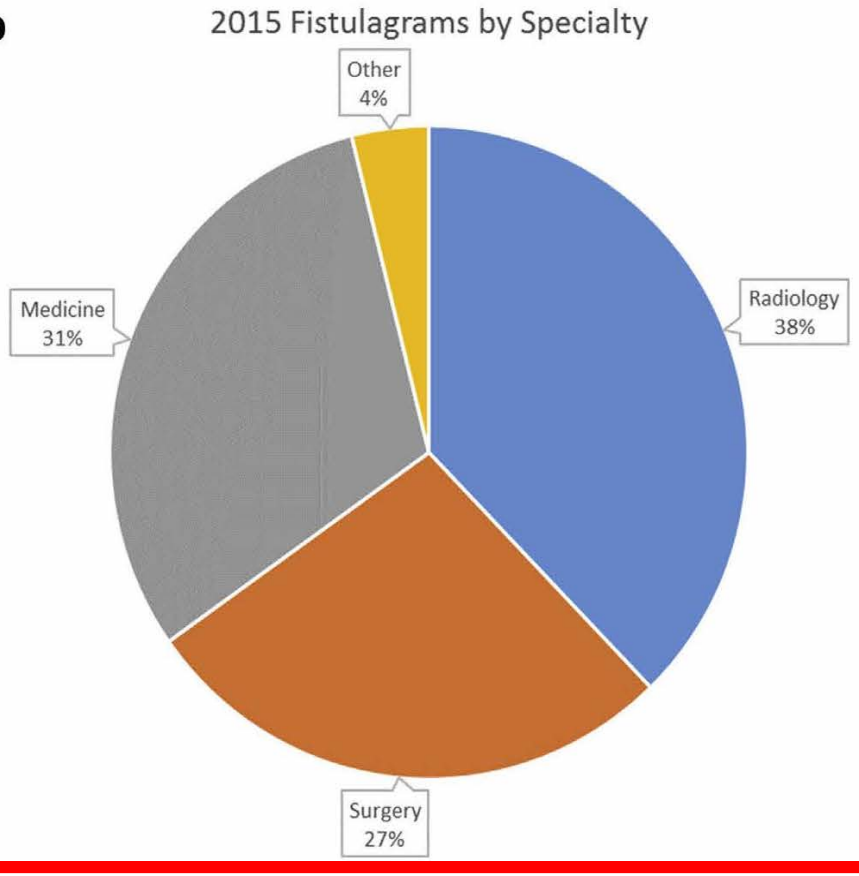
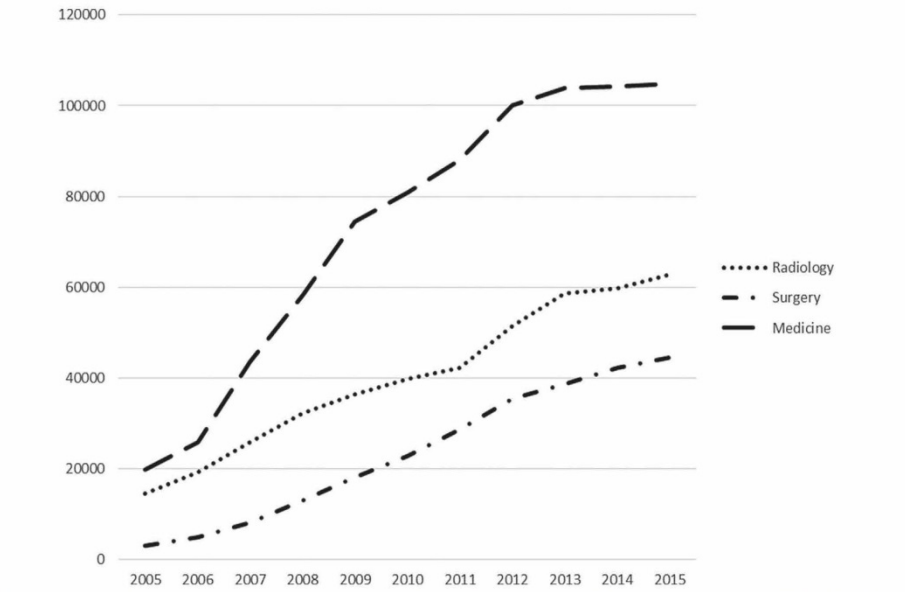


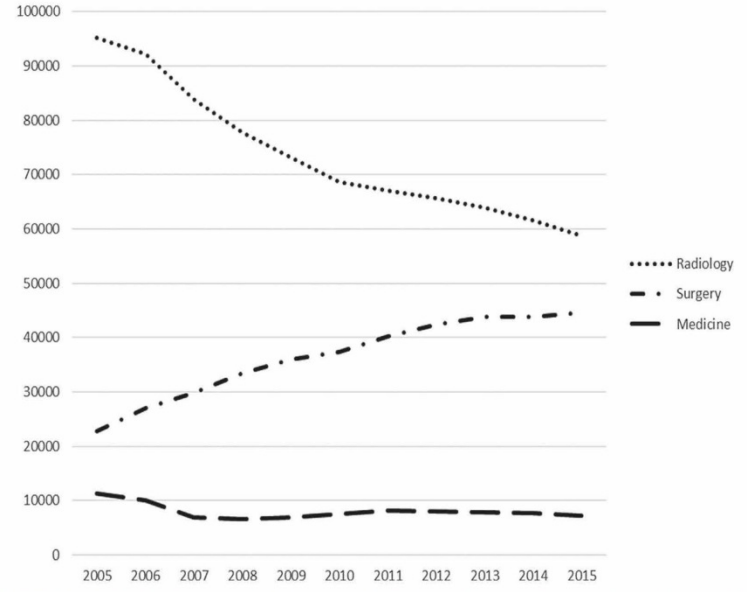
Table 3. Hemodialysis Conduit Angiography by Provider Specialty and Site of Service (2005–2015)

Radiology (DR + IR)	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**% Change**
11 - Office	14422	19275	25880	32200	36288	39746	42273	51354	58602	59745	62721	334.90%
21 - Inpatient hospital	22278	21572	21008	20175	18867	17090	17110	16881	15768	15326	15246	-31.56%
22 - Outpatient hospital	95151	92187	83902	77709	73131	68563	66995	65679	63964	61640	58786	-38.22%
23 – Emergency room	989	1019	895	897	855	831	909	1135	1249	1334	1234	24.77%
24 - Ambulatory surgery center	2705	3216	2282	467	1250	1243	1366	1132	1362	1517	1345	-50.28%
Surgery (General + Vascular)												
11 - Office	2884	4808	8072	12920	18058	22714	28591	35391	38631	42223	44457	1441.50%
21 - Inpatient hospital	7241	8531	10647	11431	10750	9926	10537	10929	10851	10607	11029	52.31%
22 - Outpatient hospital	22786	27036	29871	33430	36006	37375	40237	42403	43814	43877	44620	95.82%
23 – Emergency room	43	68	55	40	39	30	44	51	59	61	80	86.05%
24 - Ambulatory surgery center	133	87	336	674	428	279	168	229	392	680	909	583.46%
Medicine (Nephrology, IM)												
11 - Office	19747	25730	43532	58304	74463	80879	87979	100166	103841	104147	104835	430.89%
21 - Inpatient hospital	1088	864	766	805	885	874	919	949	995	925	867	-20.31%
22 - Outpatient hospital	11292	10026	6949	6622	6846	7462	8127	7916	7832	7680	7235	-35.93%
23 – Emergency room	2	3	2	10	3	8	11	1	8	1	2	0.00%
24 - Ambulatory surgery center	552	700	792	328	85	30	409	85	185	763	1103	99.82%

Angiography Performed in Office vs. Hospital Setting

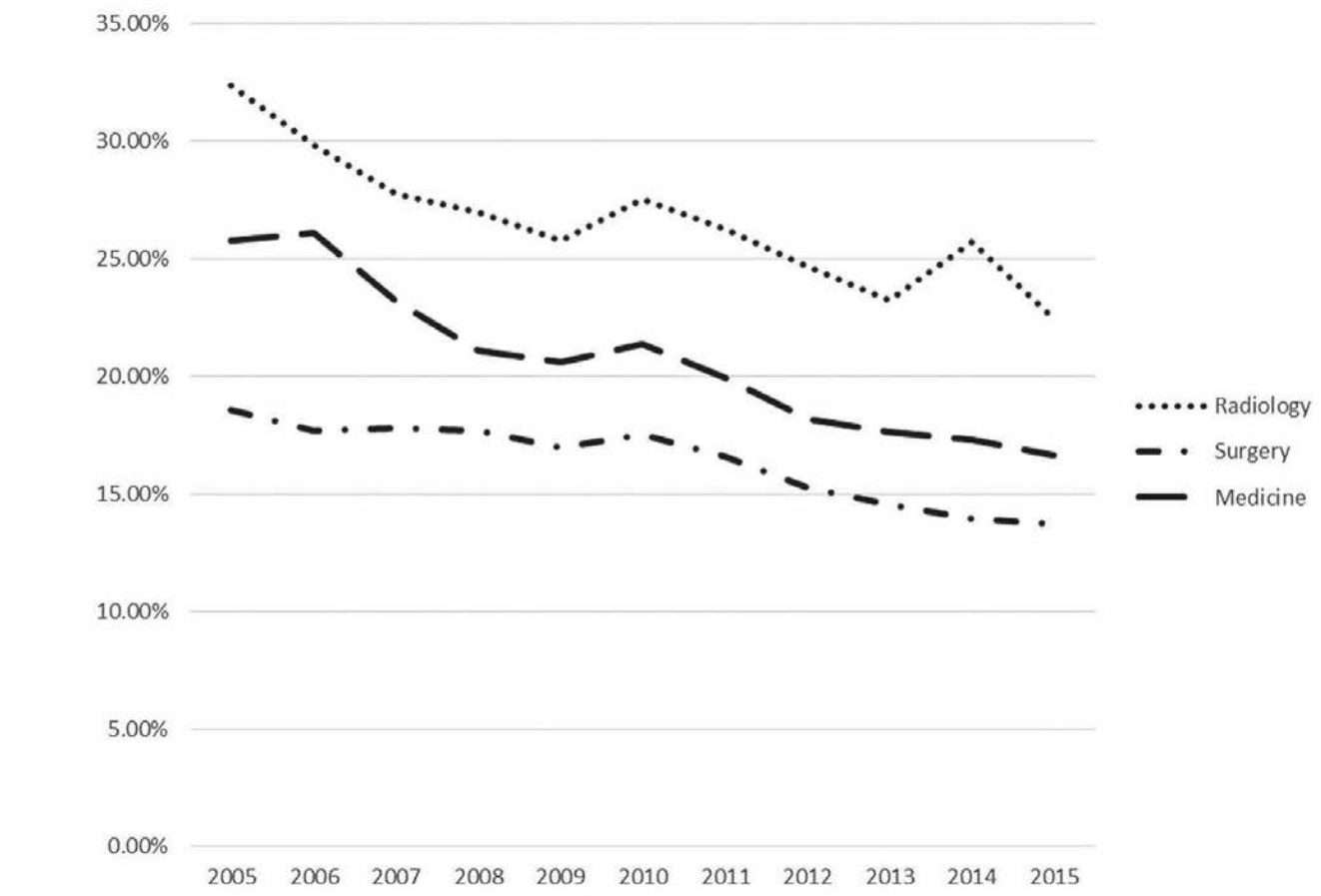


Annual frequency of hemodialysis conduit angiography performed in the office setting between 2005 and 2015.



Annual frequency of hemodialysis conduit angiography performed in the outpatient hospital setting between 2005 and 2015.

Thrombectomies per Angiograms by Specialty



Percentage of thrombectomies per hemodialysis conduit angiographies performed by specialty between 2005 and 2015.

International Differences in the Location and Use of Arteriovenous Accesses Created for Hemodialysis: Results From the Dialysis Outcomes and Practice Patterns Study (DOPPS)

Ronald L. Pisoni, Lindsay Zepel, Richard Fluck, Charmaine E. Lok, Hideki Kawanishi, Gültekin Süleymanlar, Haimanot Wasse, Francesca Tentori, Jarcy Zee, Yun Li, Douglas Schaubel, Steven Burke, and Bruce Robinson

Background: Vascular access practice is strongly associated with clinical outcomes. There is substantial international variation in the use of arteriovenous fistulas (AVFs) and grafts (AVGs), as well as AVF maturation time and location.

Study Design: Prospective cohort study.

Setting & Participants: Hemodialysis patients participating in the prospective Dialysis Outcomes and Practice Patterns Study (DOPPS) from the United States, Japan, and Europe/ANZ (Belgium, France, Germany, Italy, Spain, Sweden, United Kingdom, Australia, and New Zealand), including 3,850 patients receiving 4,247 new AVFs and 842 patients receiving 1,129 new AVGs in 2009 to 2015. AVF location trends were based on 38,868 AVFs recorded in DOPPS 1 to 5 cross-sections (1996-2015).

Predictors: Demographics, comorbid conditions, dialysis vintage, body mass index, facility percentage AVF use, median blood flow rate, and AVF location.

Outcomes: AVF location; successful AVF/AVG use (≥30 days of continuous use); time-to-first successful AVF/AVG use (maturation).

Results: During DOPPS 1 to 5, the percentage of AVFs created in the lower arm was consistently ≥93% in Japan and 65% to 77% in Europe/ANZ, but in the United States, this value declined from 70% (DOPPS 1) to 32% (DOPPS 5). Patient characteristics associated with AVF location differed by region. Successful AVF use was 87% in Japan, 67% in Europe/ANZ, and 64% in the United States, whereas successful AVG use was 86%, 75%, and 78%, respectively. Successful AVF use was greater for upper- versus lower-arm AVFs in the United States, with little difference in Europe/ANZ and the opposite pattern in Japan. Median time until first successful AVF use was 10 days in Japan, 46 days in Europe/ANZ, and 82 days in United States; until first successful AVG use: 6, 24, and 29 days, respectively.

Limitations: Potential measurement error related to chart data abstraction in multiple hemodialysis facilities.

Conclusions: Large international differences exist in AVF location, predictors of AVF location, successful use of AVFs, and time to first AVF/AVG use, challenging what constitutes best practice. The large US shift from lower- to upper-arm AVFs raises serious concerns about long-term health implications for some patients and how policies and practices aimed at increasing AVF use have affected AVF placement location.

Complete author and article information provided before references.

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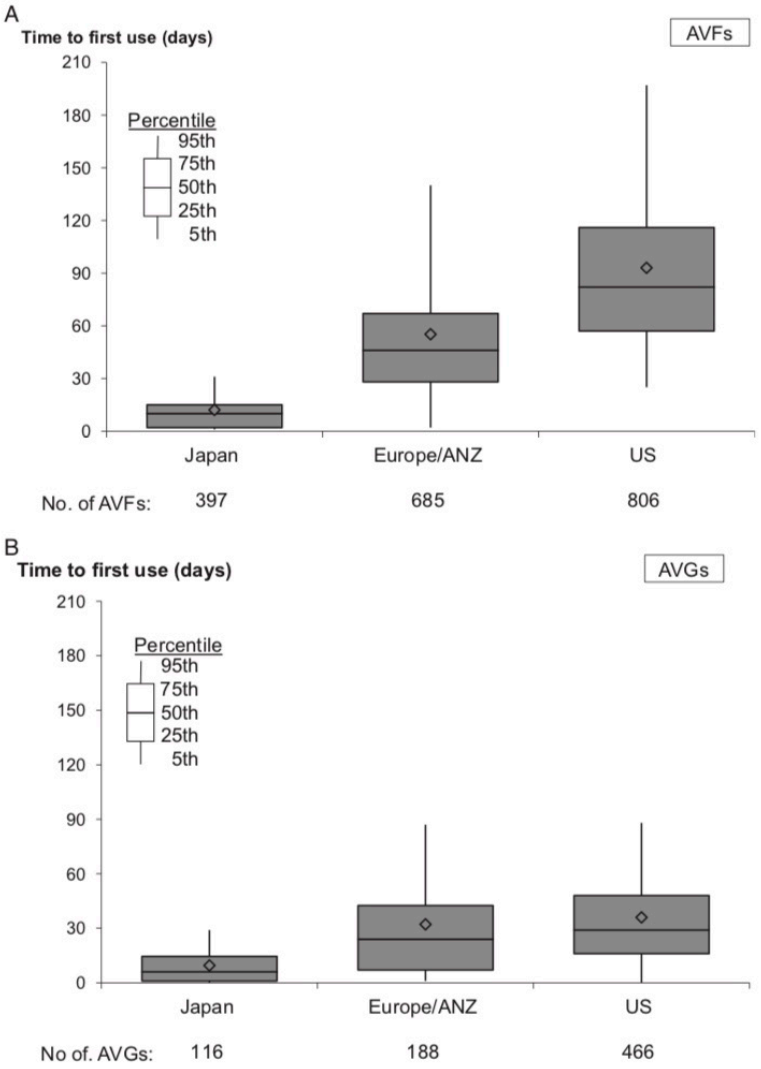


Figure 2. Distribution of time to first day of successful arteriovenous (AV) access use by region among AV accesses that were successfully used for 30 or more days: (A) AV fistulas (AVFs) and (B) AV grafts (AVGs). Sample: restricted to AVFs/AVGs that were created within the study and were successfully used for at least 30 days; open diamond represents the mean. Europe/Australia and New Zealand (ANZ) includes Belgium, France, Germany, Italy, Spain, Sweden, and United Kingdom.

Fistula Location- DOPPS 1-5

AJKD

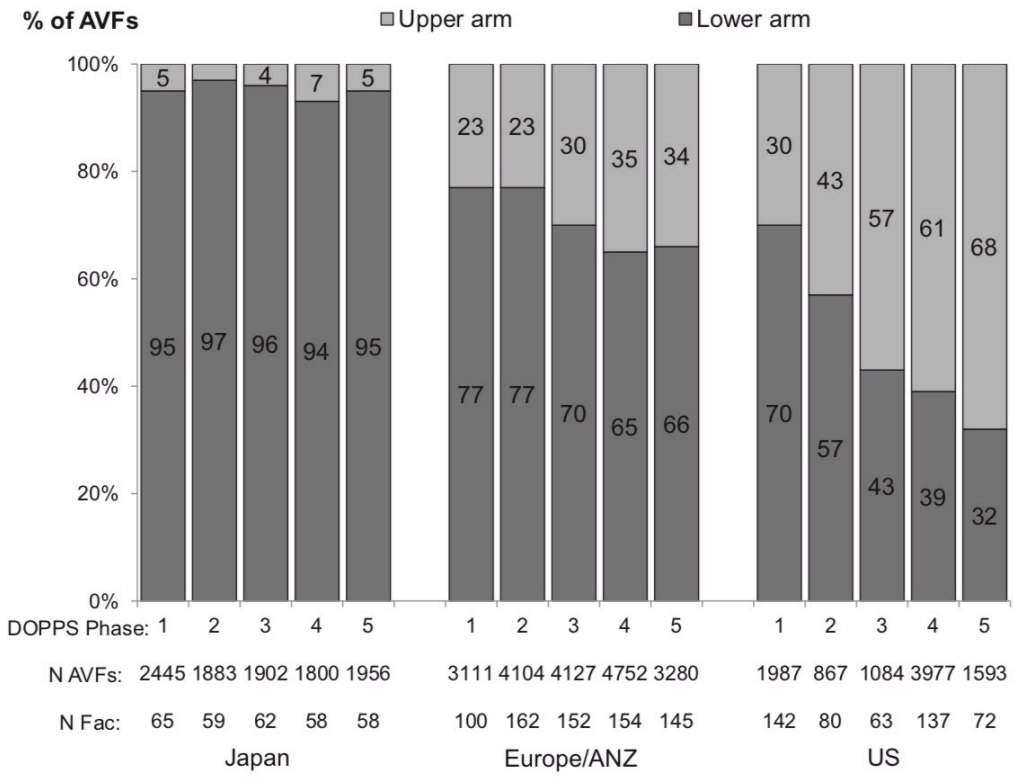


Figure 3. Trend in arteriovenous fistula (AVF) location in the upper versus lower arm from the Dialysis Outcomes and Practice Patterns Study (DOPPS) 1 (1996-2001) to DOPPS 5 (2012-2015), by region. Based on location of AVF in use at study entry in the initial round of data collection for each study phase: DOPPS 1 (1996-2001), DOPPS 2 (2002-2004), DOPPS 3 (2005-2008), DOPPS 4 (2009-2012), DOPPS 5 (2012-2015). Europe/Australia and New Zealand (ANZ) includes France, Germany, Italy, Spain, and United Kingdom (DOPPS 1) and ANZ, Belgium, France, Germany, Italy, Spain, Sweden, and United Kingdom (DOPPS 2-5). Results were similar when Europe/ANZ was restricted to countries present in all phases. Abbreviation: Fac, facilities.

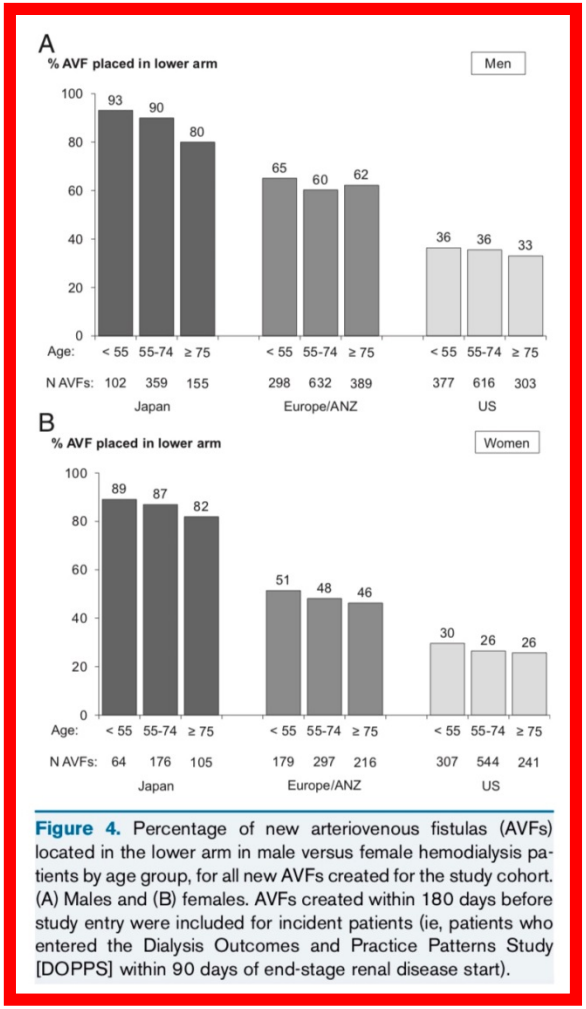
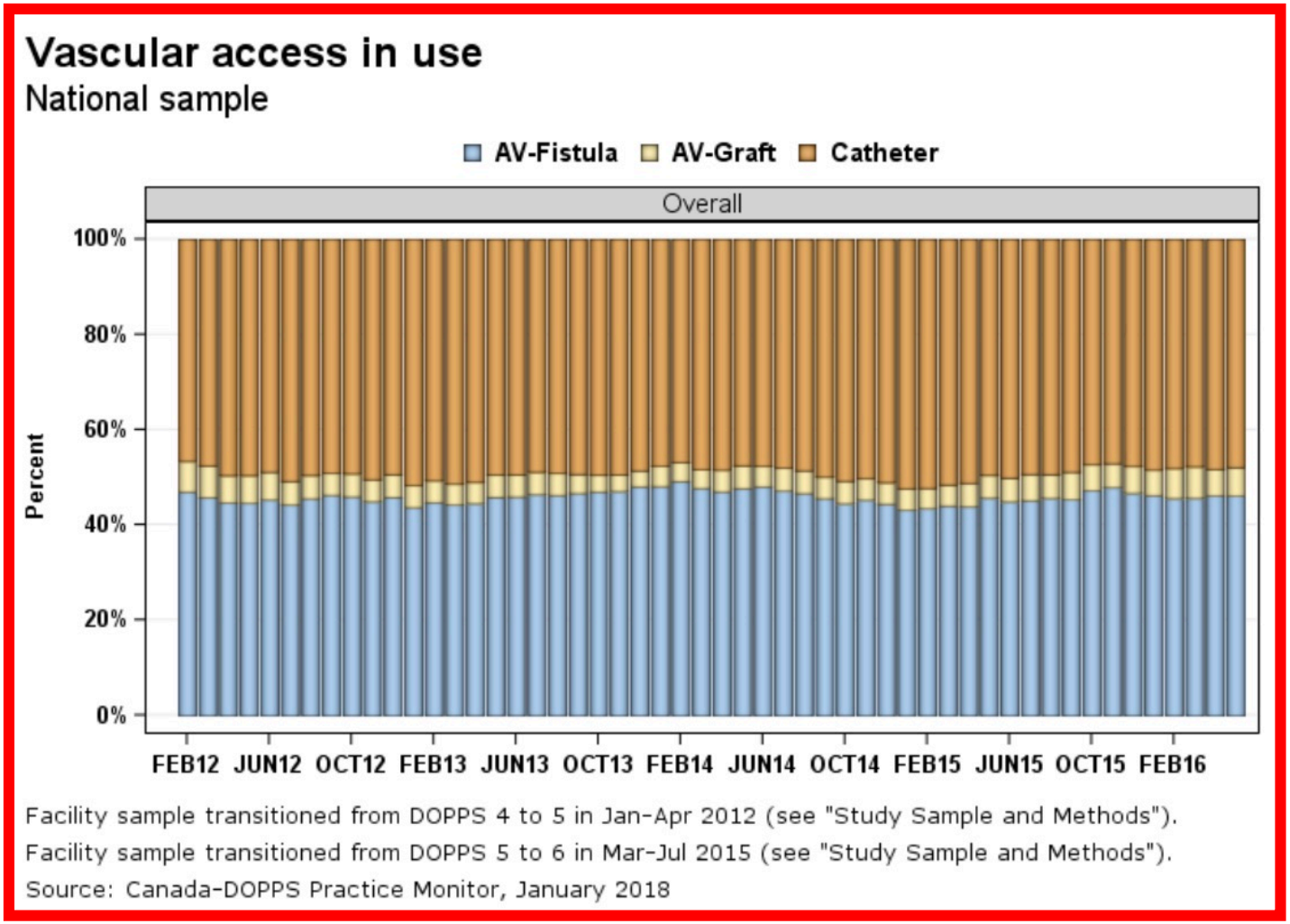


Figure 4. Percentage of new arteriovenous fistulas (AVFs) located in the lower arm in male versus female hemodialysis patients by age group, for all new AVFs created for the study cohort. (A) Males and (B) females. AVFs created within 180 days before study entry were included for incident patients (ie, patients who entered the Dialysis Outcomes and Practice Patterns Study [DOPPS] within 90 days of end-stage renal disease start).

Canada 2017


Vascular access in use
National sample
AV-Fistula
AV-Graft
Catheter
Overall
Percent
100%
80%
60%
40%
20%
0%
FEB12
JUN12
OCT12
FEB13
JUN13
OCT13
FEB14
JUN14
OCT14
FEB15
JUN15
OCT15
FEB16
Facility sample transitioned from DOPPS 4 to 5 in Jan-Apr 2012 (see "Study Sample and Methods").
Facility sample transitioned from DOPPS 5 to 6 in Mar-Jul 2015 (see "Study Sample and Methods").
Source: Canada-DOPPS Practice Monitor, January 2018

Take Home Points

- Catheters are still widely used at initiation of treatment
- Over several years, surgeons and nephrologist have achieved an equal share with IR in maintenance of access.
- U.S. trends towards upper arm fistulas compared with international health systems.